Ministry of Environment, Water and Natural Resources
Water Resources Management Authority
The Republic of Kenya

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

Final Report
Volume 1 Main Report

September 2014

JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

NEWJEC INC.

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FINAL REPORT

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

FINAL REPORT
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TABLE OF CONTENTS

Acronyms and Glossary

ATCM	Assistant Technical Coordination Manager of WRMA
BOQ	Bill of Quantities
BL/R	Baseline Survey Report
BWRBs	Basin Water Resources Boards
CBO	Community Based Organization
C/P	Counter Part
CMO	Catchment Management Officer of WRMA
CMS	Catchment Management Strategy
CFMO	Community driven Flood Management Organization
DAC	Development Assistance Committee of OECD
DANIDA	Danish International Development Agency
DDMC	District Disaster Management Committee
DOC	Disaster Operation Centre
DTCM	Deputy Technical Coordination Manager of WRMA
EIA	Environmental Impact Assessment
EOI	Expression of Interest
FMU	Flood Management Unit of WRMA
GFDRR	Global Facility for Disaster Reduction and Recovery
GFAS	Global Flood Alert System
GIS	Geographic Information System
GIZ	The Deutsche Gesellschaft für Internationale Zusammenarbeit
GOK	Government of Kenya
HRD	Human Resource Department of WRMA
HQ	Head-Quarter of WRMA
IC/R	Inception Report
IFAS	Integrated Flood Analysis System
IFM	Integrated Flood Management
IFMC	Integrated Flood Management Committee
IFMP	Integrated Flood Management Plan
IPCC	The Intergovernmental Panel on Climate Change
KeNHA	Kenya National Highways Authority
KeRRA	Kenya Rural Roads Authority

KEWI	Kenya Water Institute
KRA	Kenya Revenue Authority
KRCS	The Kenya Red Cross Society
LOGUMI	Lower Gucha Migori
MEWNR	Ministry of Environment, Water and Natural Resources
MOU	Memorandum of Understanding
MWI	Ministry of Water and Irrigation
M/M	Minutes of Meeting
NEMA	National Environmental Management Authority
NWCPC	National Water Conservation and Pipeline Corporation
R/D	Record of Discussions
RO	Regional Office, WRMA
OJT	On the Job Training
O&M	Operation and Maintenance
JCC	Joint Coordinating Committee
PCM	Project Cycle Management
PDM	Project Design Matrix
P/R	Progress Report
SCMP	Sub Catchment Management Plan
SRM	Sub Regional Manager of WRMA
SRO	Sub Regional Office, WRMA
NWRMS	National Water Resource Management Strategy
NWRS	National Water Resource Strategy
WRRA	Water Resources Regulatory Authority
WRUA	Water Resources User Association
WSTF	Water Service Trust Fund
WDC	WRUA Development Cycle
WRMA	Water Resources Management Authority
WG	Working Group

PART I

BACKGROUND AND OUTLINE OF THE PROJECT

PART I BACKGROUND AND OUTLINE OF THE PROJECT

TABLE OF CONTENTS

Chapter 1 Background and Objective of the Project

Submitted herewith is the Final Report compiled in accordance with the Minutes of Meeting (M/M) on the Project on Capacity Development for Effective Flood Management in Flood Prone Area (hereinafter referred to as "the Project") signed on September 14, 2010 and Record of Discussions (R/D) signed on February 7, 2011 and signatories being Ministry of Water and Irrigation (MWI), Water Resources Management Authority (WRMA), for the Republic of Kenya and Japan International Cooperation Agency (JICA).

1.1 Background of the Project

The Republic of Kenya (hereinafter referred to as "Kenya") experiences perennial nationwide flood occurrence during the rainy seasons. The floods affect approximately five thousand (5,000) people and causes financial damage of approximately US Dollars Two Million ($2,000,000/-) every year. In 2003, the southern part of Lake Victoria Basin including Nyando River suffered from very serious flooding which affected approximately twenty two thousand (22,000) people. In 2007, Garissa Town that is located in the middle Tana River Basin was hit by floods and encountered approximately US Dollars eight million five hundred thousand ($8,500,000/-) in financial damage. Based on the analysis reported in the fourth assessment report published by the Intergovernmental Panel on Climate Change (IPCC), it is anticipated that climate change will lead to increased incidence of occurrence of floods in Kenya.

The Government of Kenya (hereinafter referred to as "GOK") established Water Resources Management Authority (WRMA), under the then Ministry of Water and Irrigation (MWI), currently referred to as the Ministry of Environment, Water and Natural Resources (MEWNR), through the sector reform enforced by Water Act 2002. WRMA acts as implementation organization in charge of overall water resource management of each catchment that are segmented into levels i.e. headquarters; six (6) regional offices; and twenty six (26) sub-regional offices.

In 2005, WRMA formulated "Integrated Flood Management Policy" focusing on Lake Victoria Basin where severe flood damages occur. It was intended to promote Integrated Flood Management (IFM) to raise awareness of community and strengthen institutional capacity to allow flood mitigation, prediction and warning. Based on the request from GOK, JICA carried out the "Study on the Integrated Flood Management for Nyando River Basin (2006-2009)" as the Technical Cooperation Scheme and "Programme for Community based Flood Disaster Management to Adapt to Climate Change in the Nyando River Basin (2009-2011)" as the Grant Aid Programme with the aim of establishing a flood management system in the southern part or Lake Victoria Basin through IFM. Through the above mentioned projects, community based flood management activities have been implemented and deployed combining both structural and non-structural measures such as protection measures for building structures in prioritized communities and workshops for mapping flood damaged areas. Some positive outcomes have since been realized.

GOK proposes to expand these activities, currently limited in the area of Nyando River Basin, nationwide to promote community based water resource management activities including flood management. GOK has been currently working on the institutionalization of Water Resource User Associations (WRUAs) managed by community. A framework has already been established which enables the WRUAs to receive funds from the Water Service Trust Fund (WSTF) sourced from technical support, official aid, and donor's funds. This framework is known as WRUA Development Cycle (WDC).

GOK plans to utilize WDC framework to deploy nationwide community driven activities based on IFM which integrates the outcomes from the previous JICA funded projects. However it is considered that GOK does not have enough capacity to provide appropriate

technical advice to relevant entities in IFM including the WRUAs. This is because previous JICA funded projects on flood management were not in line with WDC framework and moreover there were no experiences of flood management through WDC framework in any other projects. Therefore WRMA could not accumulate the necessary knowledge and know-how on IFM and thus WRMA was not in position to give technically adequate instruction to WRUAs on IFM.

Based on the above background, this Project therefore, is expected to strengthen WRMA in the following ways: WRMA staffs' basic capabilities on flood management; and also in the ability to support communities in IFM; and WRMA's institutional capability through the capacity development on basic flood management to promote community based flood management activities within the WDC framework.

1.2 Objective of the Project

The objective of the Project is to establish an implementation structure within WRMA to promote community based flood management activities in the project targeted areas through enhancement of staffs' basic ability and institutional ability on entire flood management at all levels of WRMA from headquarters, regional offices and sub-regional offices, and improvement of WRMA's system and capacity to support community-based flood management activities.

The chief aim of the Project is to develop capacity of WRMA to implement high-quality community-based disaster risk reduction activities on flood management in the project target areas.

Overall goal, project purpose and indicators to measure the achievement of the goal and purpose are as shown below;

1.2.1 Overall Goal

Institutional framework of flood management in the context of integrated water resource management is expanded to all six catchments.

Indicators

1. WRMA's Strategic Plan properly addresses flood management.

2. WRMA staff in charge of flood management has capacity to implement community based activities in the six catchments.

3. Flood management is incorporated in CMS and SCMP of flood prone areas in the six catchments

4. WRMA's knowledge management mechanism (knowledge management) and training system function covering the six catchments are established.

5. Budget for flood management is secured in the six catchments.

Project purposes and indicators to measure the achievement of the purposes are as shown below.

1.2.2 Project Purpose

In the Project target areas, institutional framework of flood management in the context of integrated water resource management is established for effective and sustainable implementation of community based activities.

Indicators

1. Staffs of WRMA in charge of flood management in the project target areas have capacity to implement community based activities.

2. Flood management is incorporated in CMSs and SCMPs of flood prone areas in the project target areas.

3. WRMA's knowledge management mechanism (knowledge management) and training system function covering the project target areas are established.

4. Budget for flood management is secured in the project target areas.

Chapter 2 Scope of the Project

2.1 Scope of the Project

The Project implementation was based on the Minutes of Meeting (M/M) signed on September 14, 2010 and Record of Discussions (R/D) signed on February 7, 2011. Project Design Matrix (PDM) was mutually agreed upon by JICA and GOK. Initially, the indicators for PDM were defined approximately five (5) months after the project commencement. However, the Project Team determined that the indicators should be fixed based on an embodiment of the training plan.

The indicators were therefore approved in the 4th JCC Meeting that was held on October 8, 2013 and thereafter the PDM was revised as version 2. The revised PDM is shown below.

- Participation ratio of the training course (Number): (1-4) More than 40 persons of WRMA staffs attend training course by the end of this Project.

- Number of participants to the community based disaster prevention activities : (2-3) More than 25 number of WRMA staffs have experience of community based flood management activities in the Project target areas.

PDM version one (1) under the agreement with Kenyan side at the beginning of the project and the PDM version two (2) are shown in the following tables.

Table 2.1-1 (1) Project Design Matrix Ver. 1

Project Name: The Project on Capacity Development for Effective Flood Management in Flood Prone Areas
Duration of the project: 3.0 years
Target Group: Working Group in WRMA

	Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption
Overall Goal	Institutional framework of flood management in the context of integrated water resource management is expanded to all of the six catchments.	- WRMA's Strategic Plan properly addresses flood management. - WRMA staff in charge of flood management has capacity to implement community based activities in the six catchments. - Flood management is incorporated in CMS and SCMP of flood prone areas in the six catchments - WRMA's knowledge management mechanism (knowledge management) and training system function covering the six catchments are established. - Budget for flood management is secured in the six catchments.	- Strategic Plan of WRMA Training records and performance appraisal records - CMS and SCMP - WRMA's activity records and training records - Financial records	GOK maintains its strategy to promote flood management.
Project Purpose	In the Project target areas, institutional framework of flood management in the context of integrated water resource management is established for effective and sustainable implementation of community based activities.	- Staff of WRMA in charge of flood management in the project target areas has capacity to implement community based activities. - Flood management is incorporated in CMS and SCMP of flood prone areas in the project target areas. - WRMA's knowledge management mechanism (knowledge management) and triaging system function covering the project target areas are established. - Budget for flood management is secured in the project target areas.	- Training records, project records and performance appraisal records. - Strategies and plans in the project target areas. - WRMS's activity records and training records - Financial records	Budget and personnel for flood management is allocated as planned.
Outputs	1) At each level of WRMA (headquarters, regional offices and sub-regional offices), sustainable organizations in charge of flood management are strengthened.	(1-1) A future plan of WRMA on flood management covering personnel, budget and function is prepared. (1-2) Catchment Management Strategies (CMSs) in the Project target areas properly integrate flood management. (1-3) Training plan, training material and trainers are prepared. (1-4) More than ** % of WRMA staffs attend training course by the end of this project. (1-5) WRMA's institutional setup and budgetary system for flood management are clearly defined and operated in the Project target areas.	1.1 Project records 1.2 CMS 1.3 Project records 1.4 Project records 1.5 Project records and financial records	- Trained staff continue working for WRMA - Residents in the pilot areas cooperate to the Project.
	2) For promoting community based activities of flood management, capacity of WRMA to support WRUAs and communities is strengthened.	(2-1) Flood management plans in the pilot areas prepared. (2-2) Materials describing the case and lessons of the community based flood management activities are prepared. (2-3) More than ** number of WRMA staffs have experience of community based flood management activities in the Project target areas.	2.1 Project records 2.2 Project records 2.3 Project records	

Table 2.1-1 (2) Project Design Matrix Ver. 1

	Narrative Summary	Objectively Verifiable Indicator		Means of Verification	Important Assumption
Activities	(1-1) Working Group (WG) analyzes the actual state of flood management at national, regional and sub-regional level respectively. (1-1-1) Institutional framework (1-1-2) Budget arrangement (1-1-3) Personnel allocation (1-1-4) Good practices (1-2) WRMA formulates a future plan of WRMA on flood management including personnel, budget and strategy. (1-3) WRMA elaborates Catchment Management Strategy (CMS) including flood management. (1-4) WRMA advises MWI to include a chapter of flood management in the National Water Resource Management Strategy (1-5) WRMA establishes a training system for WRMA staff. (1-5-1) Formulation of a training plan (1-5-2) Preparation of training manuals (1-5-3) Implementation of training courses for trainers (1-5-4) Implementation of training courses by the trainers (1-5-5) Evaluation and feedback of the outcomes from the training courses (1-5-6) Contribution to the relevant organization in terms of implementation of training courses (1-6) WRMA institutionalizes knowledge management mechanism at regional level and sub- regional level respectively (1-7) WRMA establishes institution and budgetary systems to address flood issues. (2-1) WRMA determines pilot sub-catchments. (2-2) WG establishes a coordinating function among relevant stakeholders such as flood management forum. (2-3) WRMA analyzes the current situations of communities.(Baseline survey) (2-3-1) Capacity assessment of community on flood management (2-3-2) Risk analysis including flood disaster map (2-4) JCC determines pilot areas based on a baseline survey. (2-5) WG facilitates communities to prepare flood management plans in the pilot areas to be integrated in Sub-Catchment Management Plan (SCMP) (2-5-1) Study on good practices (2-5-2) Participatory planning (2-6) WG supports the implementation of community based activities based on the flood management plans. (2-7) WG monitors and evaluates the community based activities. (2-8) WG prepares materials describing the cases and the lessons based on the community based activities. (2-9) WG contributes the cases and the lessons of the community based activities to the knowledge management mechanism.	Inputs **Japan side** 1. Experts a) Chief Advisor / Flood management administration b) Flood management technology c) Community based disaster management d) Promotion of disaster management activity e) Institution / Training The other field will be considered when necessity arises 2. Equipment a) Office equipment (Personal computer and printer etc.) b) Project vehicles 3. C/P training in Japan 4. Facilities and equipment for community based activities a) sub-contracting cost for local consultant b) material and equipment cost for community based activities	**Kenya side** 1. Personnel allocation from Counterpart (C/P) a) Joint Coordinating Committee (JCC) b) Working Group (WG) 2. Budget allocation 3. Office Space and Facilities a) Office space b) Depot space for construction materials, vehicles and other necessary equipment 4. Local cost		Flood management Unit is established.

Table 2.1-2 (1) Project Design Matrix Ver. 2

Project Name: The Project on Capacity Development for Effective Flood Management in Flood Prone Areas
Duration of the project: 3.0 years
Target Group: Working Group in WRMA

	Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption
Overall Goal	Institutional framework of flood management in the context of integrated water resource management is expanded to all of the six catchments.	- WRMA's Strategic Plan properly addresses flood management. - WRMA staff in charge of flood management has capacity to implement community based activities in the six catchments. - Flood management is incorporated in CMS and SCMP of flood prone areas in the six catchments - WRMA's knowledge management mechanism (knowledge management) and training system function covering the six catchments are established. - Budget for flood management is secured in the six catchments.	- Strategic Plan of WRMA Training records and performance appraisal records - CMS and SCMP - WRMA's activity records and training records - Financial records	GOK maintains its strategy to promote flood management.
Project Purpose	In the Project target areas, institutional framework of flood management in the context of integrated water resource management is established for effective and sustainable implementation of community based activities.	- Staff of WRMA in charge of flood management in the project target areas has capacity to implement community based activities. - Flood management is incorporated in CMS and SCMP of flood prone areas in the project target areas. - WRMA's knowledge management mechanism (knowledge management) and triaging system function covering the project target areas are established. - Budget for flood management is secured in the project target areas.	- Training records, project records and performance appraisal records. - Strategies and plans in the project target areas. - WRMS's activity records and training records - Financial records	Budget and personnel for flood management is allocated as planned.
Outputs	1) At each level of WRMA (headquarters, regional offices and sub-regional offices), sustainable organizations in charge of flood management are strengthened.	(1-1) A future plan of WRMA on flood management covering personnel, budget and function is prepared. (1-2) Catchment Management Strategies (CMSs) in the Project target areas properly integrate flood management. (1-3) Training plan, training material and trainers are prepared. (1-4) More than 12 % (40 numbers out of 319 technical staffs) of WRMA technical staffs % of WRMA staffs attend training course by the end of this project. (1-5) WRMA's institutional setup and budgetary system for flood management are clearly defined and operated in the Project target areas.	1.1 Project records 1.2 CMS 1.3 Project records 1.4 Project records 1.5 Project records and financial records	- Trained staff continue working for WRMA - Residents in the pilot areas cooperate to the Project.
	2) For promoting community based activities of flood management, capacity of WRMA to support WRUAs and communities is strengthened.	(2-1) Flood management plans in the pilot areas prepared. (2-2) Materials describing the case and lessons of the community based flood management activities are prepared. (2-3) More than 25 number of WRMA staffs have experience of community based flood management activities in the Project target areas.	2.1 Project records 2.2 Project records 2.3 Project records	

Table 2.1-2 (2) Project Design Matrix Ver. 2

	Narrative Summary	Objectively Verifiable Indicator		Means of Verification	Important Assumption
Activities	(1-1) Working Group (WG) analyzes the actual state of flood management at national, regional and sub-regional level respectively. (1-1-1) Institutional framework (1-1-2) Budget arrangement (1-1-3) Personnel allocation (1-1-4) Good practices (1-2) WRMA formulates a future plan of WRMA on flood management including personnel, budget and strategy. (1-3) WRMA elaborates Catchment Management Strategy (CMS) including flood management. (1-4) WRMA advises MWI to include a chapter of flood management in the National Water Resource Management Strategy (1-5) WRMA establishes a training system for WRMA staff. (1-5-1) Formulation of a training plan (1-5-2) Preparation of training manuals (1-5-3) Implementation of training courses for trainers (1-5-4) Implementation of training courses by the trainers (1-5-5) Evaluation and feedback of the outcomes from the training courses (1-5-6) Contribution to the relevant organization in terms of implementation of training courses (1-6) WRMA institutionalizes knowledge management mechanism at regional level and sub- regional level respectively (1-7) WRMA establishes institution and budgetary systems to address flood issues. (2-1) WRMA determines pilot sub-catchments. (2-2) WG establishes a coordinating function among relevant stakeholders such as flood management forum. (2-3) WRMA analyzes the current situations of communities.(Baseline survey) (2-3-1) Capacity assessment of community on flood management (2-3-2) Risk analysis including flood disaster map (2-4) JCC determines pilot areas based on a baseline survey. (2-5) WG facilitates communities to prepare flood management plans in the pilot areas to be integrated in Sub-Catchment Management Plan (SCMP) (2-5-1) Study on good practices (2-5-2) Participatory planning (2-6) WG supports the implementation of community based activities based on the flood management plans. (2-7) WG monitors and evaluates the community based activities. (2-8) WG prepares materials describing the cases and the lessons based on the community based activities. (2-9) WG contributes the cases and the lessons of the community based activities to the knowledge management mechanism.	Inputs **Japan side** 1. Experts a) Chief Advisor / Flood management administration b) Flood management technology c) Community based disaster management d) Promotion of disaster management activity e) Institution / Training The other field will be considered when necessity arises 2. Equipment a) Office equipment (Personal computer and printer etc.) b) Project vehicles 3. C/P training in Japan 4. Facilities and equipment for community based activities a) sub-contracting cost for local consultant b) material and equipment cost for community based activities	**Kenya side** 1. Personnel allocation from Counterpart (C/P) a) Joint Coordinating Committee (JCC) b) Working Group (WG) 2. Budget allocation 3. Office Space and Facilities a) Office space b) Depot space for construction materials, vehicles and other necessary equipment 4. Local cost		Flood management Unit is established.

2.2 Work Flow

The Outline Work Flow of the Project as per the revised version that was revised in January, 2014 is shown in following.

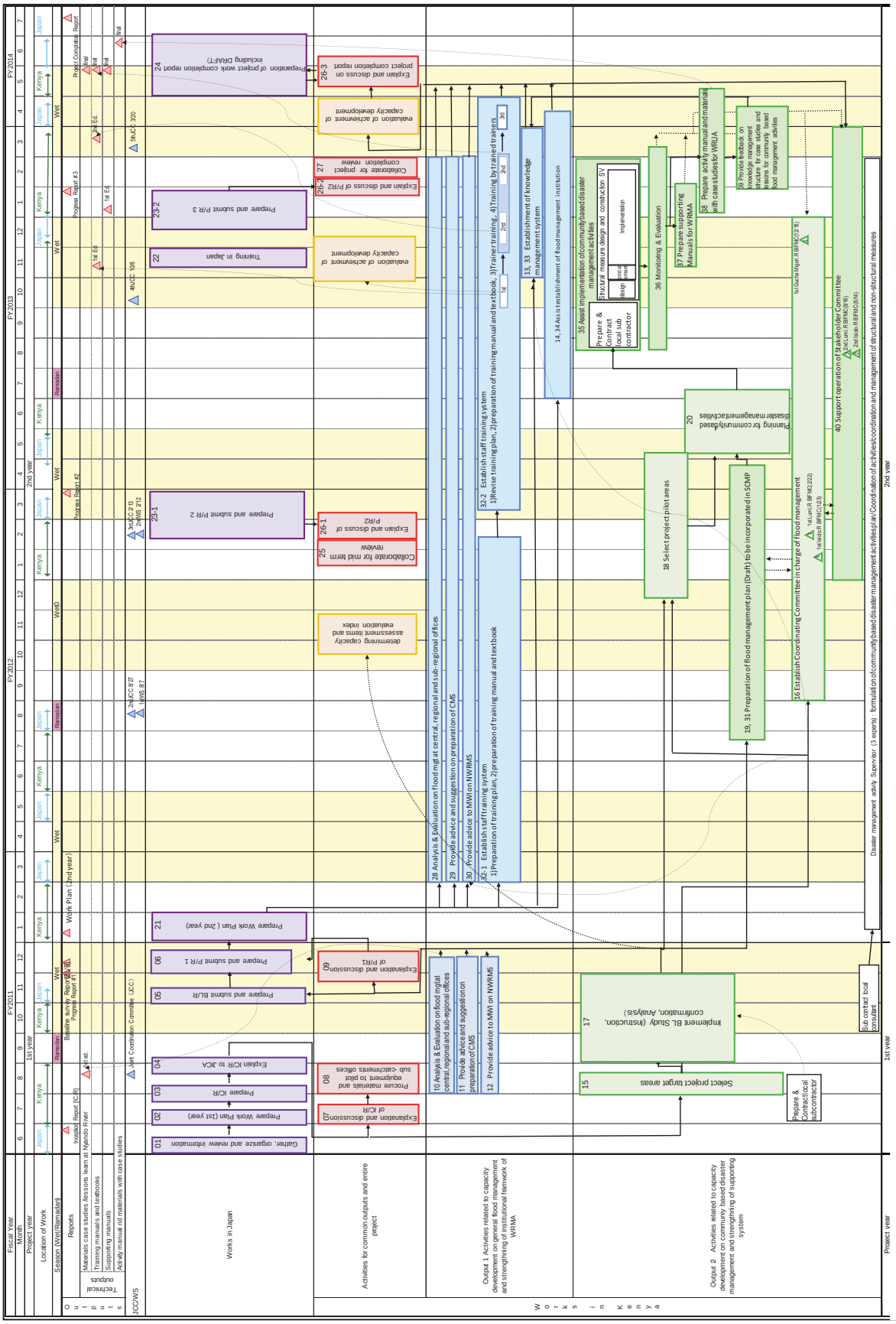


Fig. 2.2-1 Detailed Work Flow of the Project (after revision)

Chapter 3 Project Target Areas

3.1 Geographic division for water sector in Kenya

It is important to note that the boundary of water management in Kenya was reviewed. WRMA and WRUA administrative areas, river basins and catchment areas are organized as follows:

- Catchment Area: Catchment Area is defined by Water Act 2002 as follows.

  In accordance with the national water resources management strategy, the Authority may by notice published in the Gazette designate a defined area from which rainwater flows into a watercourse to be a catchment area for the purposes of this Act.
- Region: Administrative area of WRMA Regional Office (WRMA-RO) which covers the same area as a Catchment Area
- Sub-Region: Administrative area of WRMA Sub-Regional Office (WRMA-SRO)
- River Basin: A river basin is an area of land over which surface water is drained by a river and its tributaries. In this project, Integrated Flood Management Committee (IFMC) is established in each river basin. (In details of IFMC, see the final report "Part III Chapter 4")
- Sub-Catchment: A sub-catchment is an area covered by a WRUA. (More information for WRUA, see the final report "Part II Chapter 1")

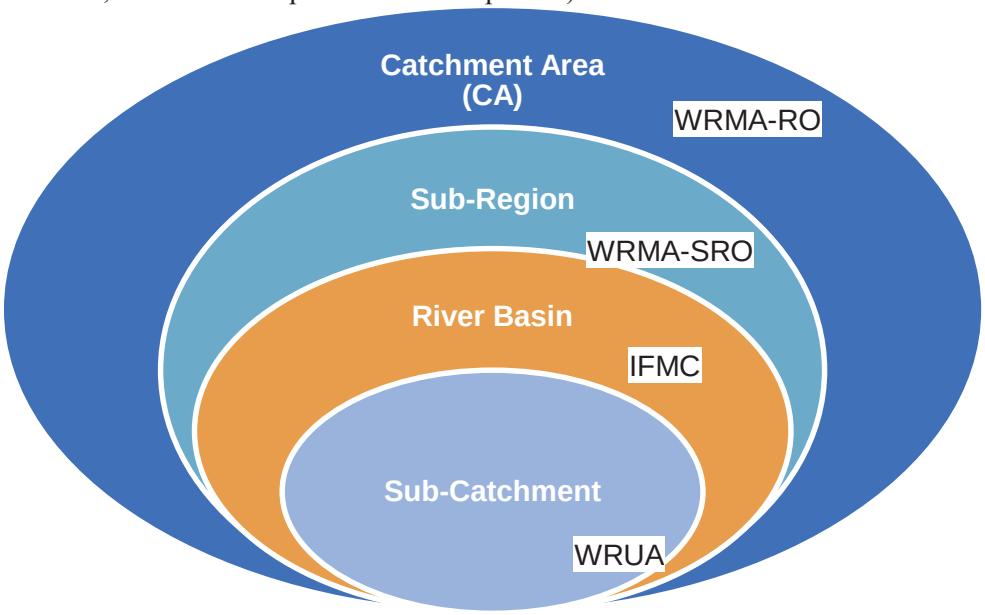
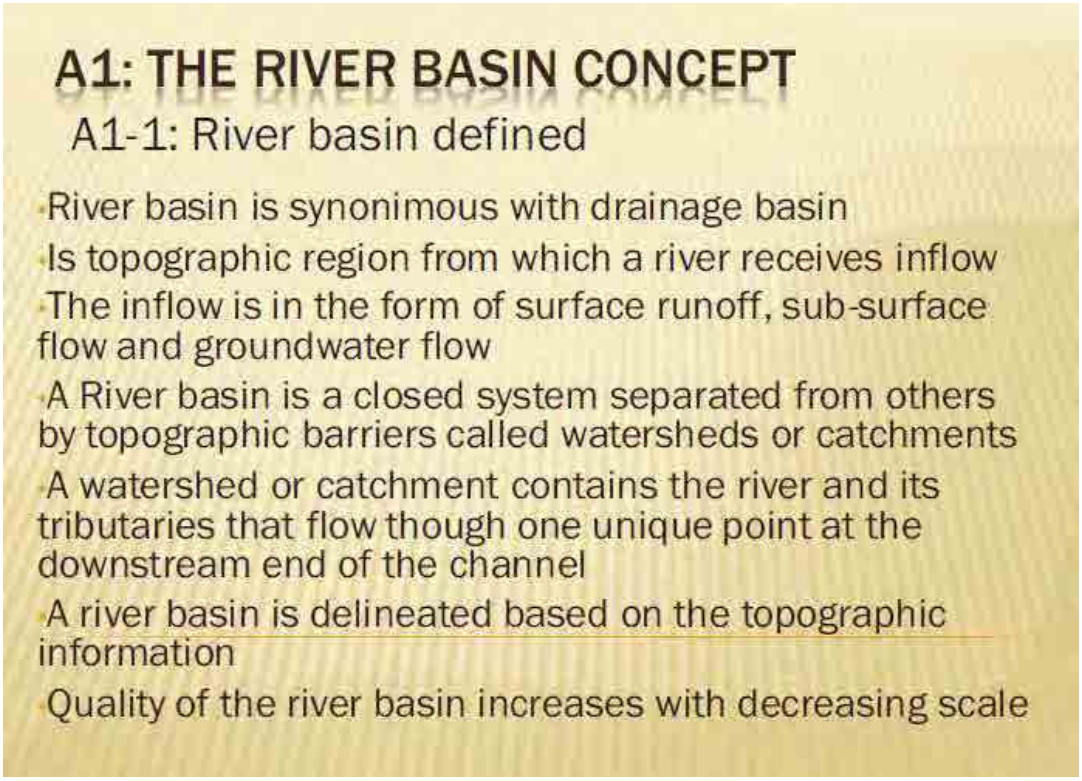


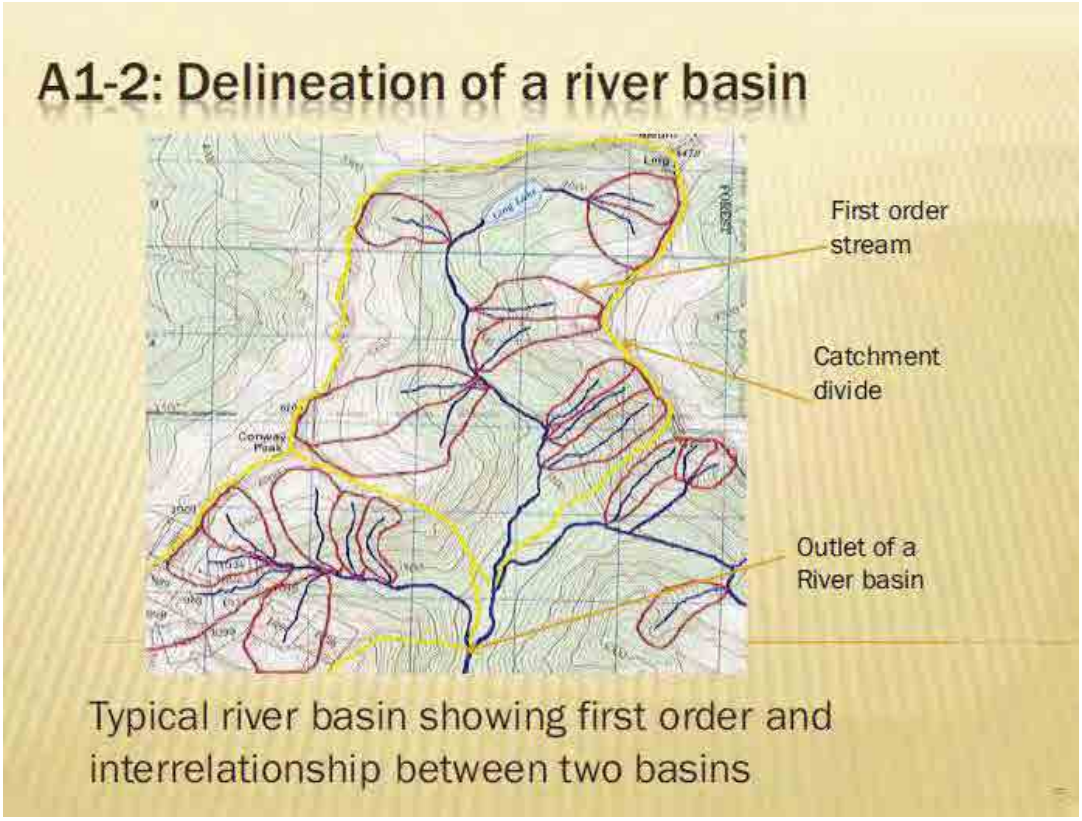
Fig. 3.1-1 Boundary of WRMA and WRUA administrative area and River basin and Catchment Area

River basin is not same concept as "Catchment Area", "Sub-Region" and "Sub-Catchment". And concept of river basin is not popular and used in WRMA, therefore the Project Team proposed to WRMA the concept of river basin on various occasions. For example, text in the slide PowerPoint presentation during the WRMA technical training for food management is shown as follows:



Source: WRMA Technical Training Text for Flood Management (Second edition), the presentation is prepared by Professor Japheth Onyando

Fig. 3.1-2 River basin concept



Source: WRMA Technical Training Text for Flood Management (Second edition), the presentation is prepared by Professor Japheth Onyando

Fig. 3.1-3 Delineation of a river basin

3.2 Project Target Areas

The Project was executed in Nairobi, where WRMA headquarters is located, and in three (3) pilot sub-catchments. Details of selection of pilot sub-catchments are described in the Final Report Part III Project Activities for Output 1, Chapter One (1).

Table 3.2-1 Pilot Project Target Areas (Pilot sub-catchments)

	Catchment Area/ Regional Office	Sub-Region/ Sub-Regional Office*	River Basin	Sub-Catchment	Type of activities
1	Lake Victoria South Catchment Area / Kisumu Regional Office	Southern Shoreline- Gucha Migori Sub-Region (Kisii)	Gucha Migori	Lower Gucha Migori Sub-Catchment	Type 1
2	Athi Catchment Area / Machakos Regional Office	Nolturesh-Lumi Sub-Region (Loitokitok)	Lumi	Lower Lumi Sub-Catchment	Type 2
3	Ewaso Ng'iro North Catchment Area / Nanyuki Regional Office	Middle Ewaso Ng'iro Sub-Region (Isiolo)	Isiolo	Isiolo Sub-Catchment	Type 2

*) Sub- Region/ Sub-Regional Office name in parentheses shows old one.

The pilot sub-catchments are categorized into two types based on the activities that were implemented as described below:

3.2.1 Common activities in both type 1 and 2

- To provide advice and suggestion on preparation of CMS[1] to include flood management plan prepared by WRMA
- Implementation of Baseline Survey;
- To prepare draft Flood Management Plan to be integrated into SCMP[2];
- To support institutionalization of knowledge management system for accumulated at WRMA regional and sub-regional levels; and
- To formulate Implementation Plan of community based flood management activities.

3.2.2 Activities in type 1

- To facilitate expansion of structural and non-structural measures experienced in Nyando Project within the same region;
- To prepare case studies on structural and non-structural measures conducted in the Integrated Flood Management Project in Nyando River Basin; and
- To support fund raising and formulating proposals to access WSTF to implement pilot activities including structural and non-structural measures in the pilot areas.

3.2.3 Activities in type 2

- To support the implementation of community based flood management activities including financial assistance; and
- To monitor and evaluate the community based flood management activities.

[1] Details in "Catchment management" and "Catchment Management Strategy" can be seen in the final report (Part II Chapter 1 Section 1.1.11)
[2] Details in "Sub Catchment Management Plan" (SCMP) can be seen in the final report (Part II Chapter1 Section 1.1.12)

Locations of selected project targeted areas are shown in Fig. 3.2-1.

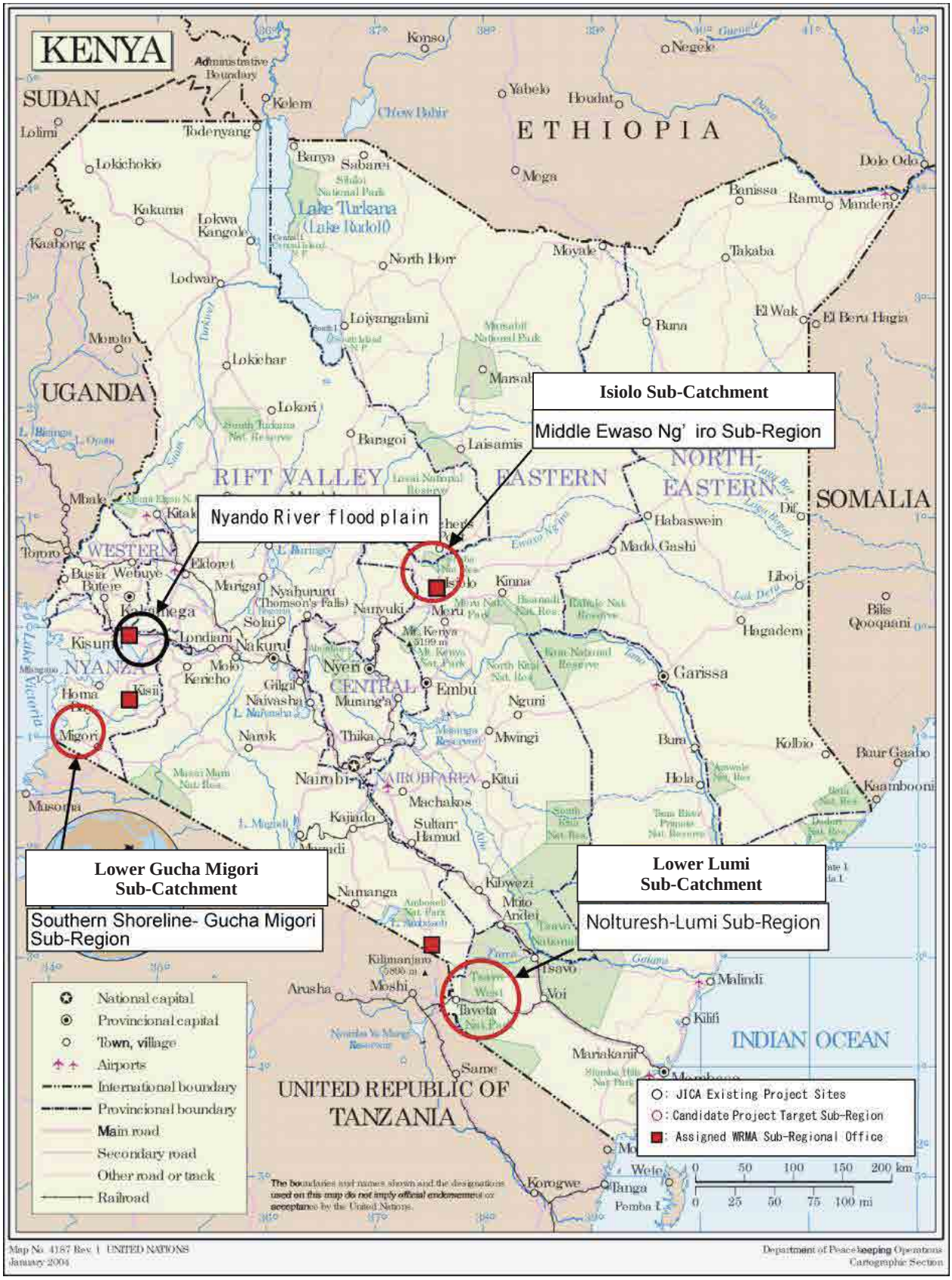


Fig. 3.2-1 Locations of Pilot Project Target Areas

Chapter 4 Project Implementation Structure

4.1 Project operating structure

This Project was executed by both Japanese side and Kenyan side based on the Project Design Matrix (PDM) and Plan of Operation (PO). The Project Team implemented the capacity development to WRMA at each level (HQ, RO and SRO), through implementing technical training on flood management and giving advices and supports in formulating draft laws and plans related to the flood management and river management.

Also the Project Team implemented the capacity development of WRMA in supporting WRUA, through implementing community based activities in the pilot sub-catchments and giving support to establishing IFMCs and drafting IFMPs. This was done because WRMA is responsible in providing technical support to WRUA to carryout flood management activities. Where possible these activities were implemented in collaboration with relevant Counties, Ministries and NGOs.

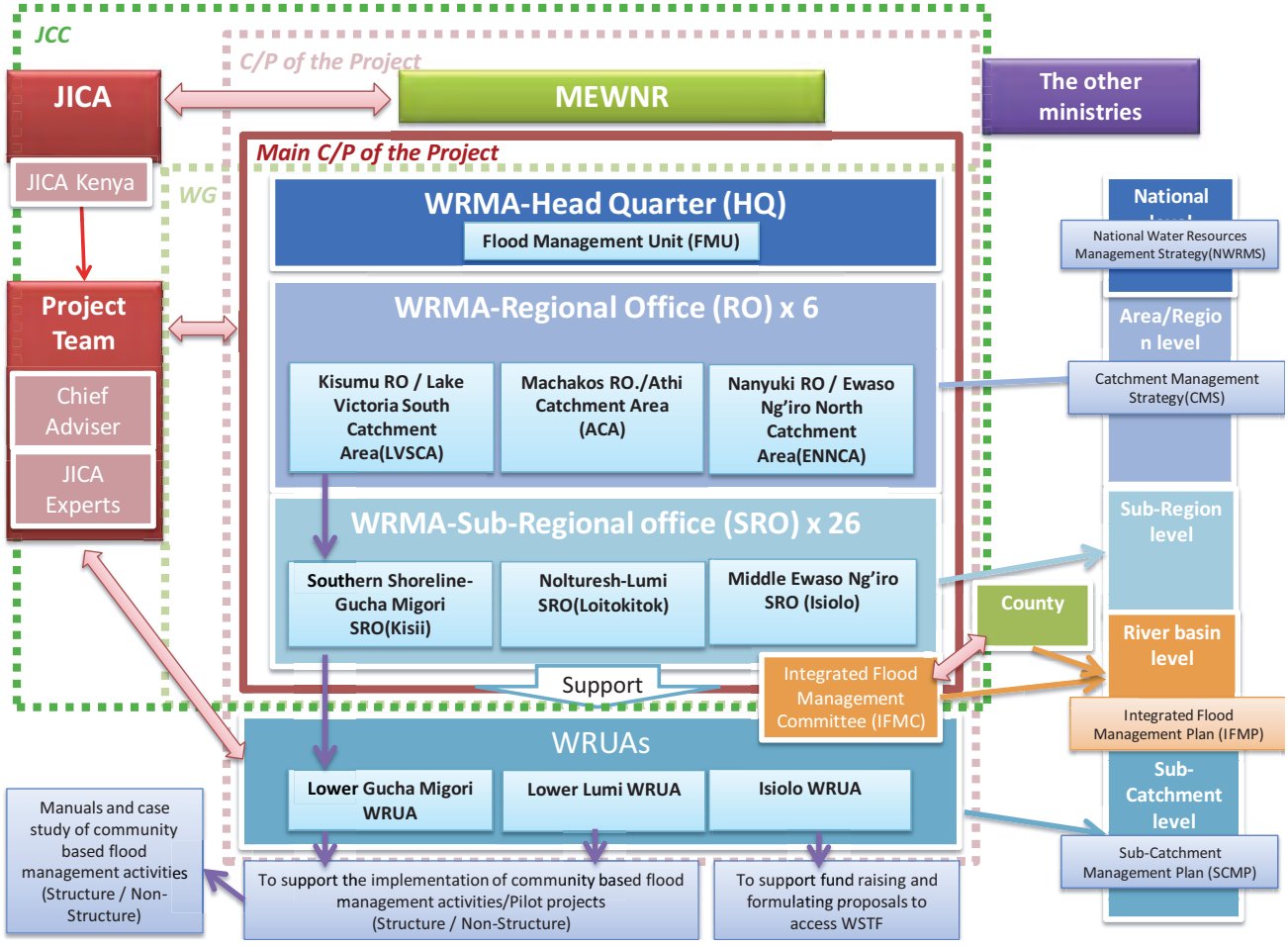


Fig. 4.1-1 Project operating structure

4.2 Kenyan Side Implementation Structure

4.2.1 Organization

In the Project organizations that were responsible in implementing were as follows:

Responsible Organization: Ministry of Water and Irrigation (MWI) (until March 2013)

Ministry of Environment, Water and Natural Resources (MEWNR)
(after March 2013)

Implementing Organization: Water Resources Management Authority (WRMA)

4.2.2 Counterpart

The counterpart (C/P) personnel related to the Project as at March 2014 were fifty nine (59) people total as shown in the table below.

4.2.3 List of Kenyan Counterpart and Administrative Personnel

(1) Project Director

Principal Secretary - State Department of Water, Ministry of Environment, Water and Natural Environment (MEWNR).

(2) Project Manager

Chief Executive Officer, Water Resources Management Authority Headquarters.

(3) Counterpart Personnel

Member of Working Group:

1) Head, Flood Management Unit, WRMA HQ
2) Unit Team Members, Flood Management Unit, WRMA HQ
3) Regional Manager, WRMA Lake Victoria South RO
4) Regional Manager, WRMA Athi RO
5) Regional Manager, WRMA Ewaso Ngiro North RO
6) Assistant Technical Coordination Manager (Flood Management), WRMA Lake Victoria South RO
7) Assistant Technical Coordination Manager (Flood Management), WRMA Athi RO
8) Assistant Technical Coordination Manager (Flood Management), WRMA Ewaso Ngiro North RO
9) Sub-Regional Manager, WRMA Southern Shoreline- Gucha Migori (Kisii) SRO
10) Sub-Regional Manager, WRMA Nolturesh-Lumi (Loitokitok) SRO
11) Sub-Regional Manager, WRMA Middle Ewaso Ng'iro (Isiolo) SRO
12) Flood Management Officer, WRMA Southern Shoreline- Gucha Migori (Kisii) SRO
13) Flood Management Officer, WRMA Nolturesh-Lumi (Loitokitok) SRO
14) Flood Management Officer, WRMA Middle Ewaso Ng'iro (Isiolo) SRO

Capacity developments for "Flood management" are done against the WRMA each staffs shown below as the main C/P.

- WRMA-HQ：FMU members

- WRMA-RO : Members belong to 3 Regional Office (KISUMU RO、Machakos RO、Nanyuki RO) including the project target area - catchment area level - as jurisdiction areas in this project.

- WRMA-SRO : Members belong to 3 Sub-Regional Office (Southern Shoreline- Gucha Migori SRO, Nolturesh-Lumi SRO, Middle Ewaso Ng'iro SRO) including the project target area - sub-catchment area level - as jurisdiction areas in this project.

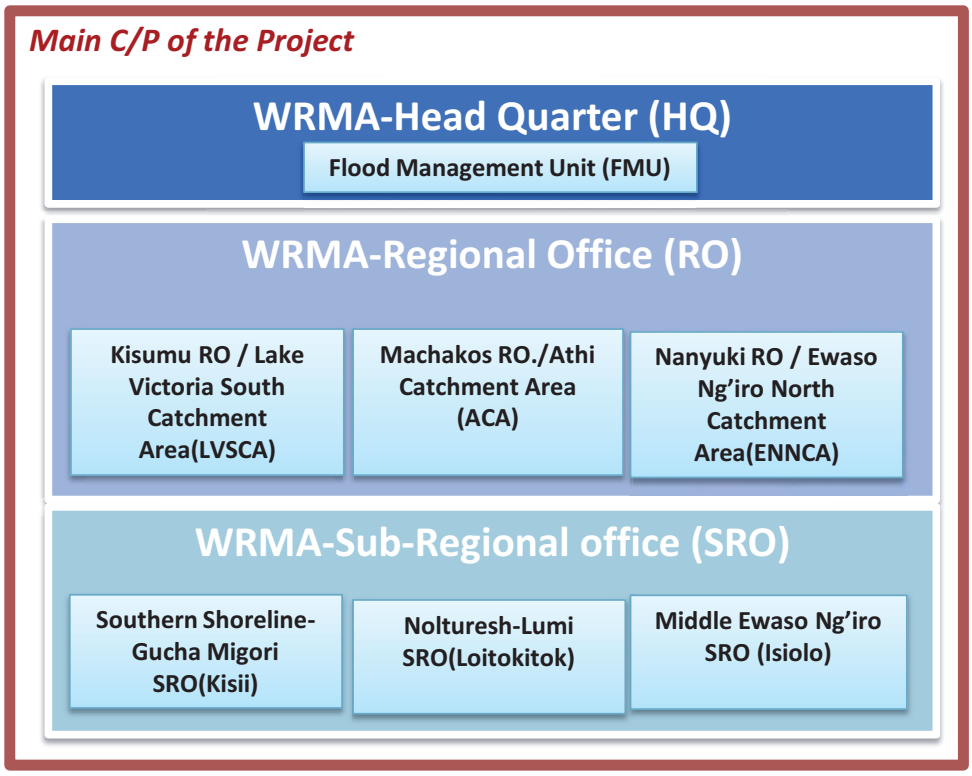
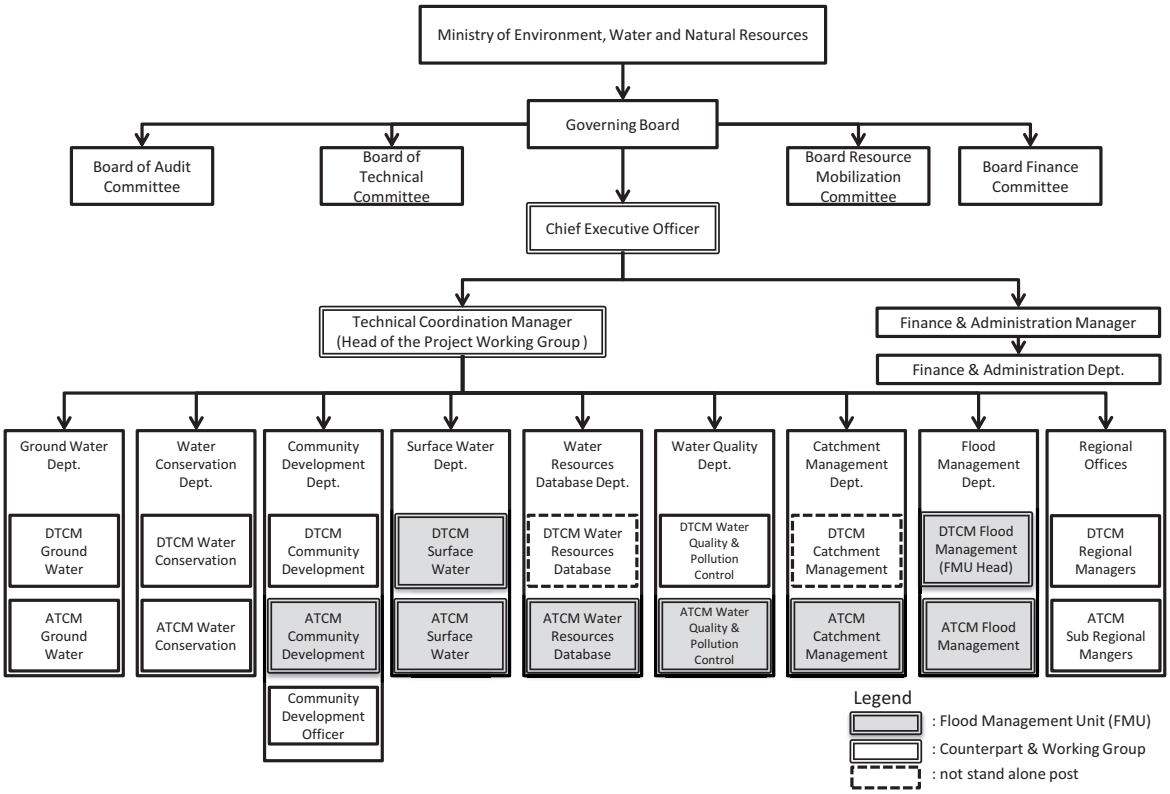
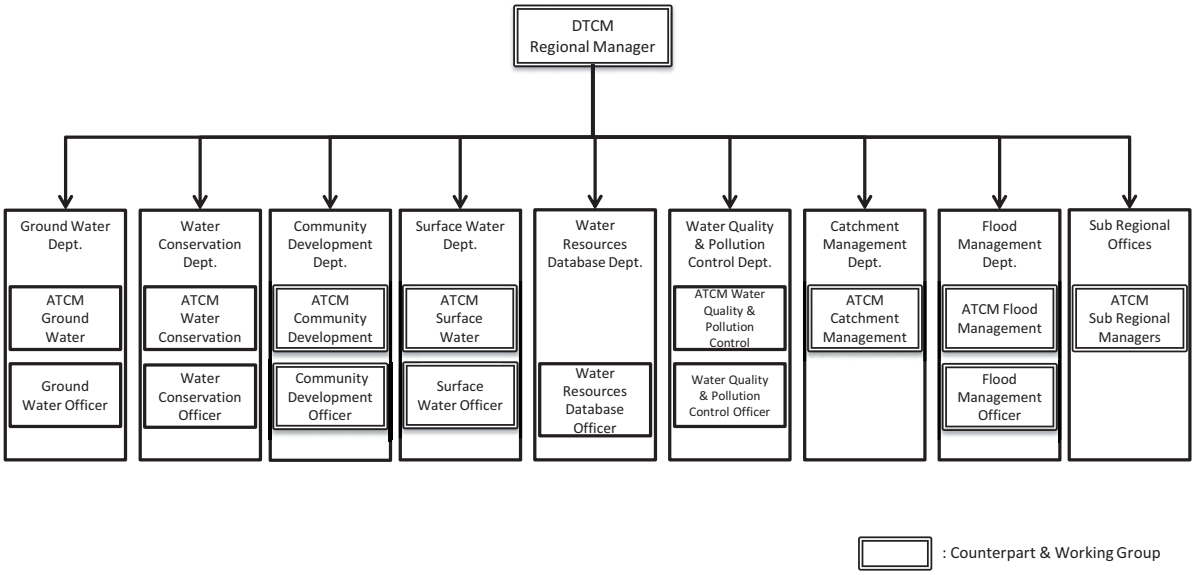


Fig. 4.2-1 Main C/P in this project



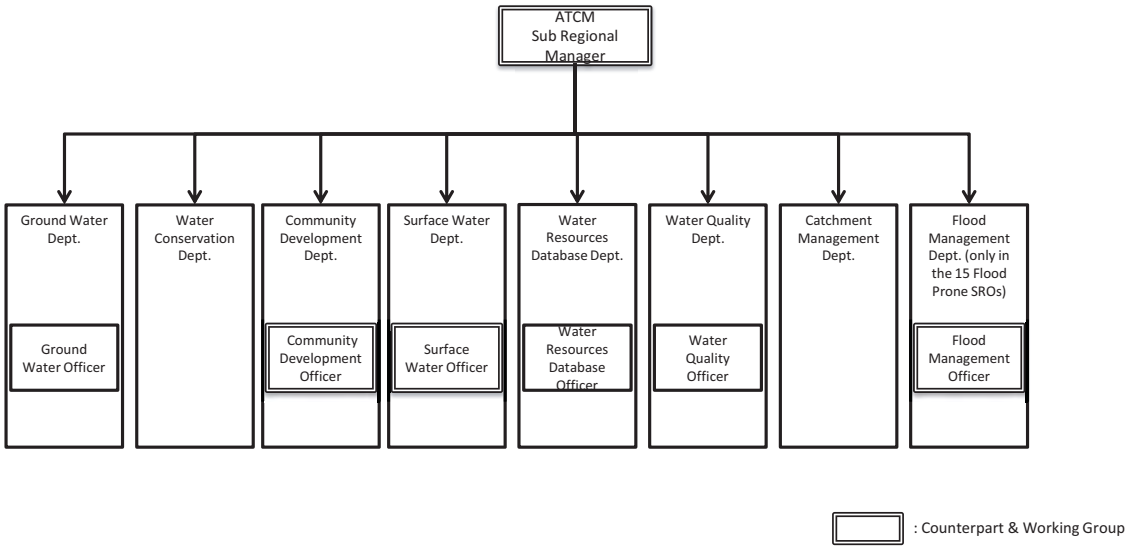
WRMA Organization Chart in Headquarters featuring Technical Division

Fig. 4.2-2 WRMA Organization Chart in Headquarters featuring Technical Division



WRMA Organization Chart in Regional Office featuring Technical Division

Fig. 4.2-3 WRMA Organization Chart in Regional Offices featuring Technical Division



WRMA Organization Chart in Sub Regional Office featuring Technical Division

Fig. 4.2-4 WRMA Organization Chart in Sub Regional offices featuring Technical Division

Table 4.2-1 List of C/P

Annex 8: List of the Counterpart personnel and Working Group

List of Counterpart Personel & Working Group Member (including transferred members) as of 13 March 2014

Pilot Area	No.	First Name	Middle Name	Last Name	Mr./Ms.	Organization/Office	Position	Period	Remarks
National Level	1	David		Stower	Mr.	Ministry of Environment, Water and Natural Resources(MEWNR)	Permanent Secretary/Project Director	Jul 2011 to Mar2013	
	2	James	T	Lepoyetum	Mr.	Ministry of Environment, Water and Natural Resources(MEWNR)	Principal Secretary/Project Director	Jul 2013 upto now	
	3	John	R.	Nyaoro	Mr.	Ministry of Environment, Water and Natural Resources(MEWNR)	Director of Water and Irrigation	Jul 2011 upto now	
	4	John	P	Olum	Mr.	WRMA HQ	WRMA CEO / Project Manager	Jul 2011 upto now	
	5	David	K	Biesuber	Mr.	Ministry of Water and Irrigation(MWI)	Senior Water Researcher / Hydrologist	Sept 2012 to Mar 2013	
	6	Nancy		Kseeh	Ms.	Ministry of Environment, Water and Natural Resources(MEWNR)	Hydrologist	Apr 2013 upto now	
	7	Joseph		Kinyua	Mr.	WRMA HQ	TCM	Jul 2011 upto now	
	8	Peter		Waithaka	Mr.	WRMA HQ	FMU Head / Head of Water Resource Component	Jul 2011 to Mar 2012	FMU Head from July 2011 to March 2012
	9	Alexander		Nzyoko	Mr.	WRMA HQ	FMU Head / DTCM(SW, WQ)	Mar 2013 upto now	FMU Head from April 2012 to June 2013
	10	Wilfred		Matagaro	Mr.	WRMA HQ	FMU Head / DTCM (WC, FM)	Jul 2013 upto now	FMU Head from July 2013
	11	Joseph		Kimanga	Mr.	WRMA HQ	FMU Member / ATCM (WC, FM)	Jul 2011 upto now	
	12	Lawrence		Thooko	Mr.	WRMA HQ	FMU Member / ATCM (SW)	Jul 2011 to Jun 2013	was transferred to Nakuru RO
	13	Simon		Mwangi	Mr.	WRMA HQ	FMU Member / ATCM (SW)	Jul 2013 upto now	
	14	Peterson		Nanu	Mr.	WRMA HQ	FMU Member / ATCM (WDB)	Jul 2011 upto now	
	15	Leah		Mukute	Ms.	WRMA HQ	FMU Member / WRUA coordinator	Jul 2011 to Jun 2012	was transferred to Kitale SRO in June
	16	Elizabeth		Diego	Ms.	WRMA HQ	FMU Member / ATCM (CD)	June 2012 upto now	
	17	Rose		Nyamon	Ms.	WRMA HQ	FMU Member / ATCM (WD)	Apr 2012 upto now	
	18	Willis	O	Memo	Mr.	Nakuru RO	ATCM (CD)	Jul 2011 upto now	He was appointed as a Working Group Member for his working experience in Nyando Project. And he was transferred from Kisumu RO to KerichoSRO in 2011, and was transferred from KerichoSRO to Kisumu RO in 2013, and transferred to Nakuru SRO from Dec 2013
Lower Sucha Migori	19	Margaret		Abira	Ms.	LVSCA RO (Kisumu)	DTCM / Regional Manager	Jul 2011 to Nov 2013	was transferred to as LVNCA RM
	20	Bifanelo		Matundu	Mr.	LVSCA RO (Kisumu)	DTCM / Regional Manager	Nov 2013 to Dec 2013	was transferred to LVNCA RO
	21	Reuben		Daenya	Mr.	LVSCA RO (Kisumu)	ATCM (FM)	Sep 2013 upto now	
	22	Joseph		Boit	Mr.	LVSCA RO (Kisumu)	CDO	Nov 2012 to Dec 2013	was transferred from Kisii SRO to LVSCA RO in Nov 2012, and transferred to Narok SRO in Jan 2014
	23	Ashert		Ogembo	Mr.	LVSCA RO (Kisumu)	CMO	Jul 2011 to Dec 2012	was transferred to Kakamega SRO in December 2012
	24	Reuben		Ngeesa	Mr.	LVSCA RO (Kisumu)	SWO	Jul 2011 upto now	
	25	Winnie		Ongany	Ms.	LVSCA RO (Kisumu)	CDO	Jul 2011 upto now	
	26	Lenox		Opiyo	Ms.	LVSCA RO (Kisumu)	CDO	From Jul 2013 upto now	
	27	Samuel		Gori	Mr.	Southern Shoreline Gucha Migori SRO	Sub Regional Manager	Jul 2011 to Jul 2012	was transferred to Siaya SRO in July
	28	Bifanelo		Maturwe	Mr.	Southern Shoreline Gucha Migori SRO (Kisii)	Sub Regional Manager	Jul 2012 to Nov 2013	Succeded Mr. Samuel, Sub Regional manager of Kisii SRO in July 2012 and transferred to LVSCA RM
	29	Leonard		Masafu	Mr.	Southern Shoreline Gucha Migori SRO	Sub Regional Manager	Nov 2013 upto now	
	30	Ibrahim		Kibati	Mr.	Southern Shoreline Gucha Migori SRO	SWO	Jul 2011 upto now	
	31	Ole	Kissa	Gombe	Mr.	Southern Shoreline Gucha Migori SRO	CMO	Nov 2012 to Aug 2013	was transferred to Athi RO in Sept 2013
	32	Joseph		Boit	Mr.	Southern Shoreline Gucha Migori SRO	CDO	Jul 2011 to Nov 2012	was transferred to Kisumu RO in Nov
	33	Samuel		Njihia	Mr.	Southern Shoreline Gucha Migori SRO (Kisii)	CMO(FMO)	Nov 2012 upto now	Succeded Mr. Boit, CMO Kisii SRO in Nov 2012
	34	Braham		Ochieng	Mr.	Southern Shoreline Gucha Migori SRO (Kisii)	CDO	Jul 2011 to Nov 2013	was transferred to Athi RO in Nov 2013
	35	Cloy	A	Anyango	Ms.	Southern Shoreline Gucha Migori SRO	CDO	Dec 2013 upto now	
Isiolo	36	Simon		Wamgombe	Mr.	ENNCA RO (Nanyuki)	DTCM / Regional Manager	Jul 2011 to Nov 2013	
	37	David		Ochilo	Mr.	ENNCA RO (Nanyuki)	DTCM / Regional Manager	Dec 2013 upto now	
	38	John		Kinyanjui	Mr.	ENNCA RO (Nanyuki)	SSWO	April 2012 to Oct 2012	Was transferred to Isiolo SRO in Oct 2012
	39	Timothy		Muiru	Mr.	ENNCA RO (Nanyuki)	ATCM(FM)	Jul 2011 upto now	
	40	Mugambi	R.	Muthenja	Mr.	ENNCA RO (Nanyuki)	CMO	Jul 2011 upto now	
	41	Shphila		Wamboi	Ms.	ENNCA RO (Nanyuki)	SWO	Jul 2011 upto now	
	42	Jacquiline		Boroki	Ms.	MEN SRO (Isiolo)	Sub Regional Manager	Jul 2011 to Oct 2011	was transferred to Machakos RO in Oct
	43	Steven		Kabui	Mr.	MEN SRO (Isiolo)	Ag.ATCM / Acting Sub Regional Manager	Oct 2011 to Oct 2012	
	44	John		Kinyanjui	Mr.	MEN SRO (Isiolo)	Sub Regional Manager	Oct 2012 upto now	Was transferred from ENCCA RO to Isiolo SRO in Oct 2012
	45	Gideon		Gituma	Mr.	MEN SRO (Isiolo)	SWO	Jul 2011 upto now	
	46	Abraham		Githinga	Mr.	MEN SRO (Isiolo)	CMO (FMO)	Jul 2011 upto now	
	47	David		Kisefa	Mr.	MEN SRO (Isiolo)	CDO	Jul 2011 upto now	
Lower Tumi	48	Bilanco		Maturue	Mr.	Athi CA RO (Machakos)	Acting Regional Manager	Jul 2011 to Jul 2012	was transferred from Machakos RO to Kisii SRO in July 2012
	49	Camule		Mwakamba	Mr.	Athi CA RO (Machakos)	DTCM / Regional Manager	Jul 2012 upto now	was transferred to Machakos RO in July
	50	Stephen		Munyao	Mr.	Athi CA RO (Machakos)	ATCM	Jul 2011 upto now	
	51	Anthony	K.	Kiambu	Mr.	Athi CA RO (Machakos)	CMO	Jul 2011 upto now	
	52	Jacquiline		Boroki	Ms.	Athi CA RO (Machakos)	CMO	Oct 2011 upto now	was transferred from SRO Isolo in Oct
	53	Enles	W	Wacheg	Ms.	Athi CA RO (Machakos)	CDO	Jul 2011 upto now	
	54	Angela		Kithuka	Ms.	Athi CA RO (Machakos)	SWO	Jul 2011 upto now	
	55	Geofrey		Mwona	Mr.	Nol Turesh-Lumi SRO (Loitoktok)	Sub Regional Manager	Jul 2011 to Nov 2012	
	56	Kimeu		Musau	Mr	Nol Turesh-Lumi SRO (Loitoktok)	Sub Regional Manager	Nov 2012 upto now	
	57	Joseph	Gitau	Maina	Mr.	Nol Turesh-Lumi SRO (Loitoktok)	FMO	DEC 2013 upto now	
	58	John		Kinyua	Mr.	Nol Turesh-Lumi SRO (Loitoktok)	SWO	Jul 2011 upto now	
	59	Phoebe		Otina	Ms.	Nol Turesh-Lumi SRO (Loitoktok)	CDO	Jul 2011 upto now	

Abbreviation:
CEO: Chief Executive Officer
TCM: Technical Coordination Manager
DTCM: Deputy Technical Coordination Manager
ATCM: Assistant Technical Coordination Manager
SWO: Surface Water Officer
CMO: Catchment Management Officer
CDO: Community Development Officer
FMO: Flood Management Officer
LVSCA: Lake Victoria South Catchment Area
ENNCA: Ewaso Ngiro North Catchment Area
MEN: Middle Ewaso Ngiro

4.3 Joint Coordinating Committee (JCC)

It was predetermined that the Joint Coordinating Committee (JCC) would be organized by GOK and chaired by the Project Director, and that it was to meet at least every six months (but also meet wherever necessity arises) in order to fulfill the following functions:

- To authorize PDM indicator within 5 months of the Project commencement;
- To approve the annual work plan of the Project;
- To review and evaluate the general progress of the Project;
- To exchange opinions on issues regarding the Project; and
- To discuss any other issues pertinent to the smooth implementation of the Project

JCC members were shown below:

4.3.1 JCC members from Kenyan side

(1) Project Director (Chairperson of the JCC):

Principal Secretary - State Department of Water, Ministry of Environment, Water and Natural Environment (MEWNR)

(2) Project Manager:

Chief Executive Officer, Water Resources Management Authority (WRMA)

(3) Members:

1) Principal Secretary - State Department of Environment and Natural Resources, MEWNR

2) Principal Secretary - The National Treasury

3) Principal Secretary - State Department of Devolution, Ministry of Devolution and Planning

4) Principal Secretary - State Department of Interior, Ministry of Interior and Coordination of National Government

5) The Director – Regional Development Authorities, MEWNR

6) The Director –Water Resources Management, MEWNR

7) The Director – Kenya Meteorological Services, MEWNR

8) The Director – Water Storage and Land Reclamation, MEWNR

9) The Chief Executive Officer – Water Service Trust Fund

Table 4.3-1 gives a comparative perspective of JCC members as at March 2014 and the initial as at July 2011 composition for Kenyan side for reference.

Table 4.3-1 the comparison of JCC members at the present and the original in Kenyan side

Present (as of March 2014)	**Original (as of July 2011)**
1. Project Director (Chairperson of the JCC):	
Principal Secretary – State Department of Water, MEWNR	Permanent Secretary, Ministry of Water and Irrigation
2. Project Manager:	
The Chief Executive Officer – Water Resources Management Authority	CEO, Water Resources Management Authority Headquarters
3. Members:	
1) Principal Secretary – State Department of Environment and Natural Resources, MEWNR	1) Permanent Secretary, Ministry of Environment and Mineral Resources
2) Principal Secretary – The National Treasury	2) Permanent Secretary, Ministry of Finance
3) Principal Secretary – State Department of Devolution, Ministry of Devolution and Planning	3) Permanent Secretary, Ministry of State for Special Programmes
4) Principal Secretary - State Department of Interior, Ministry of Interior and Coordination of National Government	
5) The Director - Regional Development Authorities, MEWNR	4) Permanent Secretary, Ministry of Regional Development Authorities
6) The Director -Water Resources Management, MEWNR	5) Director of Water Resources Management Department, MWI
7) The Director - Kenya Meteorological Services, MEWNR	6) Director, Kenyan Meteorological Department
8) The Director - Water Storage and Land Reclamation, MEWNR	7) Director of Land Reclamation Department, MWI
	8) Director of Water Service Department, MWI
9) The Chief Executive Officer - Water Service Trust Fund	9) Chief Executive Officer, Water Service Trust Fund
	10) Director of Water Sector Reform Department, MWI
	11) Director of Irrigation and Drainage Department, MWI

4.3.2 JCC members from the Japanese side

1) Chief Advisor, Project Team
2) Experts, Project Team
3) Chief Representative of JICA Kenya Office
4) Representative(s) of JICA Kenya Office
5) Representative(s) of JICA Headquarters

4.3.3 JCC members: Observers

Representative(s) of Embassy of Japan

Other developing partners and other concerned organizations

4.4 Japanese Implementation Structure

Japanese experts assigned to the Project are listed as below.

1) Mr. Katsuro KONDO: Chief Adviser/ Flood Management Administration Expert (from November 2012 to June 2014)
2) Mr. Hajime KOBAYASHI: Chief Adviser/ Flood Management Administration Expert (from July 2011 to December 2012)
3) Mr. Hideki SAWA: Team Leader/ Disaster Management Activity Promotion Expert
4) Mr. Masaru ARAKIDA: Community Based Disaster Management Expert
5) Mr. Masayuki INOUE: Institution/ Training Expert
6) Mr. Taketoshi MATSUNAGA: Institution/ Training Expert 2
7) Mr. Yukihiro MIKUMO: Disaster Management Activity/Community Based Disaster Management Assistant
8) Four (4) short term experts in the respective fields that were deemed necessary based on mutual agreement between Kenyan and Japanese Project implementing organizations

Supporting structure of the Project is as described in diagram below.

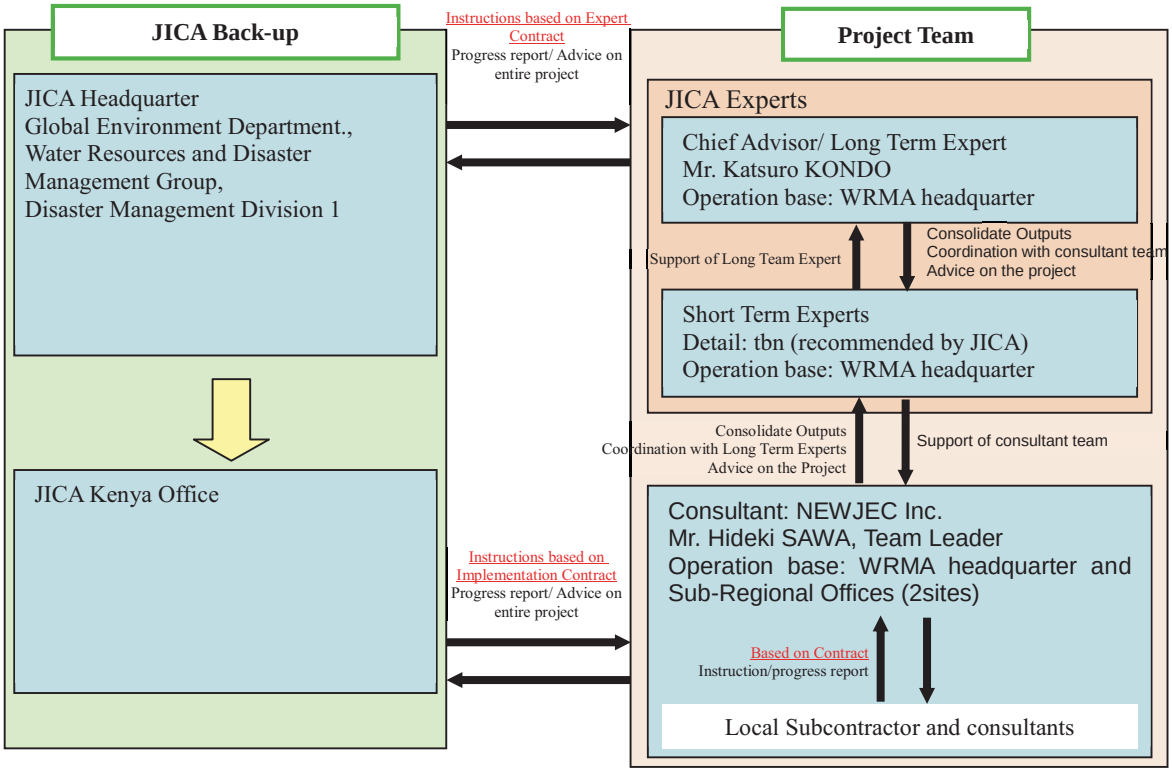


Fig. 4.4-1 Supporting Structure of Japanese Side in 2014

Chapter 5 Inputs of the Project

5.1 Inputs from Japanese side

5.1.1 Dispatch of Experts

The actual dispatching schedule for the Japanese experts is described in the table below.

Table 5.1-1 Dispatch schedule of Experts

Dispachng Schedule

Republic of Kenya, Project on Capacity Development forEffective Flood Management in Flood Prone Areas

	Name (Assignment)		Trip	FY 2011 6 7 8 9 10 11 12	FY 2012 1 2 3 4 5 6 7 8 9 10 11 12	FY 2013 1 2 3 4 5 6 7 8 9 10 11 12	FY 2014 1 2 3 4 5 6 7 8 9	Days	M/M	Days	M/M
				1st Contract	2nd Contract			Hajime KOBAYASHI		Katsro KONDO	
	Hajime KOBAYASHI (Chief Advisor)	Plan	1					540	18.00		
		Actual	1					540	18.00		
	Katsro KONDO (Chief Advisor)	Plan	1							570	19.00
		Actual	1							570	19.00
	Works in Kenya, Total	Plan						540	18.00	570	19.00
		Actual						540	18.00	570	19.00

	Name (Assignment)		Trip	FY 2011 6 7 8 9 10 11 12	FY 2012 1 2 3 4 5 6 7 8 9 10 11 12	FY 2013 1 2 3 4 5 6 7 8 9 10 11 12	FY 2014 1 2 3 4 5 6 7 8 9	Days	M/M	Days	M/M
				1st Contract	2nd Contract			1st Contract		2nd Contarct	
1Work in Kenya	Hideki SAWA (Team Leader / Disaster Management Activity Promotion Expert)	Plan	8	(67) (30)	(50) (64) (36)	(53) (57) (28)	(65) (15)	97	3.23	368	12.27
		Actual	8 +[1]	1/30 3/19 6/4 8/9 11/11 12/16 (67) (30) [3] (50) (64) (36)	1/8 4/14 6/23 11/2 11/24 12/21 (53) [44] [77] (57) (28)	1/15 4/26 5/14 6/30 7/19 8/2 (65) [37] [49] (15)		97	3.23	368	12.27
	Masaru ARAKIDA (Community Based Disaster Management Expert)	Plan	6	(30) (30) (53) (60)	(28) (33) (21)	(27) (37)		60	2.00	239	7.97
		Actual	6 +[1]	3/4 4/25 7/16 9/13 (30) (30) (53) (60)	2/1 2/28 10/21 11/2 11/24 12/14 (28) (13) (21)	1/13 2/8 3/11 4/16 (27) (37)		60	2.00	239	7.97
	Msayuki INOUE (Institution/ Training Expert)	Plan	5	(45) (30) (38) (45)	(38) (19) (20)			75	2.50	160	5.33
		Actual	4 +[1]	2/5 3/13 7/8 8/30 (45) (30) (38) [9]	1/8 2/22 6/30 7/18 10/3 10/24 (38) [8] (19) (20)			75	2.50	160	5.33
	Taketoshi MATSUNAGA (Institution/ Training Expert 2)	Plan	0	(21)				0	0.00	21	0.70
		Actual	1	9/16 10/6 (21)				0	0.00	21	0.70
	Yukihiro MIKUMO (Disaster Management Activity Promotion /Community Based Disaster Management Assistant)	Plan	7	(53) (60) (15)	(52) (40) (24)	(53) (15)		0	0.00	312	10.40
		Actual	7 +[2]	2/5 3/28 4/16 6/24 7/12 8/30 9/17 10/15 (53) (60) [10] [5] (15) [14]	1/8 2/28 6/25 8/23 9/30 10/31 (52) (40) [20] (24) [8]	2/2 4/16 7/19 8/2 (53) [21] (15)		0	0.00	312	10.40
	Works in Kenya, Total	Plan						232	7.73	1100	36.67
		Actual						232	7.73	1100	36.67

Legend : Actual Plan Additional Work

5.1.2 Provision of equipment

a） Office equipment（Personal computer and printer etc.）

JICA provided the following equipment to the WRMA-HQ and SROs under which the pilot sub-catchments were located.

Table 5.1-2 List of the provided equipment for WRMA-HQ

	Name of the item	Serial number	Model	Price (Kshs.)	The Month brought	The current user		Status
						Name	Designation	
1	CPU	PO Number. PO052011020007	Optiplex980		November 2012	Ms. Alacoque Achieng	Project Administrative Assistant	Ok
2	Key board	CN-07D0KG-65891-11G-02GG-A00	Dell keyboard KB212-B		November 2012	Ms. Alacoque Achieng	Project Administrative Assistant	Ok
3	Mouse	DPPID:CN-011D3V-71581-0CO-040H	Dell		November 2012	Ms. Alacoque Achieng	Project Administrative Assistant	Ok
4	Monitor	CN-OT5JNN-72872-183-2YKM	Dell		November 2012	Ms. Alacoque Achieng	Project Administrative Assistant	Ok
5	Printer	CNCTCBJ0SP	HP Color LaserJet CP3525dn		November 2012	Project Team		Ok
6	Photocopier	Machine no. QJK1133467	Taskalfa250Ci		November 2012	Project Team		Ok
7	Laptop				November 2012	Project Team		Ok
8	SPSS (Program)			75,000/=	27th February 2012	Project Team		Ok
9	Digital Planimeter	013042	Tamiya PLANIX6	90,000/=	23rd March 2012	Project Team		Ok

Table 5.1-3 List of the provided equipment for WRMA-SRO

No.	Location	Name of Item	Qty.	Unit	Date of Handover	Officer/section in charge of maintenance	Current operational conditions	What measures shall be done in case of trouble
1	Southern Shoreline-Gucha Migori (Kisii) SRO	Desktop Computer-Dell Optiplex 790 Including APC Back-UPS 650VA	1	Set	November 10, 2011	Accounts	In good condition	Inform the officer in charge who calls in the WRMA SRO contracted technician to do repair
2	Ditto	Projector-Dell 1210S or Sony VPL EX100	1	Pcs	November 10, 2011	Accounts	In good condition	Ditto
3	Ditto	Digital Camera-SONY DSC-W530 Including 2 GB Memory	1	Pcs	November 10, 2011	Accounts	In good condition	Inform the officer in charge who will confirm the status of the camera in case of memory card of battery the SRO procures a replacement
4	Ditto	A3 Color Printer-HP Officejet K7000 A3 Printer	1	Pcs	November 24, 2011	Accounts	In good condition	Inform the officer in charge who calls in the WRMA SRO contracted technician to do repair
5	Ditto	Photo Copy Machine-CANON imageRUNNER ADVANCE C2020L	1	Set	February 6, 2012	Accounts	In good condition	Ditto
6	Nolturesh-Lumi (Loitokitok)	Desktop Computer-Dell Optiplex 790 Including APC	1	Set	November 10, 2011	Accounts	In good condition	Ditto

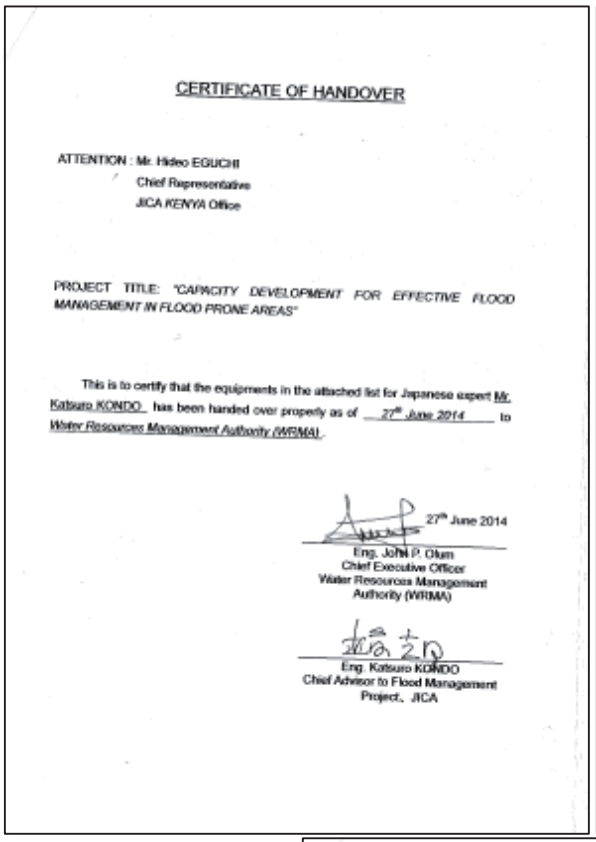
No.	Location	Name of Item	Qty.	Unit	Date of Handover	Officer/section in charge of maintenance	Current operational conditions	What measures shall be done in case of trouble
	SRO	Back-UPS 650VA						
7	Ditto	Projector- Dell 1210S or Sony VPL EX100	1	Pcs	November 10, 2011	Accounts	In good condition	Ditto
8	Ditto	Digital Camera- SONY DSC-W530 Including 2 GB Memory	1	Pcs	November 10, 2011	Accounts	In good condition	Inform the officer in charge who will confirm the status of the camera in case of memory card of battery the SRO procures a replacement
9	Ditto	A3 Color Printer- HP Officejet K7000 A3 Printer	1	Pcs	November 24, 2011	Accounts	In good condition	Inform the officer in charge who calls in the WRMA SRO contracted technician to do repair
10	Ditto	Photo Copy Machine- CANON imageRUNNER ADVANCE C2020L	1	Set	February 6, 2012	Accounts	In good condition	Ditto
11	Middle Ewaso Ng'iro (Isiolo) SRO	Desktop Computer- Dell Optiplex 790 Including APC Back-UPS 650VA	1	Set	November 10, 2011	Accounts	In good condition	Ditto
12	Ditto	Projector- Dell 1210S or Sony VPL EX100	1	Pcs	November 10, 2011	Accounts	In good condition	Ditto
13	Ditto	Digital Camera- SONY DSC-W530 Including 2 GB Memory	1	Pcs	November 10, 2011	Accounts	In good condition	Inform the officer in charge who will confirm the status of the camera in case of memory card of battery the SRO procures a replacement
14	Ditto	A3 Color Printer- HP Officejet K7000 A3 Printer	1	Pcs	November 24, 2011	Accounts	In good condition	Inform the officer in charge who calls in the WRMA SRO contracted technician to do repair
15	Ditto	Photo Copy Machine- CANON imageRUNNER ADVANCE C2020L	1	Set	February 6, 2012	Accounts	In good condition	Ditto

Table 5.1-4 List of the provided equipment (Facilities and Maintenance tools for pilot projects) for WRMA-SRO

No.	Name of Item	Unit	Qty.	Place	Date of Handover
1	Riverbank protection using gabion mattress along the Eastern Marania River at Matunada Full Gospel Church	Set	1	Middle Ewaso Ng'iro (Isiolo) SRO	25 April 2014
2	Mattock complete with handle	Pcs	5	Ditto	Ditto
3	Shovel complete with handle	Pcs	5	Ditto	Ditto
4	Wheelbarrow	Pcs	5	Ditto	Ditto
5	Masons hammer	Pcs	5	Ditto	Ditto
6	Galvanized binding wire	Roll	2	Ditto	Ditto
7	Pliers	Pcs	5	Ditto	Ditto
8	Gabion Basket	Pcs	5	Ditto	Ditto
9	Raised Access Road at Eldoro Primary School	Set	1	Nolturesh-Lumi (Loitokitok) SRO	25 April 2014
10	Raised Evacuation Space at Eldoro Primary School	Set	1	Ditto	Ditto
11	Raised 2 Compartment Toilets at Eldoro Primary School	Set	1	Ditto	Ditto
12	Culvert at Eldoro Primary School	Set	1	Ditto	Ditto
13	Jembe	Pcs	5	Ditto	Ditto
14	Fork Jembe	Pcs	5	Ditto	Ditto
15	Mattock	Pcs	5	Ditto	Ditto
16	Pick Axe	Pcs	5	Ditto	Ditto
17	Spade	Pcs	5	Ditto	Ditto
18	Wheel Barrow	Pcs	5	Ditto	Ditto
19	Wooden Bar	Pcs	2	Ditto	Ditto
20	Claw Hammer	Pcs	3	Ditto	Ditto
21	Sledge Hammer	Pcs	2	Ditto	Ditto
22	Craw Bars	Pcs	2	Ditto	Ditto
23	Machete (Panga)	Pcs	5	Ditto	Ditto
24	File sharpeners	Pcs	2	Ditto	Ditto
25	Cutlass (Slashers)	Pcs	5	Ditto	Ditto
26	Plastic Can(20 Litres)	Pcs	5	Ditto	Ditto
27	Rope (1 Coil)	Coil	2	Ditto	Ditto
28	Nails	Pcs	2	Ditto	Ditto
29	Cotton Rope(1 Coil)	Coil	2	Ditto	Ditto
30	Triangle	Pcs	1	Ditto	Ditto
31	Spirit Level	Pcs	1	Ditto	Ditto
32	Compactor	Pcs	5	Ditto	Ditto

b） Project vehicles

JICA had provided one (1) Project vehicle (car), the certificate of handover shows in follows.



CERTIFICATE OF HANDOVER

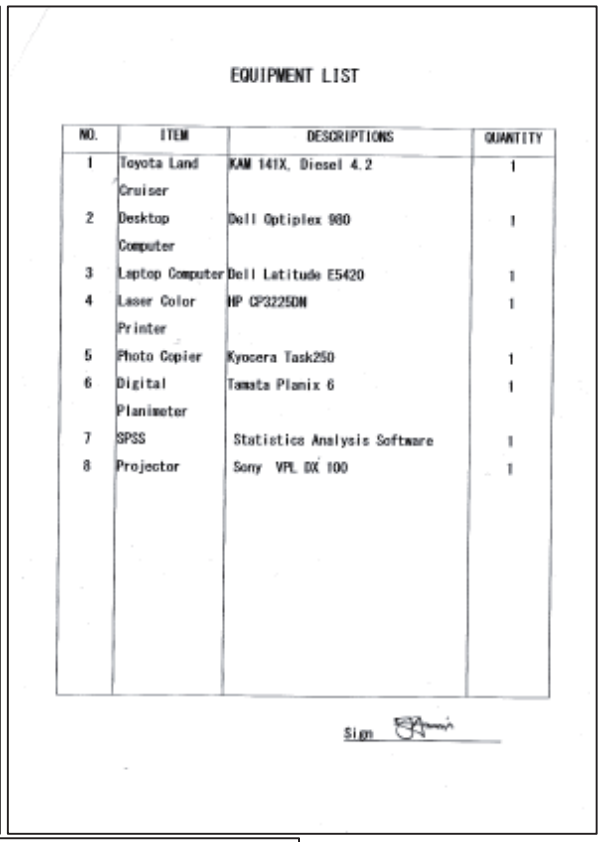
ATTENTION : Mr. Hideo EGUCHI
Chief Representative
JICA KENYA Office

PROJECT TITLE: "CAPACITY DEVELOPMENT FOR EFFECTIVE FLOOD MANAGEMENT IN FLOOD PRONE AREAS"

This is to certify that the equipments in the attached list for Japanese expert Mr. Katsuro KONDO has been handed over properly as of 27th June 2014 to Water Resources Management Authority (WRMA).

27th June 2014
Eng. John P. Olum
Chief Executive Officer
Water Resources Management Authority (WRMA)

Eng. Katsuro KONDO
Chief Advisor to Flood Management Project, JICA



EQUIPMENT LIST

NO.	ITEM	DESCRIPTIONS	QUANTITY
1	Toyota Land Cruiser	KAM 141X, Diesel 4.2	1
2	Desktop Computer	Dell Optiplex 980	1
3	Laptop Computer	Dell Latitude E5420	1
4	Laser Color Printer	HP CP3225DN	1
5	Photo Copier	Kyocera Task250	1
6	Digital Planimeter	Tamata Planix 6	1
7	SPSS	Statistics Analysis Software	1
8	Projector	Sony VPL DX 100	1

Sign

Annex

The vehicle is handed over with the followings:

Toyota Landcruiser (KAM141X)

1. Logbook
2. Transfer Letter from JICA Kenya Office
3. Two keys
4. Multi Lock Certificate
5. Duplicate Certificate of Insurance
6. Tool Kit
7. Fast Aid Kit
8. Jack
9. Two Lifesaver Panels
10. A Spare Tire
11. Radio

5.1.3 C/Ps training in Japan

In the course of the Project period some of C/Ps staffs underwent training in Japan. The training in Japan was implemented as follows:

One (1) officer from MEWNR, eleven (11) officers from WRMA and three (3) executive members from WRUA were dispatched to Japan for training based on the scope of the Project, namely "Effective Community Based Flood Management".

Furthermore, six (6) officers from WRMA were dispatched to Japan to attend Group Training Course organized by JICA, namely "Capacity Development for Flood Risk Management with Integrated Flood Analysis System (IFAS)".

One (1) officer from MEWNR was also dispatched to Japan to attend a training organized by JICA, namely "Capacity Development of Policy Making in Climate Change Adaptation in Water". The details of these trainings of C/P are shown in following table.

Table 5.1-5 Records of C/P training in Japan

Name of Course		Training Content	Implementing Agency	-Head-count -Time Span -Period	Actual Trainees
1	(Project Course) **Effective Community Based Flood Management**	-Community-based Flood Management -Integrated Flood Management	-JICA, Tokyo -NEWJEC Inc.	- 15 persons (total) - 11 Nov. to 26 Nov. 2013 (16 days)	- One (1) officer from MEWNR - Eleven (11) officer from WRMA in Headquarters, Regional Offices and Sub Regional Offices - Three (3) WRUA executives (see attached the list of trainees of training in Japan)
2	(Group Training Course) **Capacity Development for Flood Risk Management with Integrated Flood Analysis System (IFAS)**	-IFAS, GFAS -Community-based Disaster Management	-JICA, Tsukuba -ICHARM Tsukuba	- 6 person - 1 month	Six (6) WRMA staffs <Headquarters> 1) Mr. Joseph Kimanga (2012) 2) Mr. Simon Mwangi (2013) <Regional Office> 3) Mr. Reuben Ngessa (2014) 4) Mr. Elvis Ongoro (2014) <Sub-Regional Office> 5) Mr. Kimeu Musau (2012) 6) Mr. Johnson Maina (2012)
3	(Assigned Course) **Capacity Development of Policy Making in Climate Change Adaptation in Water**	-Water Resources Management -Integrated Disaster Management -Climate Change Adaptation	-JICA, kansai	1 person 1 month(2011)	Mr. John Rao Nyaoro(Director of Water Resources, MEWNR)

Table 5.1-6 List of trainee of Effective Community based flood management

Name	Position and Institution	Group
Ms. Nancy Cherono Koech	Hydrologist, MEWNR	1
Mr. Wilfred Ochenge Matagaro	Dep. Tech. Cord. Manager, WRMA HQ	1
Ms. Rose Akinyi Nyamori	Ass. Tech. Cord. Manager, WRMA HQ	1
Mr. Alexander Nzyuko	Dep. Tech. Cord. Manager, WRMA HQ	2
Mr. Stephen Ngao	Ass. Tech. Cord. Manager, WRMA Athi Catchment Area Regional Office (Machakos)	2
Mr. Joseph Maina	Catchment Man. Officer, WRMA Nol Tresh Lumi Sub-Regional Office (Loitokitok)	2
Mr. Fredy Emanuel Reuna	Secretary, Lower Lumi WRUA	2
Mr. Peterson Njiru	Ass. Tech. Cord. Manager , WRMA HQ	3
Mr. Timothy Mutie	Ass. Tech. Cord. Manager, WRMA Ewaso Ngiro North Catchment Area Regional Office (Nanyuki)	3
Mr. Abraham Gitonga	Catchment Man. Officer, WRMA Middle Ewaso Ngiro Sub-Regional Office (Isiolo)	3
Mr. David Nabea Mwiti	Secretary, Isiolo WRUA	3
Ms. Elizabeth Akinyi Diego	Ass. Tech. Cord. Manager, WRMA HQ	4
Mr. Joseph Boit	Catchment Man. Officer, WRMA Lake Victoria South Catchment Area Regional Office (Kisumu)	4
Mr. Samuel Njihia	Catchment Man. Officer, WRMA Southern Shoreline Gucha Migori Sub-Regional Office (Kisii)	4
Mr. Joshua Ouma Ojwang	Secretary, Lower Gucha Migori WRUA	4

5.1.4 Facilities and equipment for community based activity

JICA provided a total amount of Japan Yen ninety eight million, six hundred and thirty eight thousand and two hundred and seventy 98,638,270yen [equivalent to Kenya Shillings eighty eight million and seventy eight thousand nine hundred and fifty five (88,078,955Ksh)]to supplement the Project activities during the Project period.

This amount was disbursed through long term experts, experts (Consultants), and JICA Kenya Office as bellow.

Long term experts : 24,458,432yen（22,163,080Ksh）including a) sub-contracting cost for local consultant and b) material and equipment cost for community based activities

JFY 2011	1,739,011yen	1,925,815Ksh	0.903yen/Ksh
JFY 2012	5,716,725yen	5,821,512Ksh	0.982yen/Ksh
JFY 2013	5,246,849yen	4,461,606Ksh	1.176yen/Ksh
JFY 2014	11,755,847yen	9,954,147Ksh	1.181yen/Ksh

Consultants：65,006,000yen（57,966,275Ksh）

JFY 2011	10,460,011yen	11,583,622Ksh	0.903yen/Ksh
JFY 2012-2014	54,546,000yen	46,382,635Ksh	1.176yen/Ksh

JICA Kenya Office：9,173,838yen（7,949,600Ksh）

5.2 Inputs from Kenyan side

5.2.1 Personnel allocation from Counter Part (C/P)

a） Joint Coordinating Committee (JCC)

JCC had already been mentioned above

b） Working Group (WG)

WG had already been mentioned above.

5.2.2 Office Space and Facilities

a） Office space

WRMA-HQ and SRO had provided adequate office space for the Project.

b） Depot space for construction materials, vehicles and other necessary equipment

In this Project there was no need to depot space for construction materials, vehicles and other necessary equipment.

5.2.3 Local cost

The total amount from WRMA that was spent as expenses from June 2011 to March 2014 was Kenya Shillings seven million and forty thousand nine hundred and fifty one (7,040,951 Ksh.) (approximately Japanese yen eight million four hundred and sixty three two hundred and twenty three 8,463,223 yen) this is inclusive of the cost for business trip of C/Ps, operation and maintenance cost such as renting or setting up office space, furniture and parking fee.

Chapter 6 Capacity Development of WRMA on Flood Management

In this chapter the capacity development of WRMA on flood management is described. The chapter reflects on the capacity developed vis-à-vis WRMA's understanding of its required capacity and its transition from the commencement stage to completion stage of the Project.

6.1 The Requisite WRMA Capacity to be developed in Flood Management

In July 2012, the requisite capacity for WRMA to be developed in the field of flood management was discussed in the Working Group meeting with the Project Team. Based on the discussions in that meeting, prioritized subjects which should be tackled by GOK were listed as follows:

1) To integrate data and analyze causes and effect relationship of flood;

2) To formulate river basin flood management plan; and

3) To develop resilient community to floods.

And, the requisite capacities to be developed in order to conduct abovementioned subjects were agreed upon as follows:

- To develop a system to collect information/data related to cause and effect of flood holistically;
- To analyze information/data related to cause and effect of flood holistically;
- To coordinate relevant stakeholders for better flood management;
- To advice WRUAs to formulate SCMPs;
- To formulate and update a manual on flood cause and effect assessment and teach RO/SRO and District officers; and
- To formulate "River Basin Flood Management Plans (RBFMP)" the RBFMP shall be under the CMSs and oversee the SCMPs.

6.1.1 Integration and Analysis of the Data of Causes and Influences of Flooding

It was observed that indeed meteorological data, hydrological data and flood-damage data were being collected and stored by KMD, WRMA and KRCS and authorities concerned respectively. The Project Team pointed out that those data were not comprehensively combined for analyzing their causes and influences.

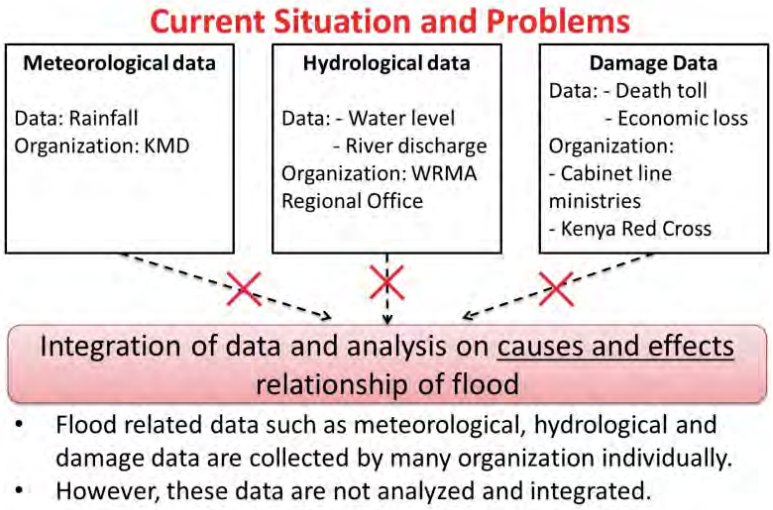


Fig. 6.1-1 Current Situation and Problems as to Integration and Analysis of Meteorological Data, Hydrological Data and Damage Data

It was pointed out that the integration and analysis of data would produce the following effects:

1) Effective early warning of flood;
2) Efficient suggestion for WRUA to prepare SCMP;
3) Prediction of economic loss due to flood; and
4) Analysis of cost performance for flood mitigation.

(1) Effective early warning of flood

Early warning system of flood is yet to be implemented in most parts of Kenya and only in Nzoia River Basin has it been implemented under the project funded by World Bank.

The warning equipment at Nzoia for precipitation, water level and flow amount observation was provided by the World Bank project team with KMD and Ministry of Water & Irrigation. In other areas however, precipitation observation is done by KMD and water level / flow amount observation is done by WRMA and those data are not shared. Thus, no analysis to dispatch early warning had been carried out.

As an example for early warning system shown below, if time-relationship should be recognized as to water level and upstream precipitation at the nearby observatory when dike breakage occurs, threshold value can be examined for announcing warning on the precipitation and water level.

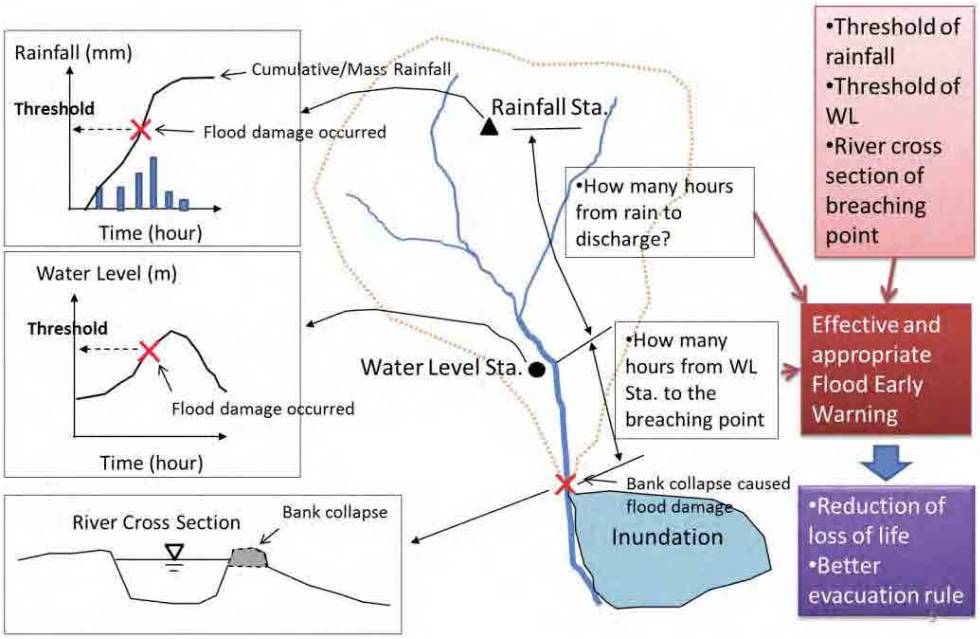


Fig. 6.1-2 Image of Effective Early Warning of Flood

Possible water level to cause flood can be assessed as the threshold value by plotting observation record of water level at a certain observatory and expected time of flooding occurrence at its downstream area.

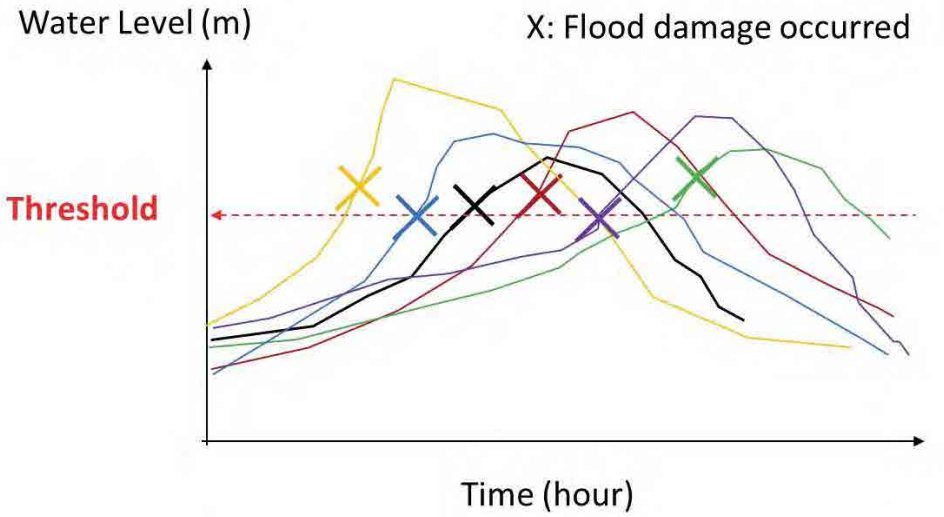


Fig. 6.1-3 Analysis Image of Water Level and Flood Occurrence

(2) Suggestion for WRUA to Prepare SCMP

During the development or review of the SCMP, WRUA can study on proper plan to mitigate flood damage by analyzing the damage by such analysis, when inundation, as flooding at school route, isolation of hospital in the inundation area or damage to the crops having weakness against flooding in order to examine damage-avoidable measures.

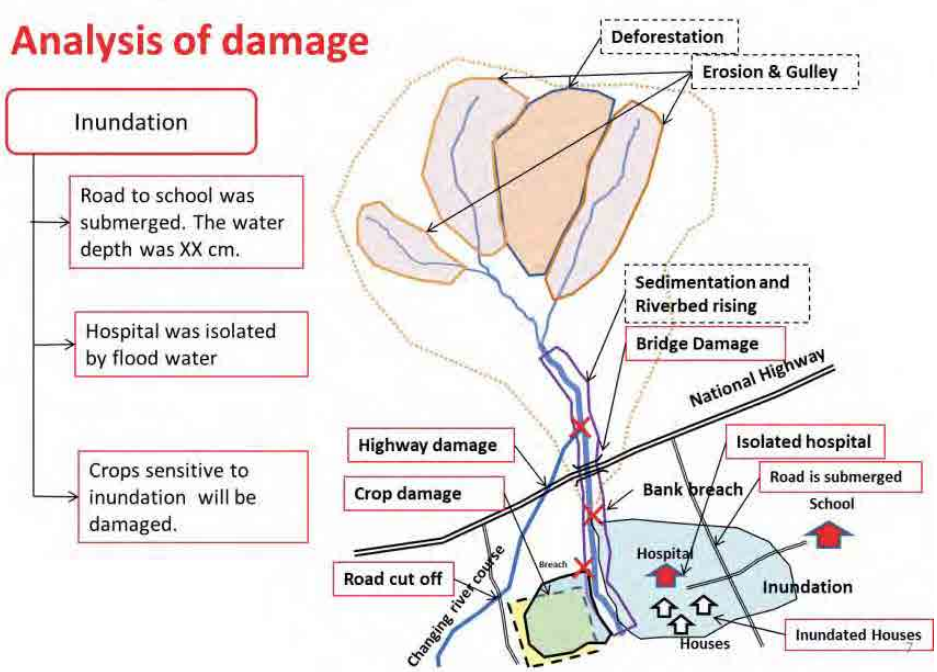


Fig. 6.1-4 Analysis Image of Damage

(3) Prediction of Economic Loss due to Flood

When direct and indirect damage amount on account of flood be able to estimate, annual flood damage amount can be compared with GDP and with other disasters also with regional damage amount, by so doing flood control can be carried out at appropriate magnitude and locations.

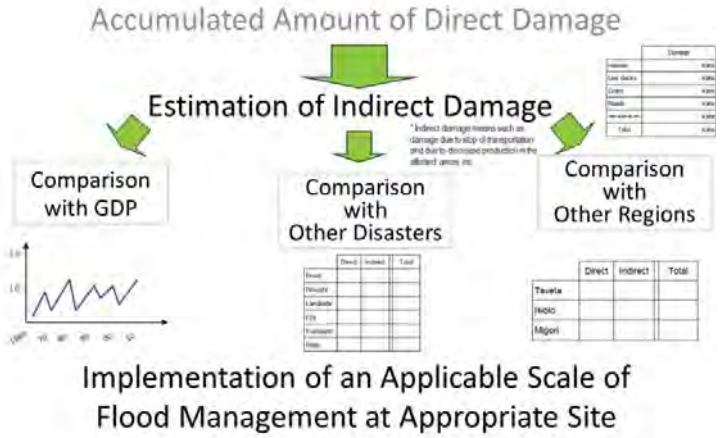


Fig. 6.1-5 Estimation Image of Economic Loss due to Flood

(4) Analysis of Cost Performance for Flood Mitigation

By plotting various relationships between inundation depth and flood damage amount at a certain area, their correlation can be identified and correlation curve can be depicted. By so doing, it can be predicted that damage amount could be reduced to some value when the countermeasure should be taken for reducing inundation depth to some point.

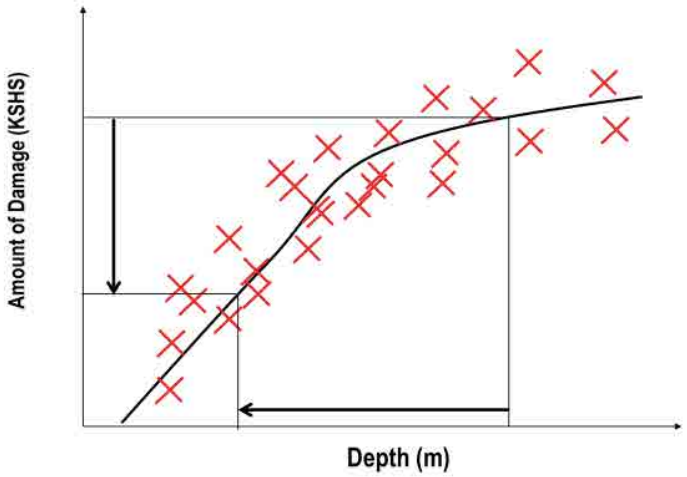


Fig. 6.1-6 Relation between Inundation Depth and Damage Amount

6.1.2 Preparation of Flood Management Plan per River Basin Unit

Currently so far the dikes have been constructed between the town located in the middle basin of some river system and its downstream area without considering outflow conditions threats. In such countermeasure, flooding will be avoided in the middle basin, but flooding will occur at the downstream side to cause damages at the towns located at the downstream areas.

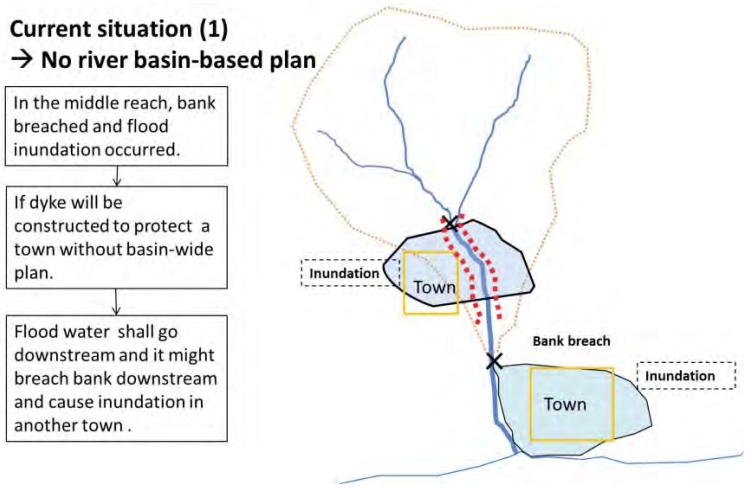


Fig. 6.1-7 Example of Flood Control Plan with River-Basin-Based Plan (1)

Another example shows the sedimentation in the middle basin by the debris inflow from upstream side even though the dike has been constructed there, which was caused by the raising of riverbed level on account of outflowing earth produced by ground erosion from upstream side. Due to those phenomena, flowing capacity in the middle basin had become insufficient and caused dike collapse. Countermeasures against ground erosion at upstream side should be required in advance.

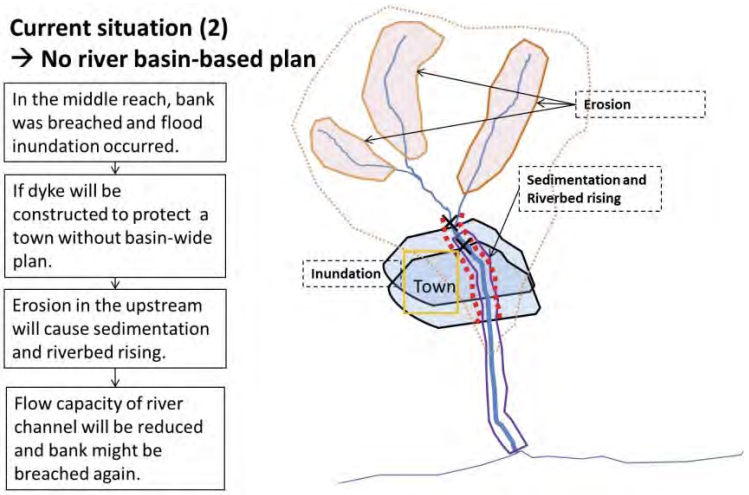


Fig. 6.1-8 Example of Flood Control Plan without River-Basin-Based Plan (2)

Another example shows the construction of dike in the middle basin which caused dike collapse due to sedimentation thereat by the earth outflowing from the upstream side where forestry had been destroyed without countermeasure against it. In such case, flowing capacity in the middle basin had been weakened by the subsequent sedimentation of outflowed earth to cause the dike collapse.

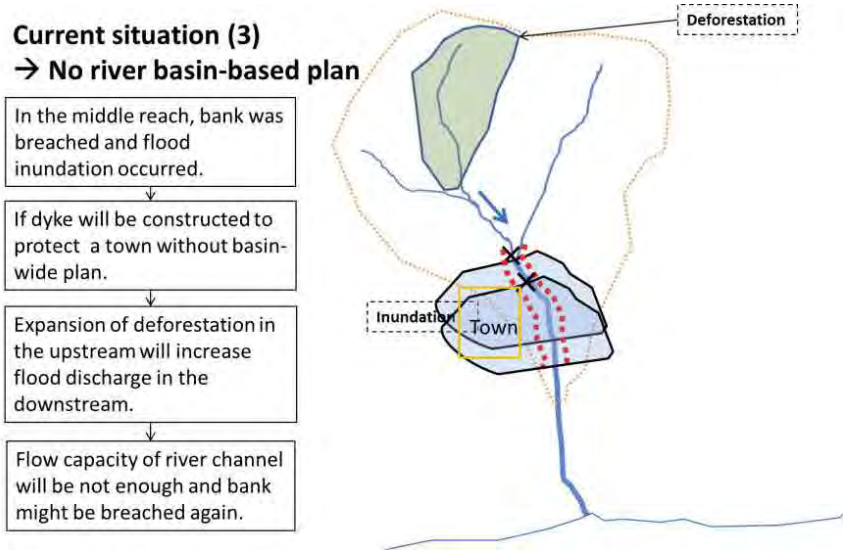


Fig. 6.1-9 Example of Flood Control Plan without River-Basin-Based Plan (3)

To avoid those possible phenomena caused by the above-mentioned plans, it is requisite to frame countermeasures in consideration of the whole river basin conditions for not only structural measure such as dam, dike, sabo-dam/ check dam but also for non-structural measure such as plantation, evacuation and resident-enlightenment.

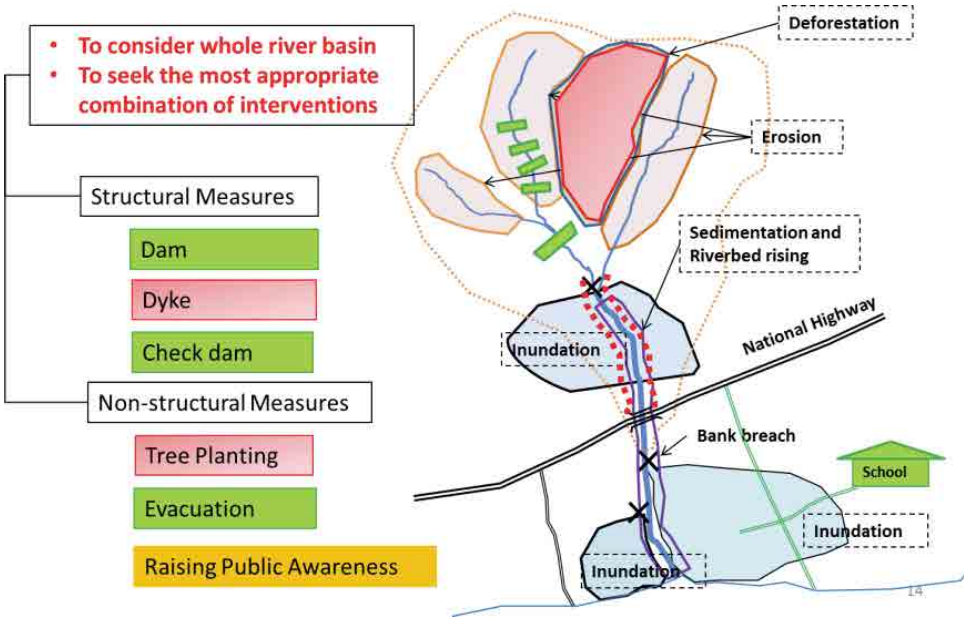


Fig. 6.1-10 Image of Combined Countermeasures in Consideration of Whole River Basin Conditions

6.1.3 Establishment of Community's Earliest Capability to Recover Flooding (Community Resilience)

The Current conditions of flood damages in Kenya indicates that floods indirectly affect traffic (disruption of transport networks) including school-commuting route, transportation of agricultural crops and their market. Since flood damages affect daily livelihood of community members in various fields, systematic flood control plan to protect stakeholders involved in various fields must be established.

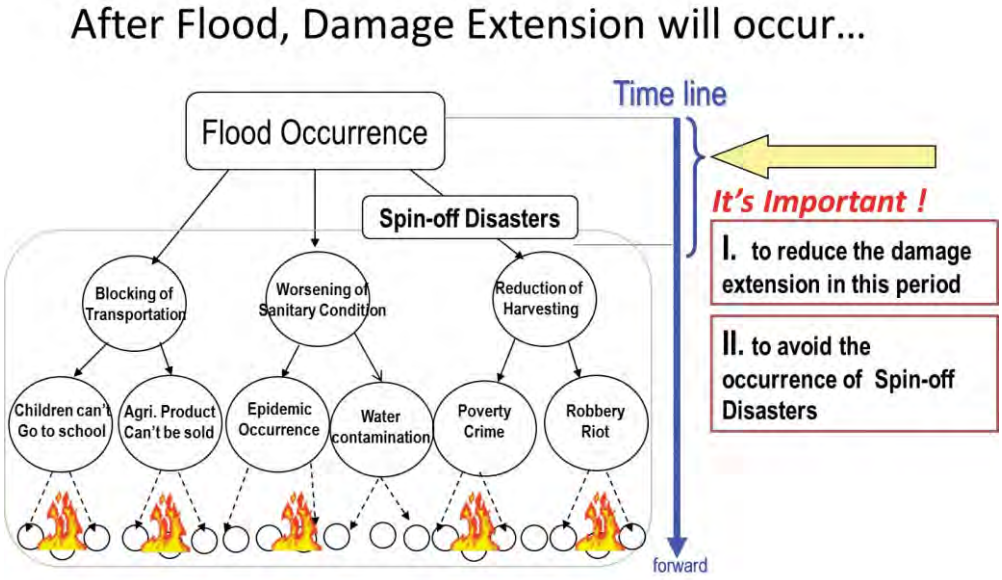


Fig. 6.1-11 Subsequent Damage Spread of Flood

6.1.4 Capacity Required for WRMA's Flood Management

In order for WRMA to implement the above-mentioned three (3) (6.1.1 to 6.1.3), the following capacities are requisite and substantial requirements:

-Data collection concerning causes and results of flooding;
-Analysis of those collected data;
-Collaboration with the related stakeholders to better flood control;
-Advice to WRUA in preparation of SCMP;
-Arrangement and update of the manuals on flood management; and
-Preparation of integrated river basin management to be utilized in between CMS (Catchment Management Strategy) and SCMP (Sub-Catchment Management Plan)

The Project has been implemented focusing on enhancement of those 6 capacities.

6.2 WRMA Capacity Development in Flood Management

Within the Working Group, the abovementioned capacity was assessed in November 2012, one and half years after the Project commencement as a pre-Project assessment. Before the end of the Project, in June 2014, WG meeting on the assessment of capacity was held again as a post-Project assessment. As a result, the contribution of the Project to WRMA capacity development in flood management was evaluated, as shown in the following table. As a summary capacity element that have been "very much improved" was 23 % among all capacity elements, "partially improved" was 55 %, and "not improved" was 22 %.

The result of capacity evaluation can be seen in "Appendix 1-1: The transition of WRMA staff's capacity in flood management". Details in capacity evaluation at the beginning of the Project can be seen in "Appendix 2-2: Capacity index of WRMA staffs".

Table 6.2-1 Outline of WRMA Capacity Development in Flood Management as of June 2014

Capacity to be developed	Number of elements of capacity development	Very much improved	Partially improved	Not improved
1. To develop a system to collect information/data related to cause and effect of flood holistically	40 (100 %)	3 (8 %)	22 (55 %)	15 (37 %)
2. To analyze information/data related to cause and effect of flood holistically	39 (100 %)	1 (3 %)	27 (69 %)	11 (28 %)
3. To coordinate relevant stakeholders for better flood management	20 (100 %)	3 (15 %)	17 (85 %)	0 (0 %)
4. To advice WRUAs to formulate SCMPs	24 (100 %)	18 (75 %)	4 (17 %)	2 (8 %)
5. To formulate and update a manual on flood cause and effect assessment and teach RO/SRO and County (District) officers	11 (100 %)	3 (27 %)	6 (55 %)	2 (18 %)
6. To formulate "River Basin Flood Management Plans" which shall be under the CMSs and oversee the SCMPs	7 (100 %)	4 (57 %)	2 (29 %)	1 (14 %)
Total	141 (100 %)	32 (23%)	78 (55%)	31 (22%)

Capacity elements which were viewed as "very much improved" in "4 To advice WRUAs to formulate SCMPs" category was 75%, in "6 To formulate "River Basin Flood Management Plans" which shall be under the CMSs and oversee the SCMPs" 57%, and in "5 To formulate and update a manual on flood cause and effect assessment and teach RO/SRO and District officers" 27%.

The reason why "4 to advice WRUAs to formulate SCMPs" was highly evaluated seemed to be attributable to the Project's contribution to the development of flood management modules in WDC Manual, establishment of flood management training for WRMA officers and establishment of flood management training for WRUAs. The reason why "6 To formulate "River Basin Flood Management Plans" was highly evaluated seemed to be attributable to the development of Integrated Flood Management Plans (IFMPs) in three pilot river basins, the establishment of flood management training for WRMA officers, deployment of Flood Management Officers, and the establishment and operation of Integrated Flood Management Committee (IFMC). The reason why "5 to formulate and update a manual on flood cause and effect assessment and teach RO/SRO and District officers" was highly evaluated seemed to be attributable to the development of materials for WRMA flood management training and the development of manuals.

On the other hand, capacity elements which were evaluated as "not improved" were "1. To develop a system to collect information/data related to cause and effect of flood holistically" 38 % and "2 to analyze information/data related to cause and effect of flood holistically" 28 %. From the beginning of the Project, insufficient capacity of collection and analysis of information related to cause and effect of flood was considered as a serious problem of WRMA. And it was revealed by the assessment that the improvement this capacity element was still not enough. Further On-the-Job-Training, procurement, installation and operation of observation equipment, capacity building and training of WRMA officers in this regards shall be conducted.

Table 6.2-2 Capacity Assessment for WRMA (1-1)

Project Purpose: In the Project target areas, institutional framework of flood management in the context of integrated water resource management is to be established for effective and sustainable implementation of community-based activities.
Output 1) At each level of WRMA (headquarters, regional offices and sub-regional offices), sustainable organizations in charge of flood management are to be strengthened.
Output 2) For promoting community-based activities with respect to flood management, WRMA staffs are to support WRUAs and communities are to be strengthened.

WRMA Capacity to be Developed	Required Capacity Element	Pre-Project Assessment (*29th to 30th Nov. 2012*)	Target Group	Post-Project Assessment (*4th to 5th June 2014*)	Actions
1. To Develop a System for Collecting and Analyzing Information/Data with respect to Flood Phenomena	[Personal aspects]				
	1-1 To collect and analyze information/data about rainfalls and river flows which may be the cause of floods	**Skills and expertise:** 1) Regarding collecting and analyzing information/data of rainfalls and river flows, which may be the cause of floods, staffs of WRMA-HQ, RO and SRO have skills and knowledge of low water, but they don't have enough skills and knowledge (few staffs with skills) of high water(lack of equipment for high flow measurement). 2) Regarding the observation of rainfalls, WRMA staffs don't have enough knowledge and technique (few staffs with skills) for short-term interval rainfall observation. 3) Regarding the observation of water levels and river flows, they don't have enough knowledge and technique for one-hour interval water level observation and high water discharge observation. **Supplementary Notes:** 4) There are some opportunities for training the staffs of HQ, while there are few opportunities for training staffs of ROs and SROs. 5) No technical instruction books for hydro/meteorological observation exist. 6) WRMA stuffs can collect data but cannot analyze and bank information/data.	**SRO, RO, HQ**	**Improvements attributable to the Project** (To select "Very much improved", "Partially improved", and "Not improved yet") On collecting and analyzing information/data of rainfalls and river flows, which may be the cause of floods: ADCP available but other logistical (accessories) challenges in measuring high flows. **Partially Improved** On the observation of rainfalls, WRMA staffs don't have enough knowledge and technique for short-term interval rainfall observation. 1) Partially improved 2) Partially improved (Reason shall be described) 3) Partially improved **Challenges remaining** 1) Additional equipment are required. 2)Staff numbers are inadequate 3) Accessories to equipment (cable ways) 4) Vandalism to metallic installation 5) Capacity to analyze	▪ Cable ways to capture high flows ▪ On the job-training on the use of equipment ▪ Installation of automated gauge stations (telemetric)
	1-2 To collect and analyze information/data on impacts and damages by floods	**Skills and expertise:** 1) WRMA-SRO staffs cannot collect and analyze information/data about the human damages, such as the number of missing persons and deaths, physical damages which constitute the number of destroyed houses and crops affected by floods, etc.	**SRO**	**On WRMA-SRO staffs cannot collect and analyze information/data about the human damages, Partially Improved** **Improvements attributable to the Project** 1) Partially improved: a. Trained WRMA staff designated as flood management officers **Challenges remaining** 1) Liason between WRMA and other stakeholders with crucial data 2) Capacity to collect and analyses the data in a timely manner	▪ Enhancement of liason with KRCS, Agriculture, Transport and Education sectors ▪ Strengthening of IFMC ▪ Enhance the capacity of WRUA in collecting data ▪ Establish/ enhance a system of data collection, analysis and dissemination ▪ Establishing knowledge centre at various levels
	1-3 To collect and analyze both the characteristics of river basins and cause and effect of floods by using maps	**Skills and expertise:** 1) WRMA-SRO staffs usually don't use maps in their works. 2) It is common that flooded areas have not been identified and delineated on maps. 3) Records on river course changes have not been identified and shown on maps. 4) Only for Lumi River, such kind of records was listed on a hand writing map. 5) WRMA-SRO staffs don't have maps, which show the location of rainfall stations and water level gauging stations. 6) The use of GIS maps remains minimal in WRMA-HQ.	**SRO, RO**	**On WRMA-SRO staffs usually don't use maps in their works-Partially improved** **Improvements attributable to the Project** 1) Partially improved: a. Maps are being used in the three pilot project areas b. Maps are also being used in water rights permit processing and WDC application 2) Partially improved: a. It has been done at the three pilot areas. b. Training has incorporated delineation of flooded areas skills 3) Partially improved: a. The change of GuchaMigori river course has been identified and documented and shown on the map 4) Not improved yet 5) Very much improved: a. Maps showing rainfall and water level stations 6) Partially improved: a. GIS maps are being used in the reports, presentations etc **Challenges remaining** 1) Bullet 5 Maps are yet to be displayed 2) Bullet 6 Inadequate capacity in the use of GIS at the Regional offices	▪ Improve the use and display of maps ▪ Capacity building in the use of GIS
	1-4 To summarize and report the status of floods and their damages	**Skills and expertise:** 1) WRMA-SRO staffs don't have enough skills and expertise to collect and analyze information/data of rainfalls, flow rates, geographical characteristics, flood affected areas, flood affected population, etc.	**SRO**	**Improvements attributable to the Project** 1) Partially improved: a) Data collection has improved as a result of some staff being trained. b) Some of the equipment have been distributed to the SROs c) Participation in the development of IFMP in the three pilot project areas. d) WRUA sensitization and training. e) Established CFMOs under the WRUA. f) Development of flood management module in the WDC manual g) Establishment of flood management department from the headquarters to the SROs h) Submitted flood disaster reports are available **Challenges remaining** ▪ Inadequate equipment at the SRO. ▪ Developing of IFMP for the remaining 13 flood prone areas ▪ Inadequate system for flood data collection, analysis and dissemination	▪ Procure and train staff on the use of the equipment. ▪ Establish the system for flood reporting and dissemination. ▪ To make a work plan and budget for the remaining 13 flood prone areas.

Table 6.2-3 Capacity Assessment for WRMA (1-2)

WRMA Capacity to be Developed	Required Capacity Element	Pre-Project Assessment (29th to 30th Nov. 2012)	Target Group	Post-Project Assessment (4th to 5th June 2014)	Actions
	[Organizational aspects] (Human, physical, financial, knowledge, etc.)				
	1-5 To collect and arrange information/data systematically and appropriately with respect to rainfalls and high water discharges	**Organization:** 1) There are no common methods of installation, maintenance and calibration of hydro/meteorological observation equipment 2) There is no particular system for installation, maintenance and calibration of hydro/meteorological observation equipment 3) Although there are staffs in charge of data collection, there are no instruction manuals for guiding volunteer observers. 4) There are no officers in charge of checking and statistically processing data. 5) Although staffs in charge of databases were stationed in SROs, ROs and HQ, there is no system to share the result of databases. **Standing instructions:** 6) There are no such regulatory documents of posts. **Budget Measures:** 7) Insufficient budget. **Equipment:** 8) WRMA-ROs have Acoustic Doppler Current Profilers (ADCPs) and Acoustic Doppler Velocity-meters (ADVs) 9) WRMA-SROs have SEBA Current Flow Meters ready. 10) The number and the volume of hard disks of personal computers are not enough in WRMA-SROs. **Supplementary Notes:** 11) Poor accessibility to hydro/meteorological observation stations with the exception of a few stations.	SRO, RO, HQ	**Improvements attributable to the Project** 1) Partially improved: a) There are staffs that have been trained. b) Standard procedures for installation, and operation 2) Not improved yet 3) Not improved yet 4) Partially improved: a. Staffs trained on data have been posted to the some of the SRO 5) Partially improved: a. There is the year book available in the WRMA website b. There is feedback from the Headquarters to the Regional office on data analysis 6) Partially improved a) The schedule was developed and communicated b) Flood survey sheets developed 7) Partially improved a) There is budget line for Flood Management 8) Partially improved a) Two more ADPs added for Kisumbu and Narok Sub regions b) 16 No. officers trained in use of ADCPs mainly from sub regions/regions 9) No improvement a) Non has been added and each sub region need SEBA current flow meters 10) No improvement 11) No improvement **Challenges remaining** ▪ Bullet 1Calibration of equipment ▪ Bullet 1Measuring the effectiveness on the use of procedures and manuals ▪ Bullet 2 There is no section on instrumentation ▪ Bullet 4 Inadequate staffs for data analysis ▪ Bullet 5 Inadequate capacity ▪ Bullet 7 Disbursement and voting of the fund ▪ Bullet 9 Servicing and calibration	▪ Develop observers' manual ▪ Establishing of data analysis section ▪ Establishment of instrument specialists office ▪ Enhance data management capacity ▪ Develop quality control manual for data management ▪ Assess the effectiveness of use of the schedule and flood data survey sheet ▪ Work on work plan and come with clear budget ▪ To procure ADPs and train other 14 flood prone sub regions ▪ Improve on capacity of servers and number of computers at ROs and SROs ▪ Improve on interconnectivity of WRMA offices ▪ Automate hydromet stations with telemetric system
	1-6 To collect and analyze information/data about the effects and damages of floods	**Organization:** 1) There are no flood management staffs in ROs and SROs **Standing instructions:** 2) nonexistent **Budget Measures:** 3) Insufficient budget **Equipment:** 4) The number of personal computers and vehicles are not enough in ROs and SROs.	SRO, RO	**Improvements attributable to the Project** 1) Very much improved a) Staff trained and posted 2) Partially Improved a) Flood survey data sheet developed 3) Applies to above **Challenges remaining** ▪ Bullet 1 inadequate trained staff ▪ Bullet 1 no clear job description for FMOs	▪ Training and deployment of FMOs ▪ Assess the effectiveness in the use of the forms
	1-7 To collect and analyze the characteristics of river basins and cause and effect of floods by using maps	**Organization:** 1) It is very rare to use maps in SROs, ROs and HQ. 2) There are two staffs in HQ to be able to use GIS, whose skills are included to a medium or an upper class. 3) There are two staffs to be able to use GIS in RO, whose skills are included to a beginner class. 4) It is very hard for the staffs to use GIS for WRMA's works. **Standing instructions:** 5) Nonexistent **Budget Measures:** 6) insufficient budget **Equipment:** 7) The number of personal computers and vehicles are not enough in WRMA. **Supplementary Notes:** 8) Information/data are collected routinely, but not analyzed in graphs. 9) WRMA staffs don't identify and instruct mistakes of volunteer observers.	SRO, RO, HQ	**Improvements attributable to the Project** 5) Partially improved a) There has been increase in use of maps in pilot areas b) There has been capacity building in use of maps in other 15 flood prone sub regions 6) Partially improved a) Some staff members have been trained in GIS 7) Ditto 8) Ditto 10) As above 11) As above 12) As above 13) As above 14) Partially improved a) Work instructions and procedures available at relevant functional levels **Challenges remaining** ▪ Prohibitive cost of license	▪ Enhance capacity to use maps ▪ Procure adequate GIS software licenses at SRO, RO and HQ ▪ Enhance staff capacity on use of GIS software ▪ Assess the effectiveness of the work instructions and the procedures
	1-8 Reports for summarizing the situation of flood damages will be shared nationwide through HQ and ROs.	**Organization:** 1) There are no Flood Management Officers in ROs and SROs. **Standing Instructions:** 2) nonexistent **Budget Measures:** 3) insufficient budget **Equipment:** 4) The number of personal computers and vehicles are not enough in WRMA. **Supplementary Notes:** 5) There are no flood disaster reports in WRMA.	SRO, RO, HQ	**Improvements attributable to the Project** ▪ Covered above (1-4) 5) Partially Improved a) Regular reports have been submitted by SROs and ROs **Challenges remaining** ▪	▪ Include Flood management reports in the annual/quarterly water resources situation reports

Table 6.2-4 Capacity Assessment for WRMA (1-3)

WRMA Capacity to be Developed	Required Capacity Element	Pre-Project Assessment (*29th to 30th Nov. 2012*)	Target Group	Post-Project Assessment (*4th to 5th June 2014*)	Actions
	Institutional aspects]				
	1-9 An agreement or a system on sharing of observed data of rainfalls, water levels and flow rates with related organizations	1) There are no agreements for exchanging and sharing observed data between WRMA—which is conducting hydro/meteorological observation— and KMD—which is conducting meteorological observation—. 2) WRMA should provide rainfall data to KMD. 3) WRMA and KMD come away with no agreements with respect to data sharing from the effort. 4) However, there is a framework of KMD's data sharing to both ASAL Secretariat—a platform of countermeasures against drought— and NPDRR—a national platform for disaster risk reduction formulated by the Government of Kenya—	HQ	**Improvements attributable to the Project** 1) Not improved. a) Attempts have been made to bring in understanding between KMD and WRMA on data sharing, results awaited. 2) 2-3 as above 4) As above **Challenges remaining** ■ Bullet 1 Pegging data access to revenue collection	■ Lobby for increased use of data in decision making

Table 6.2-5 Capacity Assessment for WRMA (2-1)

WRMA Capacity to be Developed	Required Capacity Element	Pre-Project Assessment (*29th to 30th Nov. 2012*)	Target Group	Post-Project Assessment *(4th to 5th June 2014)*	Actions
2. To Analyze Cause and Effect of Floods by Using Related Information/Data	[Personal aspects]				
	2-1 Basic knowledge of topographic maps and mapping technique	**Skills and expertise:** 1) WRMA staffs are short on experience in reading topographic maps and mapping processes, because topographic maps are not common in Kenya. **Incentive:** 2) no incentive scheme **Supplementary Notes:** 3) WRMA staffs have no chances for attending training seminars of reading maps and mapping technique. 4) WRMA staffs have no technical reference materials.	**SRO,** RO, HQ	**Improvements attributable to the Project** 1) Partial improvement ➢ Development and transfer of flood hazard maps to the topographic maps ➢ Display of rainfall and RGS stations on the topographic maps ➢ Development of WRUA capacity ➢ Delineation of flood prone areas on the topographic maps 2) Partial improvement ➢ Transfer of flood hazard maps to the topographic maps ➢ Display of the hazard maps at strategic points ➢ Utilized in the installation of the Early Warning Systems ➢ Siting of intervention measures (structural measures 3) Partially Improved ➢ On-site training on the development and reading of flood hazard maps ➢ Participated in the development of flood hazard maps 4) Partially improved ➢ Development of the flood management module in the WDC manual ➢ Development of flood hazard map manual ➢ Evacuation drill guidebook ➢ Flood management textbook for primary school education ➢ Manual on evacuation centre ➢ Manual on the Flood early warning systems ➢ To include others in process of development **Challenges remaining** ▪ The current topographic maps does not portray real ground situations ▪ Inadequate number of trained staff in map reading ▪ Limited awareness and accessibility to technical reference materials	▪ Liaise with the Survey of Kenya to update the topographic map to portray water resources situation on the ground ▪ Capacity building on water resources map development and reading ▪ Dissemination of the technical reference materials
	2-2 Basic knowledge of high water discharge observation	**Skills and expertise:** 1) WRMA staffs are short on experience and understanding in high water discharge observation, although WRMA staffs understand the importance of low water discharge observation. **Incentive:** 2) no incentive scheme **Supplementary Notes:** 3) WRMA staffs have limited opportunities for attending training seminars of high water discharge observation. 4) WRMA staffs have no technical reference materials.	**SRO,** RO, HQ	**Improvements attributable to the Project** 1) Partial improvement ➢ A number of WRMA staff were trained in high flow discharge observations ➢ WRMA staff have become Trainers of Trainers ➢ More high water discharge observation equipment provided in the regions and sub regions and hence more experience by the staff. 2) Partial improvement ➢ With provision of more equipment and training there is increased motivation. ➢ Facilitation of staff 3) Partially improved ➢ A number of WRMA staff were trained in high flow discharge observations ➢ WRMA staff have become Trainers of Trainers ➢ Acquisition of more high flow measurement equipment ▪ 4) Partially improved ➢ Operational manuals have been provided with newly acquired equipment **Challenges remaining** ▪ Extremely rough flows are difficult to measure ▪ Limited high flow measurement equipment at the sub regional level ▪ Limited capacity to handle the equipment at the sub regional level ▪ Delayed facilitation	▪ Carry out staff training needs assessment and projection ▪ Purchase, provide high water observation equipment and train WRMA officers in the remaining 14 sub regions ▪ Keep the provided manuals at the knowledge centres
	2-3 Basic knowledge of flood disaster databases	**Skills and expertise:** 1) WRMA staffs are short on experience in constructing a flood disaster database, although WRMA staffs understand the importance of it. **Incentive:** 2) no incentive scheme **Supplementary Notes:** 3) WRMA staffs have limited opportunities for attending training seminars for constructing and managing databases.	**SRO,** RO, HQ	**Improvements attributable to the Project** ▪ 1)Partially improved ➢ Collected information on the floods in the 3 pilot project areas ➢ Use of the information to develop the flood management plan in the 3 pilot areas ➢ Development of systematic collection of flood information ▪ 2) Partially improved ➢ Deployment of FMO obliges them to collect flood disaster information ▪ 3) partially improved ➢ WRMA Staff were trained in construction and management of data bases **Challenges remaining** ▪ Limited experience in data base construction	▪ Construction and management of the flood disaster data bases at the three pilot project areas and then the other thirteen flood prone areas ▪

Table 6.2-6 Capacity Assessment for WRMA (2-2)

WRMA Capacity to be Developed	Required Capacity Element	Pre-Project Assessment (29th to 30th Nov. 2012)	Target Group	Post-Project Assessment (4th to 5th June 2014)	Actions
	[Organizational aspects] (Human, physical, financial, knowledge, etc.)				
	2-4 Framework for observing high water discharges	**Organization Framework:** 1) WRMA has no observation framework on high water discharges. 2) Each WRMA Office is in her own way of discharge observation. 3) For example, Kakamega RO is conducting a routine observation of discharges, while Kisumu RO has no observation of discharges 4) No ROs have conducted any observation of high water discharges. **Standing Orders:** 5) nonexistent **Budget Measures:** 6) not enough **Equipment:** 7) ROs have deficient discharge observation instrument, although ROs have them. **Supplementary Notes:** 8) WRMA has unclear practice and procedure for observing high water discharges. 9) No manuals on discharge observation 10) Only WRMA LVSC has done discharge observation	SRO, RO, HQ	**Improvements attributable to the Project** ■ 1)Partially Improved ➢ There is a monitoring schedule produced at the beginning of the Financial Year ■ 2) Partially improved ➢ Similar equipment supplied to the WRMA regions ➢ There is coordination from the regional office ■ 3)Partially improved ➢ The 3 pilot regions now conduct regular observations of high discharges as per the monitoring schedule ■ 4) Partially improved ➢ All the 6 regions conduct regular high flow measurements ➢ Two sub regions, Kisumbu and Narok provided with high flow measurement equipment and conduct regular high flow measurements ■ 5) Partially improved ➢ There is a monitoring schedule produced at the beginning of the Financial Year ■ 6) Partially Improved ➢ A budget line in the financial year ■ 7) Partially improved ➢ Two sub regions have been equipped (Kisumbu and Narok) ■ 8)Partially improved ➢ There are documented instructions for high flow measurements ■ 9) Not improved ➢ No discharge observation manuals provided ■ 10) Very much improved All regions have been provided with high flow measurement equipment and are doing the discharge measurements. **Challenges remaining** ■ Inadequate equipment for high flow measurements ■ Inadequate capacity ■ Irregular disbursement of funds to facilitate the teams to carry out high flow measurements ■ Inconsistent high flow measurements ■ Lack of discharge observation manuals ■ no framework for high water discharge measurements	■ Purchase of high flow measurements equipment and training on the use(SRO) ■ Develop the framework for high water discharge measurements ■ Develop a manual for high water discharge measurements ■ Adherence to the budget timelines ■ Assess the effectiveness of the monitoring schedule
	2-5 Framework for developing and administrating the flood disaster database in Kenya	**Organization Framework:** 1) WRMA has not developed the flood disaster database in Kenya, although it recognizes the importance of the flood disaster database in Kenya. **Standing Orders:** 2) nonexistent **Budget Measures:** 3) N/A **Equipment:** 4) available **Supplementary Notes:** 5) JICA Consulting Team has offered a prototype of the flood disaster database in Kenya, which was made by disaster data compiled by an existing database"CRED". 6) WRMA has no manuals for developing databases.	SRO, RO, HQ	**Improvements attributable to the Project** 1) Partially improved a) A draft flood disaster database has been developed 2) Not improved 3) N/A 4) Partially improved b) Equipment available 5) Not improved 6) Not improved **Challenges remaining** ■ Bullet1 Lack of awareness of the importance of the flood disaster database in WRMA ■ Bullet 2 Lack of procedure for collecting flood disaster data ■ Bullet 5 Non adoption of prototype ■ Bullet 6 No flood disaster database manual	■ Create awareness of the importance of the flood disaster database at all levels of WRMA ■ Develop a procedure for collecting flood disaster data ■ Review and adopt the prototype ■ Develop a flood disaster database manual
	2-6 Framework for evaluating flood affected areas and flood damages	**Organization Framework:** 1) WRMA has no evaluation framework on flood affected areas and flood damages. **Standing Orders:** 2) nonexistent **Budget Measures:** 3) N/A **Equipment:** 4) nonexistent **Supplementary Notes:** 5) Overlooking the data on flood affected areas and flood damages. 6) WRMA has not gained one of important tools for appealing flood management.	SRO, RO, HQ	**Improvements attributable to the Project** 1) Partially improved a) Flood disaster assessment has been incorporated in the WDC flood management module b) Submission of flood situation report quarterly reports 2) Partially improved a) Documented instructions for submission of flood situation reports 3) Partially improved a) Existence of budget on flood management 4) Partially improved a) Procurement and disbursement of equipment including flood assessment eg GPS, Camera 5) Partially improved a) Flood management is now WRMA's mandate b) Flood situation reports prepared 6) Partially improved a) Flood management is now a WRMA mandate b) Flood damage data guidelines included in the WDC Manual c) Development of flood hazard maps **Challenges remaining** ■ Bullet 1&6 Not all WRMA staffs are conversant with the revised WDC manual ■ Bullet 1 Lack of clear evaluation framework of flood affected area and damage ■ Bullet 5&6 inadequate capacity in evaluation of flood affected areas and damages ■ Bullet 4Inadequate equipment for flood survey	■ Rollout the revised WDC manual ■ Procure equipment for flood survey ■ Build capacity in evaluation framework on flood affected areas and flood damages ■ Develop evaluation framework on flood affected areas and flood damages

Table 6.2-7 Capacity Assessment for WRMA (2-3)

WRMA Capacity to be Developed	Required Capacity Element	Pre-Project Assessment *(29th to 30th Nov. 2012)*	Target Group	Post-Project Assessment *(4th to 5th June 2014)*	Actions
	[Institutional aspects]				
	2-7 Legal systems for assisting high water discharge observation	1) WRMA has no legal stipulation for making compulsory at high water discharge observation. Supplementary Notes: 2) Legal system should be set after the revised bill is passed. 3) The water bill doesn't mention about it, but the draft of the water bill mentions about it.	SRO, RO, HQ	**Improvements attributable to the Project** 1) No improvement 2) No improvement a. The bill has not been passed 3) No improvement a. The bill has not been passed **Challenges remaining** ▪ Water bill has not been discussed	▪ Review of water resources management rules after passing of water bill
	2-8 Legal systems for assisting to evaluate flood affected areas and flood damages	1) WRMA has no legal stipulation for making compulsory at evaluation of flood affected areas and flood damages, although since 2009 CRC has been collected disaster data, such as affected areas and damages by floods. Supplementary Notes: 2) Legal system should be set after the revised water bill is passed.	SRO, RO, HQ	**Improvements attributable to the Project** 1) No improvement 2) No improvement a. The bill has not been passed **Challenges remaining** ▪ Water bill has not been discussed	▪ Review of water resources management rules after passing of water bill
	2-9 Legal systems for assisting to develop and manage the flood disaster database in Kenya	1) WRMA has no legal stipulation for making compulsory at the flood disaster database in Kenya. Supplementary Notes: 2) Legal system should be set after the revised water bill is passed.	SRO, RO, HQ	**Improvements attributable to the Project** 1) No improvement 2) No improvement a. The bill has not been passed **Challenges remaining** ▪ Water bill has not been discussed	▪ Review of water resources management rules after passing of water bill

Table 6.2-8 Capacity Assessment for WRMA (3)

WRMA Capacity to be Developed	Required Capacity Element	Pre-Project Assessment (20th to 30th Nov. 2012)	Target Group	Post-Project Assessment (4th to 5th June 2014)	Actions
3. To Coordinate Relevant Stakeholders for Better Flood Management in Communities	[Personal aspects]				
	3-1 Basic knowledge on monitoring of rainfalls and water levels, and Early Warning System	**Skills and expertise:** 1) Both systems of monitoring of rainfalls and water levels, and Early Warning Systems have not been implemented. 2) However, WRMA staffs have basic understanding on these systems. **Incentive:** 3) no incentive scheme **Supplementary Notes:** 4) There are no reference materials available to WRMA staffs.	SRO, RO, HQ	**Improvements attributable to the Project** 1) Partially improved a) Community based early warning systems in Pilot Project areas are operational b) Network for information sharing is in place in the Pilot areas 2) Much improved a) Trainings on manufacture and installation of FEWS b) Some number of FEWS have been manufactured, installed and stored 3) Partially improved 4) Partially improved a) Manuals developed **Challenges remaining** ▪ Cost of maintaining the system in terms of power requirements and telephone ▪ Bullet 3 to get a sustainable incentive scheme	▪ Installation solar powered systems ▪ Upscale FEWS in other identified areas within the pilot project sites ▪ Replicate to other flood prone areas ▪ Train more staff from other flood prone areas on manufacture and installation of FEWS ▪ Develop and implement an incentive scheme (non monetary) ▪ Improve on the developed manuals
	3-2 Basic knowledge on Hazard Mapping	**Skills and expertise:** 1) Hazard Maps are not very common but WRMA staffs understand their importance in flood management 2) There are few occasions to experience making of Hazard Maps. 3) WRMA staffs have experience to make community flood Hazard Map with JICA Project team. **Incentive:** 4) no incentive scheme **Supplementary Notes:** 5) There are few chances of receiving trainings on Hazard Maps. 6) There are no reference materials available to WRMA staffs.	SRO, RO, HQ	**Improvements attributable to the Project** 1) Partially improved a) Flood hazard maps developed for the three Pilot project areas b) Trainings of WRMA staff 2) Partially improved a) Staff in pilot areas participated in development of more flood hazard maps 3) As above 4) Job description for FMOs 5) Much improved a) ToTs has been undertaken hence there is internal capacity 6) Very much improved a) Manuals have been developed and are in use **Challenges remaining**	▪ Develop hazard maps for all flood prone areas ▪ Enhance capacity of WRMA staff in Flood hazard map development ▪
	[Organizational aspects] (Human, physical, financial, knowledge, etc.)				
	3-3 Methodologies and organizers for community-based flood responses (monitoring of rainfalls, water levels, flood damages, etc.)	**Organization Framework:** 1) WRMA is well aware of the importance of monitoring systems of water levels and flood damages, and Early Warning Systems and has an agreement on her intention to establish such systems in the near future. **Standing Instructions:** 2) onexistent **Budget Measures:** 3) N/A **Equipment:** 4) N/A **Supplementary Notes:** 5) No technical reference materials available to WRMA staffs.	SRO, RO, HQ	**Improvements attributable to the Project** 1) Partially improved a) WRMA with the community has established and operationalized FEWS in the three pilot areas 2) 2-5 as above **Challenges remaining** ▪	▪ Upscale to other areas
	3-4 Methodologies and organizers for preparing and utilizing Hazard Maps	**Organization Framework:** 1) WRMA has developed water resource maps, but they don't have experience, methodologies and organizations to draw flood Hazard Maps. **Standing Orders:** 2) nonexistent **Budget Measures:** 3) N/A **Equipment:** 4) There are no topographic maps and GIS software available. **Supplementary Notes:** 5) Some WRUAs are trying to make Hazard Maps on their own. 6) JICA Project team is preparing prototype base maps using GIS. 7) There is no technical standard available for mapping.	SRO, RO, HQ	**Improvements attributable to the Project** 1) Partially improved a) Manuals in place b) Trained staff and WRUA members 2) 2-3 as above 4) Partially improved a) Topo sheets procured for the Pilot areas 5) Partial improved a) WRUA members and WRMA staff have together developed Flood Hazard maps for the pilot areas 7) Partially improved a) Base maps for pilot areas to form the technical standard for mapping **Challenges remaining** ▪ Few number of staff and WRUA members have been trained	▪ Acquire topo sheets for other flood prone areas ▪ Enhance skills in WRUAs and WRMA staff to develop Flood hazard maps in other flood prone areas ▪ WRMA to develop base map for other Flood prone areas ▪ Review and adopt the standards in the base maps
	[Institutional aspects]				
	3-5 Legal systems for collecting and disseminating information of communities' flood responses (monitoring of rainfalls, water levels and flood damages)	1) WRMA has no legal stipulation for collecting and disseminating information of community-based flood responses, in particular, flood-related information	SRO, RO, HQ	**Improvements attributable to the Project** 1) Partially improved a) Flood management is WRMA mandate **Challenges remaining** ▪ Pending water bill	▪ Full operationalization of flood management functions at all WRMA l levels

Table 6.2-9 Capacity Assessment for WRMA (4-1)

WRMA Capacity to be Developed	Required Capacity Element	Pre-Project Assessment (29th to 30th Nov. 2012)	Target Group	Post-Project Assessment (4th to 5th June 2014)	Actions
4. To Advice WRUAs Technically to Formulate SCMPs	[Personal aspects]				
	4-1 Basic knowledge on technical advices to community-based flood responses (evacuation, flood fighting, etc.)	**Skills and expertise:** 1) WRMA's current knowledge and skills on community-based flood responses (evacuation, flood fighting, etc.) is not very high. 2) It is difficult for WRMA staffs to technically advise communities on their flood responses. **Incentive:** 3) no incentive scheme **Supplementary Notes:** 4) There are no technical reference materials available to WRMA staffs.	SRO, RO, HQ	**Improvements attributable to the Project** 1) Very much improved a) Capacity skills on community-based flood responses (evacuation, flood fighting, etc.)has been built for WRMA staff at all levels 2) Very much improved a) Training materials on community based flood management have been developed (eg evacuation drill guidebook and community flood hazard map development manual) b) Trained WRMA staff have participated in the training of WRUA (WRMA staff executed community driven flood hazard mapping and evacuation drill) 3) Very much improved a. Flood management is a mandate of WRMA b. Developed IFMP c. Inclusion of Flood management module in the revised CMS d. Incorporation of flood management module into the WDC manual e. Establishment of the IFMC f. WRMA staff working with the communities 4) Very much improved a) Development of various flood management manuals b) Revised WDC Manual **Challenges remaining** ▪ Few number of staff have been trained ▪ Lack of flood management chapter in the existing SCMPs	▪ Capacity building of more WRMA staff on community-based flood responses (evacuation, flood fighting, etc.) ▪ Review the existing SCMPs with the aim of including flood management chapter
	4-2 Basic knowledge on technical advices for flood control works (structural measures against floods)	**Skills and expertise:** 1) WRMA staffs' current knowledge and skills on flood control works (structural measures) are limited. 2) It is difficult for WRMA staffs to technically advise communities on their efforts to design, implement and manage flood control works. **Incentive:** 3) no incentive scheme **Supplementary Notes:** 4) There are no technical reference materials available to WRMA staffs.	SRO, RO, HQ	**Improvements attributable to the Project** 1) Partially improved a. Some WRMA staffs have been trained on flood countermeasures (structural measures) 2) Partially improved a. There are technical materials that WRMA staffs can use to technically advise communities on their efforts to design, implement and manage flood control works 3) Very much improved a. Flood management is a mandate of WRMA b. Developed IFMP c. Inclusion of Flood management module in the revised CMS d. Incorporation of flood management module into the WDC manual e. WRMA staff working with the communities 4) Very much improved a) There are technical reference material for flood control works available **Challenges remaining** ▪ Few number of staff have been trained ▪ Inadequate awareness and access to technical reference materials for flood control works	▪ Capacity building of more WRMA staff on flood countermeasures (structural measures) ▪ Create awareness and disseminate technical reference materials for flood control works
	4-3 Basic knowledge on technical advices to community level education for disaster prevention	**Skills and expertise:** 1) WRMA staffs' current knowledge and skills on community level education for disaster prevention are not prioritized. 2) It is difficult for WRMA staffs to technically advise communities on their efforts to educate community members. **Incentive:** 3) no incentive scheme **Supplementary Notes:** 4) There are no technical reference materials available to WRMA staffs.	SRO, RO, HQ	**Improvements attributable to the Project** 1) Very much improved a. Flood management is a mandate of WRMA b. Developed IFMP c. Inclusion of Flood management module in the revised CMS d. Incorporation of flood management module into the WDC manual e. Establishment of the IFMC f. WRMA staff working with the communities 2) Very much improved a) WRMA staff have been trained and can technically advice the community on flood management 3) Very much improved a) The revised WDC manual b) Deployment of flood management officers 4) Very much improved a) There are technical reference material for flood disaster education are available **Challenges remaining** ▪ Language barrier ▪ Gender disparities	▪ Collaborate with the local communities to interpret ▪ Community sensitization on active participation for all community members in flood management
	4-4 Basic knowledge on technical advices to obtain funds for community-based activities	**Skills and expertise:** 1) WRMA staffs' current knowledge and skills on obtaining funds on flood management issue like WDC are not very high. 2) It is difficult for WRMA staffs to technically advise communities on their efforts to apply for funds. **Incentive:** 3) no incentive scheme **Supplementary Notes:** 4) There are no technical reference materials available to WRMA staffs.	SRO, RO, HQ	**Improvements attributable to the Project** 1) Very much improved a. Flood management activities are now eligible for WDC funding 2) Very much improved a) There is a funding procedure 3) Not applicable 4) Very much improved a) There is funding procedure **Challenges remaining** ▪ Limited number of sources of finances	▪ Explore other additional sources of funding

Table 6.2-10 Capacity Assessment for WRMA (4-2)

WRMA Capacity to be Developed	Required Capacity Element	Pre-Project Assessment *(29th to 30th Nov. 2012)*	Target Group	Post-Project Assessment *(4th to 5th June 2014)*	Actions
	[Organizational aspects] (Human, physical, financial, knowledge, etc.)				
	4-5 To establish methods and organizations to technically support WRUAs in their preparing SCMPs	**Organization Framework:** 1) WRMA staffs are currently not providing adequate technical support on flood management issues to WRUAs in their preparation of SCMPs. **Standing Orders:** 2) nonexistent **Budget Measures:** 3) N/A **Equipment:** 4) N/A **Supplementary Notes:** 5) There is no technical standard or materials in WRMA for providing technical advices to WRUAs.	SRO, RO, HQ	**Improvements attributable to the Project** 1) Partially improved: a) Flood Management has been incorporated in the WDC manual(the flood management chapter is yet to be incorporated in the existing SCMPs) 2) Very much improved: a) There is a WDC manual that has flood management training module 3) N/A 4) N/A 5) Very much improved a) There is the WDC manual **Challenges remaining**	■
	4-6 To establish methods and organizations to technically support WRUAs in their applying for funds	**Organization Framework:** 1) WRMA staffs are currently not providing adequate technical support to WRUAs under their application for funds. 2) WRMA is technically appraising the applications of WRUAs for funds. **Standing Orders:** 3) nonexistent **Budget Measures:** 4) N/A **Equipment:** 5) N/A **Supplementary Notes:** 6) There is no technical standard in WRMA for providing technical advices to WRUAs.	SRO, RO, HQ	**Improvements attributable to the Project** 1) Partially improved a) Flood Management module included in the WDC manual 2) Not applicable 3) Very much improved a) Flood management module included in the WDC manual 4) N/A 5) N/A 6) Very much improved a) Flood management module included in the WDC manual **Challenges remaining** ■	■
	[Institutional aspects]				
	4-7 Legal systems for technical support to WRUAs under their preparing SCMPs	1) WRMA has a mandate to provide technical support to WRUAs under their preparing SCMPs.	-	**Improvements attributable to the Project** 1) Very much improved a) Inclusion of Flood management training module in the WDC manual **Challenges remaining** ■	

Table 6.2-11 Capacity Assessment for WRMA (5)

WRMA Capacity to be Developed	Required Capacity Element	Pre-Project Assessment (29th to 30th Nov. 2012)	Target Group	Post-Project Assessment (4th to 5th June 2014)	Actions
5 To Formulate and Update Training Manuals on Flood Management and Conduct Training Seminars to HQ/RO/SRO Staffs of WRMA	[Personal aspects]				
	—	—			
	[Organizational aspects] (Human, physical, financial, knowledge; etc.)				
	5-1 To design WRMA's own technical development system	**Organization Framework:** 1) WRMA has not established her organization to design her own technical development system. **Standing Orders:** 2) nonexistent **Budget Measures:** 3) N/A **Equipment:** 4) N/A **Supplementary Notes:**	**SRO,** RO, HQ	**Improvements attributable to the Project** 1) Partially improved a) ToTs have been trained b) Training plan under implementation. 1st and 2nd stages have been implemented. The 3rd stage is under implementation 2) Partially improved a) Training plan in place **Challenges remaining** ▪ Re-deployment of trained staff ▪ No clear job description resulting to overlaps and conflicts	▪ Continuous training of the ToTs and FMOs ▪ Staff follow up assessment after training
	5-2 To prepare WRMA's technical reference materials	**Organization Framework:** 1) WRMA has not prepared technical reference materials for her technical development system. **Standing Orders:** 2) nonexistent **Budget Measures:** 3) N/A **Equipment:** 4) N/A **Supplementary Notes:** 5) There is no technical standard available to WRMA staffs.	**SRO,** RO, HQ	**Improvements attributable to the Project** 1) Partially improved a) Certain manuals have been developed and in process of finalization and publication (Manuals: High Flow measurements, Construction and maintenance of Flood management structures, manufacturing and installations of FEWS, monitoring of staff gauges, non- structural measures e.t.c) 2) Partially improved a) Catalogues of manuals and training materials distributed during training 5) Partially improved a) There is a technical standard material to be discussed for improvement by WRMA **Challenges remaining**	▪ Publish and disseminate manuals ▪ Continual improvement of manuals ▪ Distribution of available manuals and training materials ▪ Initiate discussion towards development of technical standards for flood management
	5-3 To raise lecturers for the WRMA technical training courses at the 2nd stage in Kenya	**Organization Framework:** 1) WRMA has not established a module to raise lecturers for her own technical development system. **Standing Orders:** 2) nonexistent **Budget Measures:** 3) N/A **Equipment:** 4) N/A **Supplementary Notes:**	**SRO,** RO, HQ	**Improvements attributable to the Project** 1) Very much improved a) ToTs have been trained and have undertaken training in the 2nd and 3rd stages 2) Partially improved a) The approach of using ToTs has been established **Challenges remaining**	▪ Set a clear frame work to guide future operation
	5-4 To operationalize the WRMA technical training courses at the 2nd stage in Kenya	**Organization Framework:** 1) WRMA is not currently operating technical development system. **Standing Orders:** 2) nonexistent **Budget Measures:** 3) N/A **Equipment:** 4) N/A **Supplementary Notes:** 5) There is no standard for operation of the technical development system.	**SRO,** RO, HQ	**Improvements attributable to the Project** 1) Very much improved a) Stage 1 and 2 completed, stage 3 ongoing b) Other trainings like IFAS have been conducted 5) Not improved a) No guidelines or standards formulated **Challenges remaining** ▪	▪ Develop guidelines/ standards for operation of technical development system
	[Institutional aspects]				
	5-5 Legal systems for the WRMA technical training courses at the 2nd stage in Kenya	1) WRMA has no legal stipulation for establishing her own technical development system at this moment, but it will be incorporated with the draft water bill.	**SRO,** RO, HQ	**Improvements attributable to the Project** Very much improved: a) The use of ToTs has been implemented in the 2nd stage training **Challenges remaining** ▪ WRMA technical development should not be legal issue, it should be formalized internally.	▪ To include training on flood management in the training policy and plan

Table 6.2-12 Capacity Assessment for WRMA (6)

WRMA Capacity to be Developed	Required Capacity Element	Pre-Project Assessment *(29th to 30th Nov. 2012)*	Target Group	Post-Project Assessment *(4th to 5th June 2014)*	Actions
6. To Introduce a Concept of "River Basin Flood Management Plan (RBFMP)", which should be Set between the CMS and the SCMPs	[Personal aspects]				
	6-1 Basic knowledge on Integrated Flood Management (IFM)	**Skills and expertise:** 1) WRMA staffs understand the necessity of IFM, but do not have acquired specific experiences to implement IFM and knowledge required. **Incentive:** 2) N/A **Supplementary Notes:** 3) There is no technical reference material available to WRMA staffs.	**SRO,** RO, HQ	**Improvements attributable to the Project** 1) Very much improved: ➢ Experience gained through the preparation of 3No Draft IFMPs and implementation of pilot projects ➢ Trainings carried out on IFM ➢ The revision of CMSs includes IFM 3) Very much improved a) Reference document such manuals and training materials are available **Challenges remaining** ▪	▪ Finalization of IFMPs ▪ Revision of SCMPs to incorporate the IFM ▪ Up scaling the development of the IFMP to other flood prone areas.
	[Organizational aspects] (Human, physical, financial, knowledge, etc.)				
	6-2 To establish methods and organizations for making River Basin Flood Management Plans (RBFMPs)	**Organization Framework:** 1) WRMA understands the necessity of RBFMP but has not established organization to prepare RBFMPs. **Standing Orders:** 2) nonexistent **Budget Measures:** 3) N/A **Equipment:** 4) N/A **Supplementary Notes:** 5) There is no technical standard available to WRMA staffs.	**SRO,** RO, HQ	**Improvements attributable to the Project** 1) Very much improved a) Flood management unit in HQ, RO and SROs b) IFMC operational in the pilot project areas 2) Partially improved a) The process is ongoing but there is need for documentation **Challenges remaining** ▪ Trans-boundary issues in terms of participation in IFMCs and access to information/data. ▪ Comprehensive mapping of flood prone areas has not been done	▪ Map and document all the flood prone areas that require IFMP ▪ Replicating the IFMP in the mapped out flood prone areas ▪ Implement the relevant aspect of Kenya-Tanzania MoU on Trans boundary Water Resources Management. ▪ Lobby the Ministry of EWNR for negotiation of MOUs on Trans boundary flood management ▪ Preparation of manuals/guidelines for preparation of IFMPs
	[Institutional aspects]				
	6-3 Legal systems for River Basin Flood Management Plans (RBFMPs)	1) Each WRUA is mandated to prepare the SCMP for her sub-catchment, and WRMA prepare CMSs. 2) A RBFMP is a concept newly proposed in the Project and there is no legal provision to prepare RBFMPs.	**SRO,** RO, HQ	**Improvements attributable to the Project** 2) Partially improved a) Flood management is part of Water Resources Management functions **Challenges remaining** ▪	▪ The revision of the WRM rules to mainstream RBFMP

Chapter 7 Achievement, Problems and Way Forward

7.1 Achievement of outputs and activities

Achievements of outputs vis-à-vis the indicators in the Project Design Matrix (PDM) are shown in the following table 7.1-1.

Table 7.1-1 Indicators for Evaluation of the Achievement and their Current Status

Output	Indicator	Status as of July 2014
1. At each level of WRMA (headquarters, regional offices and sub-regional offices), sustainable organizations in charge of Flood Management are strengthened.	1-1 A future plan of WRMA on Flood Management covering personnel, budget and function is prepared.	- WRMA Strategic Plan 2012-2017 mentioned flood management as a mandate and function of WRMA. - Flood Management Department (FMD) has been established and Flood Management Officers (FMOs) appointed. - Annual Corporate Work Plan and budget for FY 2014/15 has included flood management activities.
	1-2 Catchment Management Strategies (CMSs) in the Project target areas properly Integrate Flood Management.	Revision of CMSs has been carried out by WRMA and the revised CMSs capture integrated flood management. Revised CMSs in the Project target areas have been already developed and are being presented to the counties and relevant stakeholders.
	1-3 Training plan, training material and trainers are prepared.	- Training Plan with time table, materials (including WDC manual Flood Management Module, teaching materials) were finalized. - Master trainers were fostered in the 1st stage training (TOT). Trainers for WRUA were fostered in the 2nd stage training. - The trained trainers conducted 3rd stage training for WRUA in Lower Gucha Migori in May 2014. - Budget for expansion of 2nd stage training for other WRMA officers and 3rd stage training for WRUA was included in the Annual Corporate Work Plan for FY 2014/15.
	1-4 More than 12 % (40 from 319 technical staffs) of WRMA staffs attend training course by the end of this project. (This expression should be changed.)	- 1st stage training: 17 officers x 10 days (Oct. 2013) - 2nd stage 1st batch: 16 officers x 5 days (Dec. 2013) - 2nd stage 2nd batch: 15 officers x 5 days (Feb. 2014) - In total, 15 % (48 from 319 technical officers) of WRMA staffs participated in the training.
	1-5 WRMA's institutional setup and budgetary system for Flood Management are clearly defined and operated in the Project target areas.	- Flood Management Department was established. - In total, twenty three (23) staff members were appointed in charge of flood management at HQ, 6 ROs and in 15 SROs as of June 2014. The role and mandate of FMD were clarified in the Annual Corporate Work Plan for FY 2014/15. - In the FY 2013/14, budget for FM was incorporated. - The budget of flood management for FY 2014/15 was defined.
2. For promoting Community-based activities of Flood Management, capacity of WRMA to support communities is strengthened.	2-1 Flood Management plans in the pilot areas prepared.	Integrated Flood Management Plans (IFMPs) for Isiolo River Basin and Lumi River Basin were prepared. In Gucha Migori River Basin, through the 4th IFMC meeting on 17th July, draft IFMP was adopted and is being finalized by WRMA.
	2-2 Materials describing the case and lessons of Community-based Flood Management activities are prepared.	The following three types of documents were prepared by the Project Team in cooperation with WG; 1) Manual on supporting community-based flood management activities for WRMA and WRUA 2) Manuals on community-based flood management activities for WRMA and WRUA (for structural and non-structural measures) 3) Case Study and Lessons Learnt Report

	2-3 More than 25 number of WRMA staffs have experience of Community-based Flood Management activities in the Project target areas.	- Forty (40) C/Ps in total at HQ, RO and SRO level participated in the community activities (structural and non-structural measures). - Some of them have since developed their capacities and they have become lecturers of the disaster management education program in the community and the schools. - In addition, there are many staffs who have learned techniques for producing an early warning system. CBFEWS will actually be installed later in the outside of the pilot areas. - There are also many staffs who acquired knowledge on the Integrated Flood Management Plan of a river catchment and coordination of stakeholders through the Integrated Flood Management Committee (IFMC). - Due to insufficient communication between KRCS and WRMA, WRMA staff could not be fully involved with community based activities conducted by KRCS.

7.2 Achievement of Project Purposes

Project purposes and indicators to measure the achievement of the purposes in the PDM are as shown below.

Project Purpose

In the Project target areas, institutional framework of flood management in the context of integrated water resource management is established for effective and sustainable implementation of community based activities.

Indicators

1. Staff of WRMA in charge of flood management in the project target areas has capacity to implement community based activities.
2. Flood management is incorporated in CMS and SCMP of flood prone areas in the project target areas.
3. WRMA's knowledge management mechanism (knowledge management) and triaging system function covering the project target areas are established.
4. Budget for flood management is secured in the project target areas.

Current status on each index is described below.

7.2.1 Indicator 1

Staffs of WRMA in charge of flood management in the Project target areas have capacity to implement community based activities

Many C/Ps got knowledge and had their capacities improved through the Project activities. And almost all the C/P staffs participated in the training and learned concepts of flood management through the training.

Based on the capacity assessment after the Project, in total, 23 % of elements of capacity development were very much improved and 55 % were partially improved.

7.2.2 Indicator 2

Flood management is incorporated in the CMS and SCMP of flood prone areas in the project target areas

As for CMS, revision process of CMSs is underway as per the writing period of this report, and revised CMSs were in the final draft stage. It is important to note therefore that IFM had

been incorporated in the draft revised CMSs.

As for SCMP, IFMPs for Isiolo River and Lumi River had been completed and are ready to be incorporated into SCMP. IFMP for Gucha Migori River is in the process of finalization. It is important to note that WRMA FMD had included budget for the revision of SCMPs in the three pilot river basins in the Annual Corporate Work Plan.

7.2.3 Indicator 3

WRMA's knowledge management mechanism (knowledge management) and training system function covering the Project target areas are established.

Knowledge management mechanism in the Project target area is defined by JICA Project Team (JPT) as the structure that accumulates the experiences and lessons learned from the disaster management activities at community level. It is important to note that the procedure for flood survey and the survey form were prepared and are already planned to be used in the next rainy season.

Training plan and training material were prepared and master trainers and trainers were fostered. Budget for expansion of the second stage training had been included in the Annual Corporate Work Plan. Therefore, the training system on IFM had been established.

7.2.4 Indicator 4

Budget for flood management is secured in the project target areas.

IFM Expansion plan to 12 target river basins was prepared and the Annual Corporate Work Plan and the budget were prepared by WRMA. In the Annual Plan, activities and budget for three Project target areas and the Nyando River were included.

Table 7.2-1 Action Plan of Flood Management in one Target River Basin

	Activities for IFM at a river basin	Budget (Mil. KSH)	1st Year											2nd Year										
				Rainy season						Rainy season					Rainy season						Rainy season			
			JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
	Execution of training for WRMA	2.00																								
1	Execution of training for WRUA (Including drawing Community based hazard map)	WSTF																								
2	Reflecting IFM to SCMP	WSTF																								
3	Formurating and holding of IFMC	1.25																								
4	Drafting IFMP (Including plan of flood counter measures)	1.00																								
5	Site survey and Collecting river basin data (Natural and Socio-economic condition, Development plan)	0.05																								
6	Site survey for flood damage data and Analysis of flood characteristics	0.05																								
7	Fabrication and installation of FEWS	0.15																								
	Total	2.50																								

Table 7.2-2 Target Twelve (12) River Basins for formulating IFMPs

	Batch	River Basins	WRMA Regions	Counties	Cities/Towns affected
1	I	Lower Sabaki	Athi	Kilifi	Mombasa
2		Engare Narok Melhis(Rumuruti)	Ewaso Nyiro North Catchment Area	Nyandarua and Laikipia	Rumuruti
3		Yala	Lake Victoria North Catchment Area	Siaya, Kakamega, Vihiga, Nandi, Nandi, Ewasin Gichu	Yala Swamp
4		Awach Kano	Lake Victoria South Catchment Area	Kericho & Kisumu	Shoreline
5		Perkerra	Rift Valley Catchment Area	Nakuru, Baringo & Laikipia	Mogotio
6		Lower Tana	Tana	Garissa & Tana River	Garissa, Garsen
7	II	Mbagathi	Athi	Nairobi	Nairobi & Kitengela
8		Daua	Ewaso Nyiro North Catchment Area	Mandera	Mandera
9		Sabwani Trib of Nzoia	Lake Victoria North Catchment Area	Trans Nzoia	Kitale
10		Sondu	Lake Victoria South Catchment Area	Kericho, Kisumu	
11		Ewaso Ngiro South (Narok urban centre)	Rift Valley Catchment Area	Narok	Narok
12		Thiba	Tana	Embu	Mwea

Table 7.2-3 Cost Estimation for Flood Management Programme in One (1) River Basin

No	Items	Unit Cost (Mil. Ksh)	Amount	Cost (Mil. Ksh)
1	Flood Management Training for WRUA members			
2	Support of incorporating IFMP into SCMP			
3	Establishment and Operation of IFMC	0.25	5 times	1.25
4	Formulation of IFMP		Lump sum	1.00
5	Collection and analysis on natural and social environmental information within the river basin		Lump sum	0.05
6	Collection and analysis on flood damage		Lump sum	0.05
7	Manufacturing and installation of CBFEWS	0.05	3 points	0.15
Sum per one (1) river basin <1.5 years>				**2.50**
Sum of six (6) rover basin <1.5 years>				**15.00**
Sum of twelve (12) river basin < 3 years>				**30.00**
8	Flood Management Training for WRMA officers <per one year>			2.00
Sum of three (3) years for WRMA training <3 years>				**6.00**
Grand Total of three (3) years				**36.00**

7.3 Propositions toward the achievement of Overall Goals

Overall goals and indicators to measure the achievement of the goals in the PDM are as shown below:

Overall Goal

Institutional framework of flood management in the context of integrated water resource management is expanded to all of the six catchments.

Indicators

1. WRMA's Strategic Plan properly addresses flood management.
2. WRMA staffs in charge of flood management have capacity to implement community based activities in the six catchments.
3. Flood management is incorporated in CMS and SCMP of flood prone areas in the six catchments
4. WRMA's knowledge management mechanism (knowledge management) and training system function covering the six catchments are established.
5. Budget for flood management is secured in the six catchments.

Current status of each indicator and where necessary a proposition toward the achievement of the goal are described below.

7.3.1 Indicator 1

WRMA's Strategic Plan properly addresses flood management

WRMA Strategic Plan 2012-2017 has it in Chapter 6 Strategic Objectives and Strategies that; "The Authority will also develop a strategy on effective flood management in flood prone areas. This will involve integration of data and analysis of cause and effects and formulation of Catchment Flood Management Plan".

Also in the section 6.3 "Adequate Quantity and Quality of Water Resources" of the same document, is statement "Strengthen stakeholder collaboration to enhance water storage and adaptation to climate change impacts", and the strategy in line therewith "Develop programs to mitigate and adapt to climate change impacts including floods and droughts".

Further, as a necessary human resource to achieve the above, 28 numbers of staff was planned to be assigned to Flood and Drought Management (Annex 1: Staff Establishment 2012). As for the financial resource, Kenya Shillings six hundred and eighty five million (Kshs. 685,000,000) was planned to be secured for "Design, Planning and Establishment of Water Storage Facilities" for a period 2012 to 2017 (Annex 6: Financial Flows: Development Budget).

7.3.2 Indicator 2

WRMA staffs in charge of flood management have capacity to implement community based activities in the six catchments

The Project has trained Flood Management Officers and Community Development Officers of fifteen flood-prone Sub-Regional Offices. As mentioned above, the trainings provided by the Project have now become part of WRMA's training system and are being carried out by WRMA.

Subjects and topics taught in the training are expected to be part of WRMA staff daily works, which will be augmented by the inclusion of relevant descriptions in their performance contract.

7.3.3 Indicator 3

Flood management is incorporated in CMSs and SCMPs of flood prone areas in the six catchments

WRMA has made it clear of their intention to formulate Integrated Flood Management Plans

for those flood-prone river basins under fifteen Sub-Regional Offices. This intention was presented in the meeting after the training in Japan as an Action Plan, which was later given consent by CEO and Technical Manager of WRMA.

Flood Management chapter was incorporated into the WDC Manual which serves as a guideline for development of SCMP. The Flood Management chapter was prepared and finalized by the Project Team. Therefore, in the future, newly developed or revised SCMPs will have flood management chapter.

7.3.4 Indicator 4

WRMA's knowledge management mechanism (knowledge management) and training system function covering the six catchments are established

Regarding the mechanism of knowledge management, as a result of cooperation and discussion of WRMA and the Project Team, design of the entire mechanism was finished and the time schedule was prepared. Flood Survey will be conducted in the second rainy season of 2014.

As for the training in WRMA, same as mentioned in the previous section, the training for WRMA officers on flood management is ready to be conducted every year within WRMA and the budget of the training has been secured.

7.3.5 Indicator 5

Budget for flood management is secured in the six catchments

Budgets for such community based structural measure projects as raised evacuation places and toilets, and non-structural measure projects as disaster education, awareness raising, evacuation planning and drills, will have to be secured by WRUAs through WDC mechanism of WSTF. However, observation of the process of development of SCMPs and choosing projects for WDC mechanism of WSTF funds for WRUA engraved an impression to the Project Team that in selecting project, those projects that are related to water scarcity issues are given priority.

When faced with the choice between water scarcity which is a day to day challenge, and flood damage that occurs occasionally and mainly once per year, it is very natural that the day to day challenge will be prioritized in being solved. However, it is important that the ability to determine whether such a choice would be advantageous in the long-run is noted as an important outcome of disaster education and raising awareness. Continued effort to educate people may lead to attitude change and making informed choices.

The Project Team recommends that it is desirable that policy-making in disaster education in school and raising awareness should be handled by the Ministry of Interior and execution and implementation of disaster education in school and raising awareness should be handled by county governments and Ministry of Education. However, it is important to note that after the reorganization of government agencies, disaster prevention does not have a definite lead government agency. It is therefore recommended that it will be useful to share opinions through such media as Disaster Management Platform, and prompt the government to consider solid organization structure for disaster management.

Also, there can be an idea to secure "flood management fund" in WDC scheme. In such case, the source of the fund could come from external resources, for example, GFDRR of the World Bank.

7.4 Activities to be implemented by WRMA after the Project

In the 6th JCC meeting and the weekly meeting, activities to be implemented by WRMA after the Project were discussed and the consensus was built as the table shown below.

Table 7.4-1 The consensus situation on the activities to be implemented by WRMA after the Project

Activities to be implemented by WRMA after the Project	Situation of consensus building
1. Management and operation of manuals ・ Managing manuals (updating manuals) ・ Operating manuals (to use manuals as reference materials in WRMA and WRUA training course)	・ Flood Management Department (FMD) is in charge of managing manuals ・ Community Development Department (CDD) is in charge of operation of Manuals
2. FEWS expansion toward the 12 target rivers ・ Management and operation of manuals ・ Budget acquisition for FEWS installation	・ FMD is in charge ・ Budget is secured in the "Annual Corporate Work Plan 2014/15"
3. Implementation of WRMA training course ・ Budget acquisition for implementation of 2nd stage flood management training course for WRMA staffs ・ Budget acquisition for implementation of 3rd stage flood management training course in 12 target river basins for WRMA staffs	・ FMD is in charge ・ Budget is secured in the "Annual Corporate Work Plan 2014/15"
4. Implementation of WRUA training course ・ Budget for WRUA training to be secured in order to expand integrated flood management toward 12 target river basins ・ Detailed plan for WRUA training to be prepared in order to expand the integrated flood management toward 12 rivers	・ CDD is in charge ・ Budget is secured in the "Annual Corporate Work Plan 2014/15" ・ FMD Annual Corporate Work Plan 2014/15 has relevant items
5. Facilities constructed in the pilot projects ・ Handover from WRMA to WRUA	・ FMD is in charge
6. Knowledge management ・ Implementation of the flood survey in the next rainy season(October – December 2014)	・ FMD is in charge ・ TCM committed this matter at the 6th JCC meeting - The 4th Presentation -
7. Incorporate flood management into the CMSs ・ All 6 CMSs shall be revised to be incorporated with flood management	・ FMD is in charge ・ 5 CMSs are already in final stage. Tana CMS will be finalized shortly.
8. Integrated Flood Management Plan ・ Integrated Flood Management Plans shall be developed within 12 river basins.	・ FMD is in charge ・ Budget is secured in the Annual Corporate Work Plan 2014/15.
9. Integrated Flood Management Committee ・ Integrated Flood Management Committee shall be established and operated in 12 river basins.	・ FMD is in charge ・ Budget is secured in the Annual Corporate Work Plan 2014/15.

PART II

PROJECT ACTIVITIES FOR OUTPUT 1

PART II PROJECT ACTIVITIES FOR OUTPUT 1

TABLE OF CONTENTS

Chapter 1 The Present Status of Flood Management

1.1 Legislative Framework of Flood Management in Kenya

Legislative framework of flood management in Kenya is shown in the following figure.

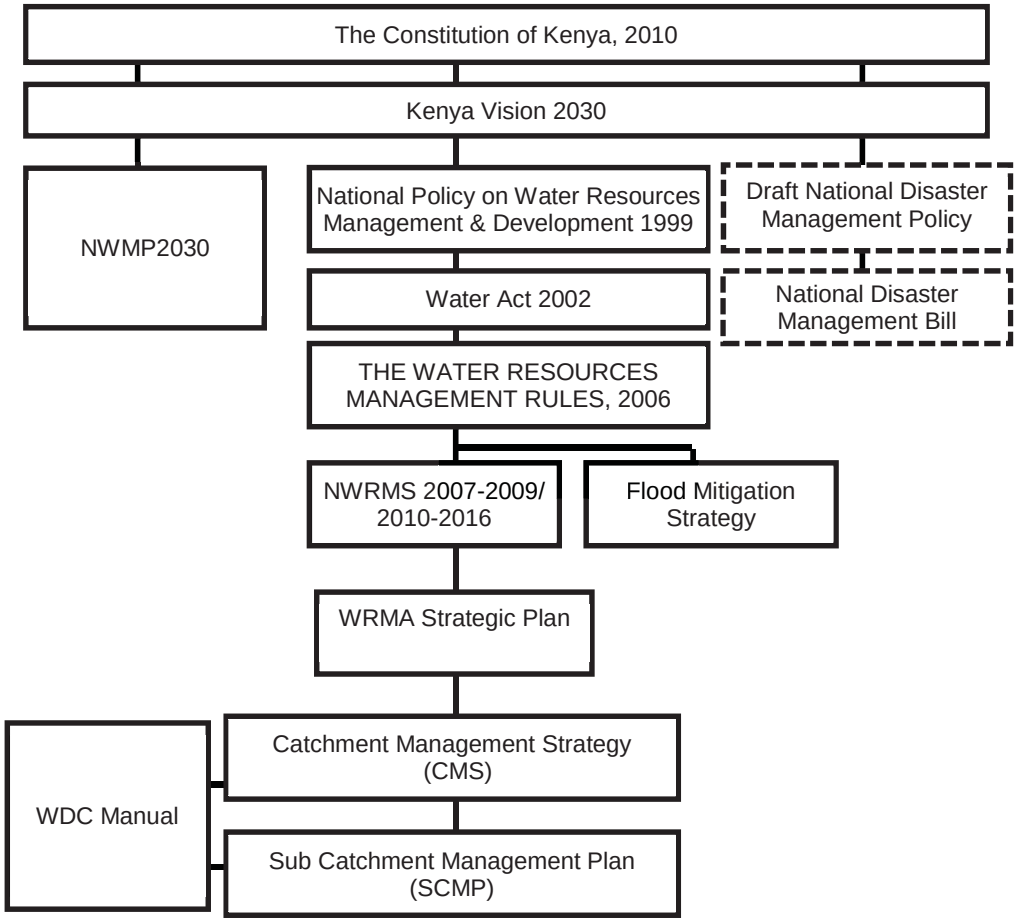


Fig. 1.1-1 Legislative Framework of Flood Management in Kenya

1.2 General Overview of National Institutions and Actors Involved in Flood Management

After the reorganization of the National Government Ministries in 2013, general disaster management is under the Ministry of Interior and Coordination of National Governments (MICNG), Flood Management is under the Ministry of Environment, Water and Natural Resources (MEWNR) and meteorological observation and issuing early warning of meteorological disasters is under the Department of Kenya Meteorological Services (KMS).

All eighteen (18) line ministries of GOK as of May 2014 are shown below;

1. Ministry of Interior and Coordination of National Government
2. Ministry of Devolution and Planning
3. The National Treasury
4. Ministry of Defense
5. Ministry of Foreign Affairs
6. Ministry of Education
7. Ministry of Health
8. Ministry of Transport and Infrastructure

9. Ministry of Information, Communication and Technology
10. Ministry of Environment, Water and Natural Resource
11. Ministry of Land, Housing and Urban Development
12. Ministry of Sports, Culture and the Arts
13. Ministry of Labour, Social Security and Services
14. Ministry of Energy and Petroleum
15. Ministry of Agriculture, Livestock and Fisheries
16. Ministry of Industrialization and Enterprise Development
17. Ministry of Commerce, Tourism and East Africa Region
18. Ministry of Mining

Note: Ministries directly connected to flood management activities are underlined.

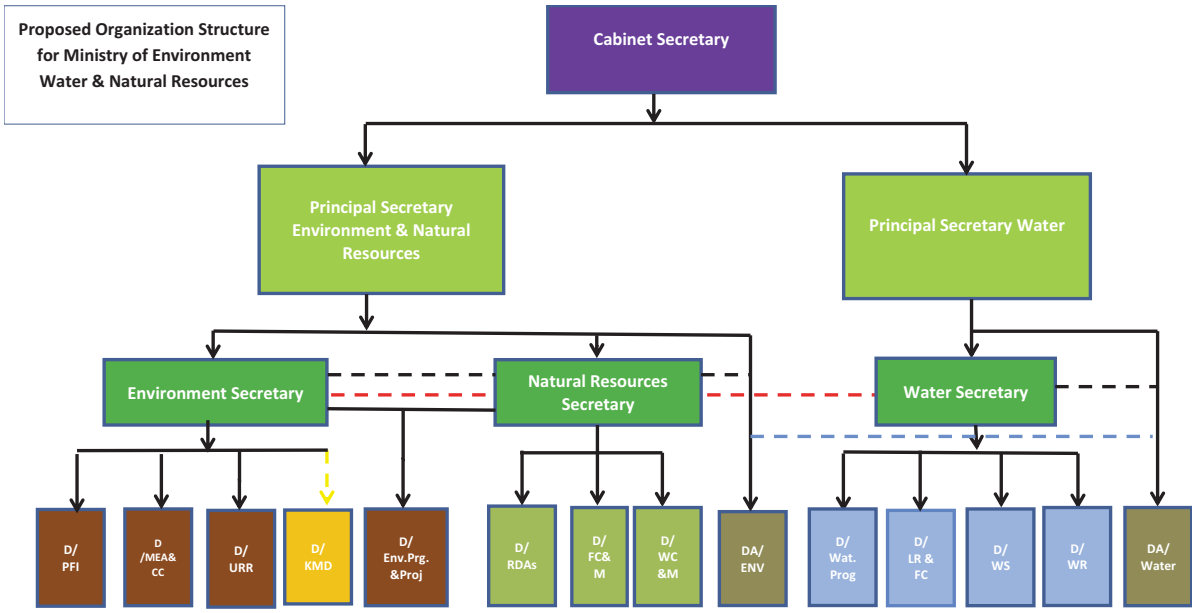
1.2.1 Ministry of Environment, Water and Natural Resources (MEWNR)

After the reorganization in 2013, the former Ministry of Water and Irrigation (MWI) and the former Ministry of Environment and Mineral Resources (MOEMR) and the former Ministry of Regional Development Authorities were merged, and the irrigation sector was transferred to the Ministry of Agriculture, and then, Ministry of Environment, Water and Natural Resources (MEWNR) was formed. There is no obvious change in the role and responsibility in water resources management from the former MWI.

The MEWNR is responsible for the development of legislation and policy formulation with regard to water resources management in the country. It is also responsible for the co-ordination, guidance, as well as monitoring and evaluation of projects and programmes in the water sector. Following the recent water sector reforms, the Ministry's functions relating to water resources and water service provision have been redefined as;

- Policy and institution formulation related to water sector;
- Coordination and resource mobilization; while implementation is delegated to the various water sector institutions created under the Water Act, 2002 to execute the relevant policies
- Implementation of water sector reform programme
- Resource mobilization and allocation in water sector

Organization chart of the Ministry is shown below.



Key:

D/WR	-	Directorate of Water Resources
D/WS	-	Directorate of Water Services
D/LR& FC	-	Directorate of Land Reclamation &Flood Control
D/Wat.Prog.&Proj.	-	Directorate of WaterProjects,Programmes& Strategic Initiatives
D/RDAs	-	Directorate of Regional Development Authorities
D/WC&M	-	Directorate of Wildlife Conservation and Management
D/FC & M	-	Directorate of Forest Conservation and Management
D/Cons. Prog.&Proj.	-	Directorate of Conservation Projects, Programmes& Strategic Initiatives
D/KMD	-	Directorate of Kenya Meteorological Department ***(This Department will soon be a SAGA)***
D/Env.Prog.&Proj.	-	Directorate Environmental Projects, Programmes and Strategic Initiatives
D/URR	-	Directorate of Urban Rivers Restoration
D/MEAs	-	Directorate of Multilateral Environmental Agreements& Climate Change
D/Env. PF& I	-	Directorate of Environmental Policy Formulation and Implementation
DA/Env.; DA/FWC, DA/Water	-	Directorate of Administration of Environment, Director of Administration of Forest & Wildlife & Director of Administration of Water

NOTE: The Title of Conservation Secretary could be changed to Natural Resources Secretary & thus bring the RDAs to the docket of this Secretary

Source: MEWNR

Fig. 1.2-1 MEWNR Organization Chart

Under the Ministry, there are a number of institutions created under the Water Act, 2002. The following table summarizes the institutions within the Ministry, together with their roles as spelt out under the Water Act, 2002.

Table 1.2-1 Roles of institutions under MEWNR

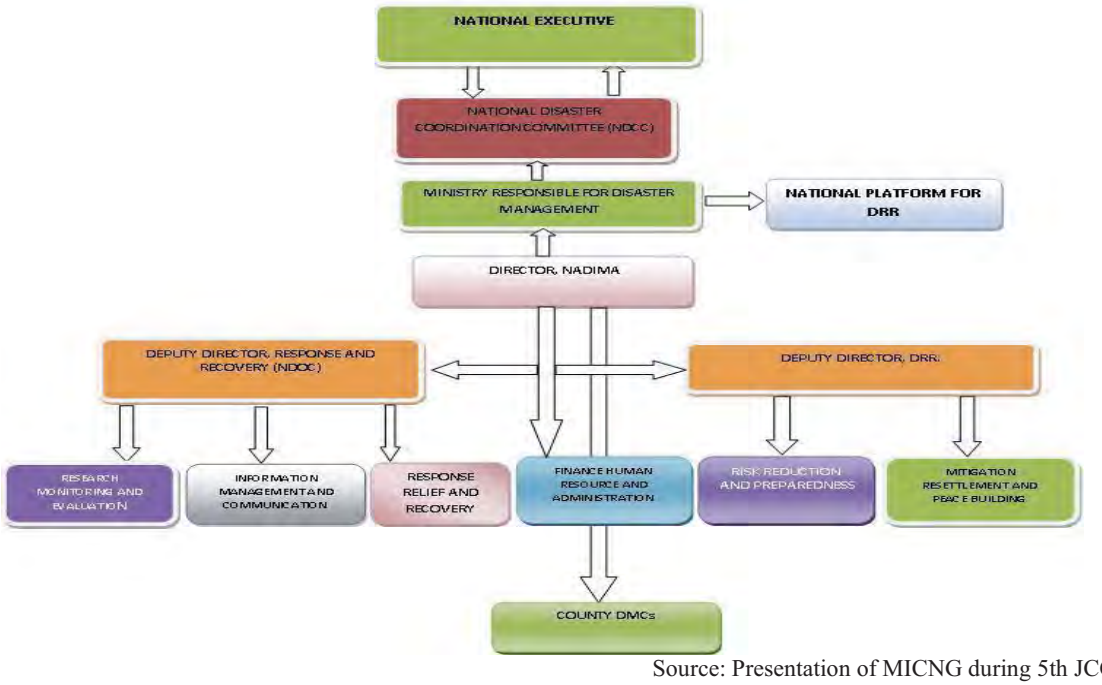
Institution		Roles and responsibilities
Ministry of Environment, Water and Natural Resources (MEWNR)		• Development of legislation, policy formulation, sector coordination and guidance, and monitoring and evaluation.
1.	Water Resources Management Authority (WRMA)	• Planning, management, protection and conservation of water resources. • Planning, allocation, apportionment, assessment and monitoring of water resources. • Issuance of water permits. • Water rights and enforcement of permit conditions. • Regulation of conservation and abstraction structures. • Catchment and water quality management. • Regulation and control of water use. • Coordination of the IWRM Plan.
2.	Catchments Area Advisory Committees (CAACs)	• Advising WRMA on water resources issues at catchment level.
3.	Water Resource Users Associations (WRUAs)	• Involvement in decision making process to identify and register water users. • Collaboration in water allocation and catchments management. • Assisting in water monitoring and information gathering. • Conflict resolution and co-operative management of water resources.
4.	Water Services Regulatory Board (WSRB)	• Regulation and monitoring of Water Services Boards. • Issuance of licenses to Water Services Boards. • Setting standards for provision of water services. • Developing guidelines for water tariffs.
5.	Water Services Boards (WSBs)	• Responsible for efficient and economical provision of water services. • Developing water facilities. • Applying regulations on water services and tariffs. • Procuring and leasing water and sewerage facilities. • Contracting Water Service Providers (WSPs).
6.	Water Service Providers (WSPs)	• Provision of water and sewerage services
7.	Water Services Trust Fund (WSTF)	• Financing provision of water and sanitation to disadvantaged groups.
8.	The Water Appeals Board (WAB)	• Arbitration of water related disputes and conflicts.
9.	National Water Conservation and Pipeline Corporation (NWCPC)	• Construction of dams and drilling of boreholes
10.	Kenya Water Institute (KEWI)	• Training and Research
11.	National Irrigation Board (NIB)	• Development of Irrigation Infrastructure

1.2.2 Office of the President: OP

The Office of the President (OP) hosts key institutions that deal with disaster management in Kenya. Some key institutions under the OP responsible for national disaster management are the Ministry of Interior and Coordination of National Government (MICNG), Ministry of Devolution and Planning (MDP). Furthermore, the National Disaster Operations Centre

(NOC) is under the MICNG, and the Relief and Rehabilitation Department (RRD) and Mitigation and Resettlement Department (MRD) are under the Directorate of Special Programmes (DSP) under MDP.

MICNG is the responsible ministry for national disaster management in general and formulation of disaster management policy. And the ministry act as a secretariat of National Platform for Disaster Risk Reduction. If the Disaster Management Bill 2014 will pass the National Assembly, National Disaster Management Authority (NADIMA) will be established under the Department of Disaster Management. And at County level, County Disaster Management Committee shall be established.



Source: Presentation of MICNG during 5th JCC

Fig. 1.2-2 Institutional Framework of Disaster Management in Kenya

1.2.3 International Organizations and NGOs

(1) World Bank

World Bank is conducting Western Kenya Community Driven Development and Flood Mitigation Project (WKCDD&FMP) in Nzoia river basin in the western Kenya. The objective of this project is to empower local communities to engage in sustainable and wealth creating livelihood activities and reduce their vulnerability to flooding.

The Water Security and Climate Resilience Project (KWSCRP) had started in June 2013. The development objectives of this project are to (i) increase availability and productivity of irrigation water for project beneficiaries; and (ii) enhance the institutional framework and strengthen capacity for water security and climate resilience for the country. The project period is planned to be 10 to 12 years.

(2) Kenya Red Cross Society

The Kenya Red Cross Society (KRCS) has often responded to flood disasters through the provision of food and non-food items (NFI), search and rescue services, as well as health and water and sanitation services, in order to combat possible disease outbreaks. KRCS is the

oldest of the local non-governmental groups in the disaster relief in Kenya. Recognized in the national legislation, the Red Cross has a right of access to any population at risk. It has established an impressive nationwide network that enables it to be at the frontline whenever disaster strikes anywhere in the country. Among its greatest strengths is the ability to mobilize local resources, as was recently witnessed during their 'Kenyans for Kenya' appeal in aid of drought victims in northern Kenya in 2011.

To respond effectively, KRC has a diversified structured, with its staff trained in a bit of everything and focusing on creating Red Cross Action Teams in each branch across the country. At the moment, there are some 47 active branches out of 70 districts. They have a presence in each of the flood-prone areas of the country. In terms of operations, the KRCS is able to move its resources across districts depending on the need in a particular place. Some of these branches are very strong, like those in Kisumu, Nakuru, Meru, and Mombasa. These branches have been critical in leading disaster response operations in various parts of the country. If the capacity of a branch to cope with a disaster is overwhelming, KRCS is able to move additional capacity in from other areas to intervene. It relies on both its in-house staff as well as an army of volunteers who can be mobilized at short notice. KRCS is keen in promoting the Red Cross movement across the country and to this end, it supports and facilitates capacity building in the branches. It has also engaged in training on disaster response, First Aid and has established high frequency radios in Busia, Eldoret and Wajir to boost communication of disaster warning. There is a plan to have such facilities for all the branches in the country.

The Kenya Red Cross Society staff and volunteers normally work closely with the Government's line ministries, particularly local administrations, and other stakeholders to carry out assessments in order to establish the extent of damage and the number of people affected by floods. During the rainy seasons, it is customary for the KRCS to place all its Disaster Response Teams in the flood zones on standby. The Emergency Operations Centre (EOC) of KRCS works round the clock with the Kenya Meteorological Department (KMD), the Kenya Electricity Generating Company (KENGEN), the KRCS branches, regional centres and weather agencies in neighbouring countries to forecast, monitor and issue alert on floods. The Centre also receives daily water levels and rates from the KenGen reservoirs' control rooms, whenever this is necessary for predicting flooding occurrences. This data enables the centre to forecast any flood that may be triggered by release of spill water from the hydro-electric dams (HEDs). The centre also uses the data to project rainfall in the highlands where the rivers to the HEDs originate. KRCS also works in close co-operation with the National Disaster Operations Centre (NDOC) and other units relevant to the flood response such as the Kenya Wild Life Service and the Kenya Police. Some of the actions taken by the Kenya Red Cross during flood disasters include:

- Undertaking search and rescue operations in flood-affected areas.
- Providing food and non-food items to families affected by floods
- Contributing to reduction of excess morbidity and mortality caused by floods and landslides by providing preventive public health, community care, and basic clinical services to populations affected and displaced by floods.
- Providing sustained access to safe water and adequate sanitation facilities and hygiene promotion for the flood affected populations
- Offering logistical support in terms of primary and secondary transportation of non-food relief, as well as stock relief items in warehouses in the field for easy access by beneficiaries at all times.

The Kenya Red Cross also creates awareness on the flood situation. The Society regularly provides updates to media stations to ensure that accurate information is transmitted. KRCS Staff usually is featured in radio interviews on the floods situation in different parts of the

country. The Society also carries out sensitization sessions in the communities to prevent more casualties from occurring.

1.3 Water Resources Management Authority (WRMA)

WRMA was established in 2005 based on the Water Act 2002. Powers and functions of WRMA described in the Water Act are listed below;

(a) to develop principles, guidelines and procedures for the allocation of water resources;

(b) to monitor, and from time to time reassess, the national water resources management strategy;

(c) to receive and determine applications for permits for water use;

(d) to monitor and enforce conditions attached to permits for water use;

(e) to regulate and protect water resources quality from adverse impacts;

(f) to manage and protect water catchments;

(g) in accordance with guidelines in the national water resources management strategy, to determine charges to be imposed for the use of water from any water resource;

(h) to gather and maintain information on water resources and from time to time publish forecasts, projections and information on water resources;

(i) to liaise with other bodies for the better regulation and management of water resources;
(j) to advise the Minister concerning any matter in connection with water resources.

Although it is not mentioned in Water Act 2002, flood management is recognized to be assigned to WRMA among MWI and other relevant authorities as part of river catchment management to achieve integrated water resources management.

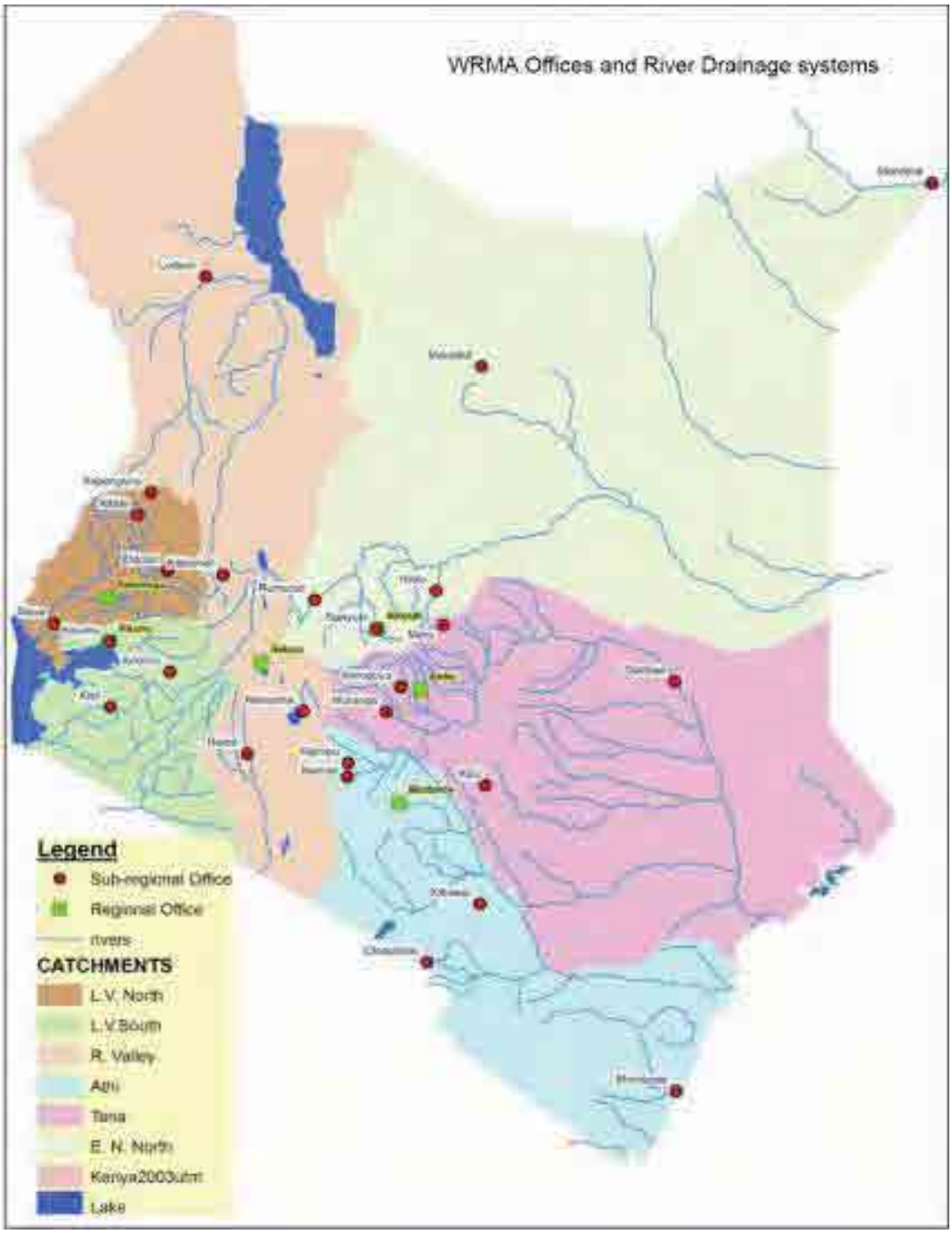
1.3.1 Organization

WRMA manages entire country under six (6) catchments and has formulated Catchment Management Strategy for each catchment. With cooperation and coordination with CAAC, WRUA manages water resources within catchments. Under the CEO, the headquarter (Nairobi), 6 regional offices, and 26 sub-regional offices are established.

Table 1.3-1 List of Regional Offices and Sub Regional Offices of WRMA

	Catchment Area/ Regional Office	Sub-Regional Office
1-1	**Athi CA / Machakos**	Upper Athi
1-2		Nairobi
1-3		Middle Athi
1-4		Nolturesh-Lumi
1-5		Coastal Athi
2-1	**Ewaso Ng'iro North CA / Nanyuki**	Upper Ewaso Ng'iro
2-2		Middle Ewaso Ng'iro
2-3		Engare Narok Melphis
2-4		North Ewaso Laggas
2-5		Ewaso Daua
3-1	**Lake Victoria North CA / Kakamega**	Elgon Cherang'anyi
3-2		Kipkaren- Upper Yala
3-3		Lower Nzoia- Yala
4-1	**Lake Victoria South CA / Kisumu**	Mara- Sondu
4-2		Northern Shoreline- Nyando
4-3		Southern Shoreline- Gucha Migori
5-1	**Rift Valley CA / Nakuru**	Lower Turkwel
5-2		Lake Baringo- Bogoria
5-3		Upper Turkwel
5-4		Naivasha- Nakuru
5-5		South Rift
6-1	**Tana CA / Embu**	Thiba
6-2		Tiva/Tyaa
6-3		Kathita/ Mutonga
6-4		Lower Tana
6-5		Upper Tana

Note: Three pilot river basins are under the jurisdiction of Regional and Sub-Regional Offices colored in grey.

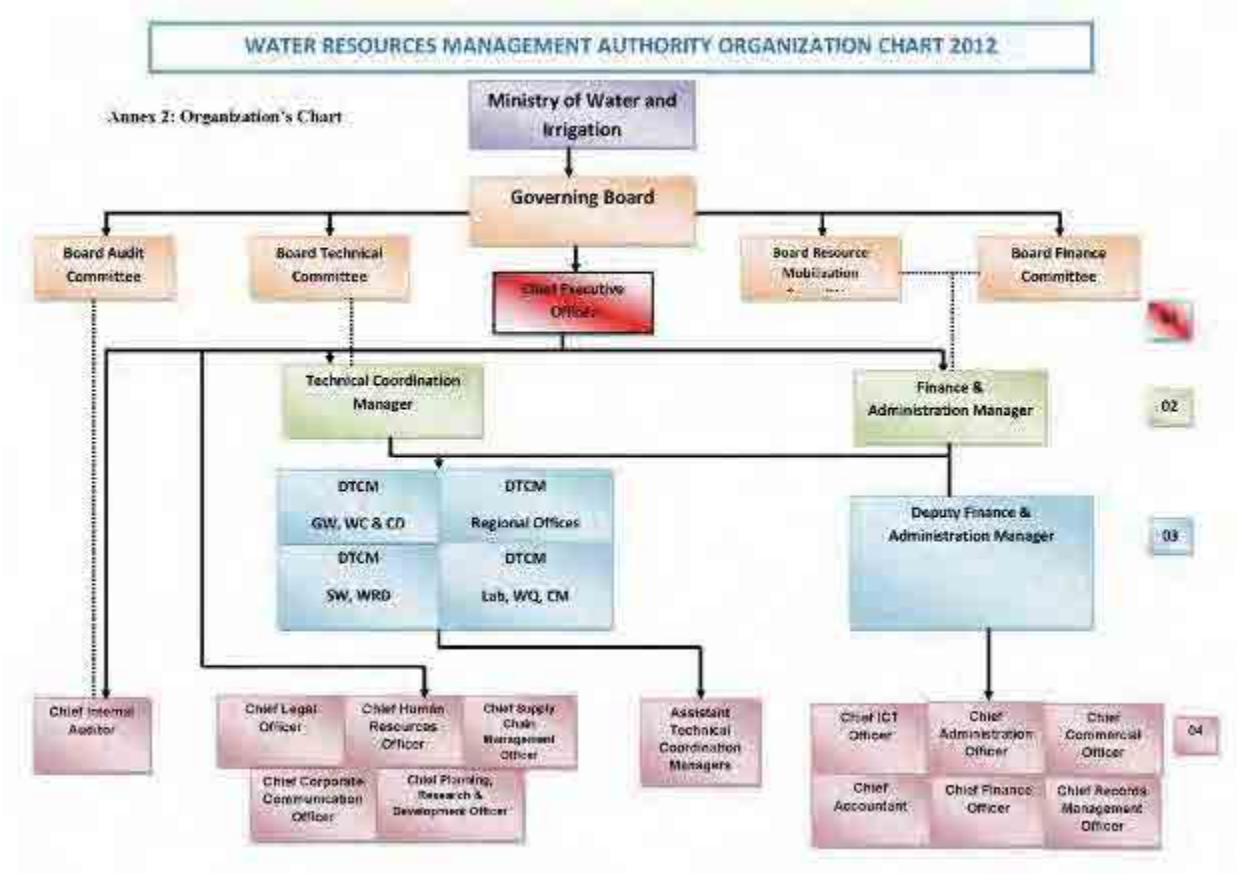


Source: WRMAs framework for engaging the County Governments kin

Fig. 1.3-1 Administrative Area and Location of ROs and SROs of WRMA

1.3.2 Staff Allocation

The organization chart of WRMA is shown below. There is no indication in this chart, but in July 2013, Deputy Technical Coordination Manager in charge of Flood Management (DTCM (FM)) was appointed in HQ under the Technical Coordination Manager (TCM), and the Flood Management Department was established under the DTCM (FM).



Source: WRMA Strategic Plan 2012-2017 Final Draft (WRMA, July 2012)

Fig. 1.3-2 Organization Chart of WRMA

1.3.3 WRMA Revenue Structure

WRMA has two major revenue streams; Internal and External Sources.

Internal Sources of WRMA Revenue include:

1. Water Use charges
2. Water Permit and Assessment Fees
3. Water Resources data fees
4. Laboratory charges
5. Credit period from debtors

Some of WRMA external sources of funds include the following;

1. Grants from Government of Kenya

2. Grants from related Government agencies
3. Grants from Lending agencies like World bank
4. Funding from Donors
5. Funding and Donations from Nongovernmental organizations, Community based organizations and Individuals
6. Loans from lending agencies

Budget for Fiscal Year 2014/15 from July 2014 to June 2015 has included budget for flood and drought management programmes of Ksh. 34,870,000- as shown in the following table, which was newly added.

1.4 Analysis of Present States of Flood Management in WRMA

1.4.1 Present Capacity of Flood Management in WRMA

WRMA has a Flood Management Unit (FMU) in HQ since the commencement of the Project, which comprises officers from various fields related to flood management. The unit has the following functions;

- Implementation of flood management strategies
- Supervision of contractors undertaking flood mitigation works e.g. evacuation centers and routes
- Liaise with community groups on flood management
- Collects hydrological data
- Disseminate Flood early warnings for others to act

Thereafter, Flood Management Department (FMD) was established in all the levels from HQ, ROs to SROs and Flood Management Officers were deployed.

1.4.2 Present Status and Problematic Points of Hydro/Meteorological Observations

According to the surveys of present states of hydro/meteorological observations for the Pilot Areas conducted by WRMA, their problems and challenges with respect to flood management are identified as follows.

(1) Actual states and issues

Present status and issues of hydro/meteorological observations being conducted by WRMA are shown as follows:

<Actual status>

- Automated data are to be collected by WRMA SRO staffs every month;
- Automated hydrological data are recorded in data loggers but not transmitted automatically;
- Automatic observation data are actually collected by WRMA SRO every 1 to 3 months.
- Visual observation work is to be undertaken by an observation volunteer who lives near the observation equipment installation.
- Visual water-level observation is to be done twice a day, at 9:00 a.m. and 3:00 p.m.
- Visual rainfall observation is to be done once a day, at 9:00 a.m.
- It has been an unwritten rule that an officer of WRMA-RO executes the river flow measurement and finds a formula of water level and river discharge relationship. WRMA-ROs are furnished with river flow measurement equipment such as ADCP.
- When an observation volunteer is not available for the measurement, he or she is to appoint somebody to carry out the observation instead.
- Visual observation result is to be recorded on the predetermined observation sheet
- The observation sheet is to be collected by WRMA-SRO officer every month, when a

fee of Ksh 1,000 per month is paid to the observation volunteer.

- In Gucha Migori river basin, there are six water-level observation points that have records for more than 10 years, and fifteen rainfall observation points that have records for more than 15 years, although there are some missing records. At Migori Water Supply only, meteorological observation has been continued for more than 10 years, and it has rainfall data for 58 years.
- Collection of visual observation records is in reality done by WRMA-SRO officers at irregular interval, once in one to six months.

<Issues>

- Automatic observation equipment is frequently destroyed and vandalized, and there are few points that have sustained recording.
- Calibration of automatic observation equipment is not implemented.
- There is no regulation concerning calibration of automatic observation equipment.
- Water level measurement is not carried out during flood time.
- Visual observation by volunteers is not always carried out every day. There are many missing records.
- Observation volunteers sometimes lose observation sheet.
- Visual observation may have large margin of errors.
- Payment of fees to volunteers is not regularly done.
- There are cases where stuff gauges are broken or buried in mud. WRMA-SROs fail to repair such gauges.

(2) Proposal for improvement of issues on hydrological and meteorological measurement

- The rules or regulations on hydrological and meteorological measurement should be established.
- There should be a formal organization to be established for hydrological and meteorological measurement at each WRMA-SRO
- SRO officers in charge of measurement should be lectured and have precise knowledge on how to use and maintain automatic measurement equipment and how to carry out visual measurement, through such occasions as training on measurement.
- Observation point should be located in such places as within the premises of public facilities to avoid theft and vandalism. It is also important that observation houses should be built
- Collection of observation records at an appropriate interval is frequently missed for such reasons as unavailability of cars. Observation points should be located where they are easily accessible from SRO offices.
- Hydrological and meteorological observation should utilize both automatic and visual observation methods.
- Hydrologic observation should be carried out to obtain sufficient data to establish H-Q (water level and discharge) relationship.
- Observation equipment should be located where it is ready accessible by the volunteer

to avoid missing observation records.

- Volunteers should be carefully selected as the quality of data depends on the willingness and capacity of the volunteer.
- It is recommended that a fee to volunteers be increased to stimulate the willingness of volunteers.
- Volunteers should take training on measurement techniques, to improve the capacity of such volunteers.

Considering the issues shown above, a draft proposal is made for hydro/meteorological observations to be conducted by WRMA, and presented at JCC held on August 7, 2012;

- A management system with respect to hydro/meteorological observations should be set up in WRMA-SROs;
- Technical trainings on observation techniques should be conducted to WRMA-SRO officers;
- Observation points should be selected where the access is easier;
- Observation points should be selected where theft and/or vandalism of observation equipment can be avoided;
- It is preferable that both automated and visual hydro/meteorological observations be conducted at one observation point;
- It is important that capable volunteers be adopted as observation volunteers;
- A fee to observation volunteers should be increased. The number of observation points can be reduced instead;
- Training for observation techniques should be conducted to observation volunteers; and
- Although no discharge observations have been carried out in the Pilot Areas, discharge measurement should be carried out at the water level observation points. It is also important to make a plan to establish H-Q relationship curves for target rivers.

(3) Draft proposal on reorganizing hydro/meteorological observation in the Gucha-Migori River Basin

Based on the draft proposal mentioned above, the following proposal on reorganizing hydro/meteorological observation in the Gucha-Migori River Basin was considered and presented in JCC held on August 7, 2012.

Considering inundation damages caused by floods in the downstream of the Gucha-Migori River, which are also caused by rainfalls on the mountains in the upstream of and hillsides in the middle of the Gucha and Migori Rivers, hydrological and meteorological observation sites are selected for the purpose of better flood management.

For conducting accurate and long-lasting hydro/meteorological observations in the Gucha-Migori River Basin, it is proposed that visual observations of water levels and rainfalls be implemented only in the sites listed below.

Table 1.4-1 Location of Hydro/Meteorological Observation Sites newly located in the Gucha-Migori River Basin

Observation		Point	Past Data Up to May 2012	Remarks
Discharge	H1	1KB0 3 (in the middle of the Gucha River)	N.A.	
	H2	1KC03 (at Migori point in the middle of the Migori River)	N.A.	
	H3	1KB05 (at Wath Onger point in the downstream of the Gucha-Migori River)	N.A.	
Water Level	H1	1KB0 3 (in the middle of the Gucha Rive)	2003/4 - 2012/5	
	H2	1KC03 (at Migori point in the middle of the Migori River)	2003/4 - 2012/5	
	H3	1KB05 (at Wath Onger point in the downstream of the Gucha-Migori River)	2003/4 - 2012/5	Automated observation in operation
Rainfall Amount	M1	Migori Water Supply (at 1KC03 point in the middle of the Migori River)	1950/1 - 2009/5	Automated observation under suspension
	M2	Keroka (in the upstream of the Gucha River)	2007/1 - 2012/5	
	M3	Lolgorian (in the upstream of the Migori River)	2007/8 - 2012/5	

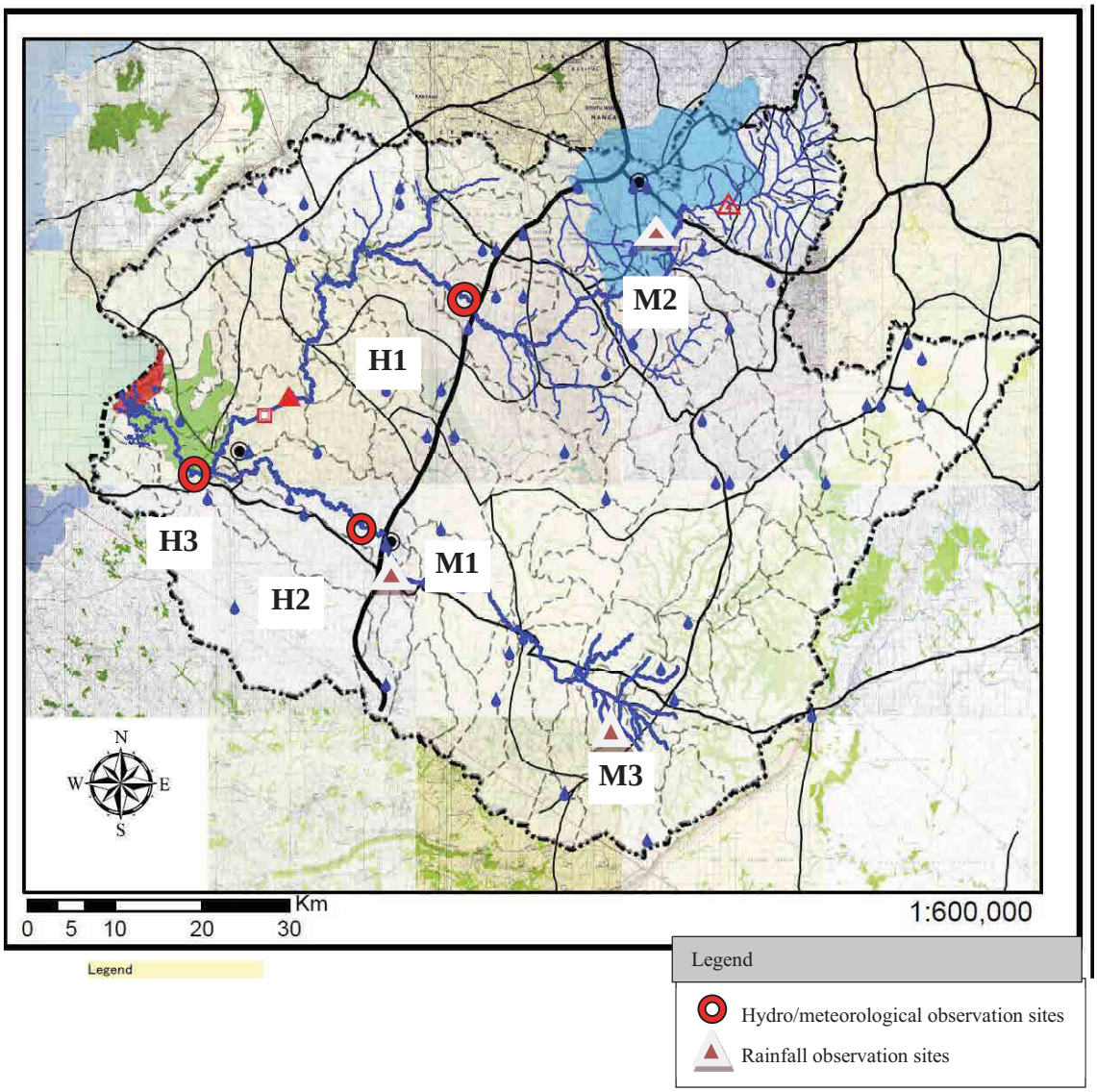


Fig. 1.4-1 Proposal on Location of Hydro/Meteorological Observation Site newly located in the Gucha-Migori River Basin

1.4.3 Present States and Proposal with Respect to Hydro/Meteorological Data Management

(1) Actual states and issues at sub-regional (SRO) level

Present states and issues of the WRMA observation data management system at a sub-regional level are discussed here, taking an example of the "Hydro/meteorological Database" at the WRMA-SRO (Kisii).

<Actual status>

- Hydrology (water level) data and meteorology (rainfall) data are to be collected at a regular interval;
- Collected visual observation data are input in PCs;
- Input data files of visual observation and automatic records are sent to WRMA-RO at a regular interval.

<Issues>

- Collection of records of water level and rainfall observation has become intermittent;
- Due to the inadequate preparation of measurement equipment there has been no discharge measurement conducted. WRMA-SRO officers, however, are willing to carry out such measurement once the measurement equipment is made ready and they have been trained on measurement method,
- Visual observation records are input in PSs. However, data format is not made uniform,
- Due to the lack of memory capacity, WRMA-SROs cannot retain observation data files.

(2) Actual states and issues at regional (RO) level

Present states and issues of the WRMA observation data management system at a regional level are discussed here, taking an example of the "Hydro/meteorological Data Base" at the WRMA-RO (Kisumu).

<Actual status>

- Whenever observation data files are sent from SROs, observation data are input and filed in RO's database;
- The RO's database is managed and accessible by designated officers only.

<Issues>

- Although discharge observation equipment is placed at each RO and administrators for the equipment are appointed, no discharge observations have been conducted at WRMA-RO(Kisumu)and most of RO's; and
- Although WRMA-HQ officers have access privileges to databases at all RO's, they cannot in reality access the database unless they go and meet the RO's administrator to obtain permission.

(3) Proposal on to the better management of hydro/meteorological data

Considering the foregoing discussion, proposal on how to better manage the "Hydro/ meteorological Database" was considered and presented at JCC held on August 7, 2012, as shown below:

- Those who are in charge of hydro/meteorological observations within WRMA-SROs should check the contents of data files. If there are missing data or incorrectly input data, they should take actions, such as giving instructions on proper observations to volunteers, checking entry tasks for input data, and so forth;
- Every WRMA-SRO should file observation data properly at its own office;
- Administrators who are in charge of database at ROs do not seem to care the quality of data. Therefore, most of missing data and incorrectly input data are frequently overlooked. This is why the administrators should check the correctness of observation data as well;
- Hydro/meteorological databases are put in place at ROs, to which only limited few administrators of WRMA have access privileges. It is important that these data be disclosed to public as annual reports, which are to be statistically analysed and published in print;

- A reading room, or library, should be established to publicize annual reports and other data to general public; and
- Although both WRMA and KMD have their own databases of hydro/meteorological data, these databases are completely independent (See following Figure). These data in databases can be altogether collected and statistically analysed and publicized as "Hydro/Meteorological Annual Report of Kenya". It is, therefore, necessary that both WRMA and KMD should work together.

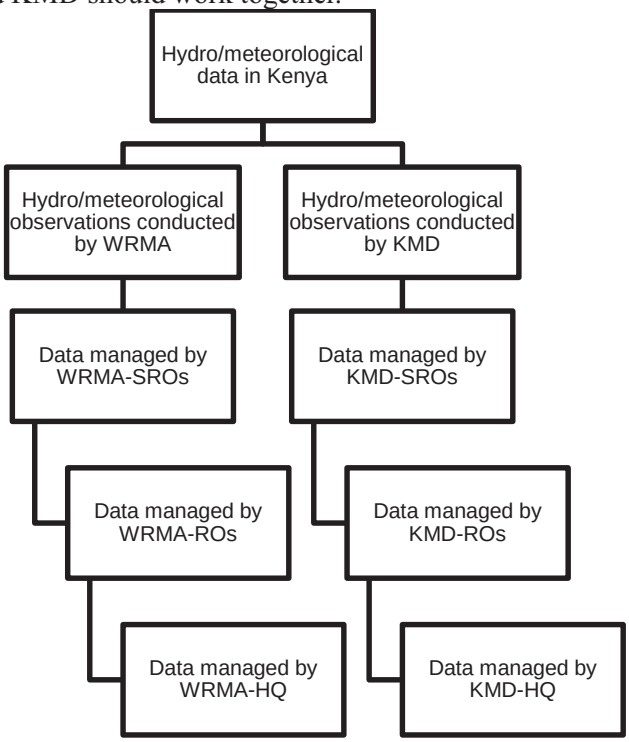


Fig. 1.4-2 Present States of Hydro/Meteorological Data System in Kenya

(4) Proposal on WRMA flood disaster database (draft)

The "Flood Disaster Database in Kenya", which the Project Team has proposed, at Working Group meeting held on February 21, 2012 and again at Weekly Meeting held on February 27, 2012, for WRMA to create, was considered to be a knowledge management system of WRMA. A proto-type of the "Flood Disaster Database in Kenya" has already been made and submitted by the Project Team. (Details are referred to Appendix 2-1.)

It is necessary for WRMA to consider the following items for creating the "Flood Disaster Database in Kenya":

- To establish a system at WRMA-SROs to check on and file data on flood disasters;
- To establish a system at WRMA-HQ to check on, file and publish data on flood disasters; and
- To establish a system at WRMA-HQ to publicized data compiled as annual reports with respect to hydro/meteorological data, along with flood disaster data, etc.

1.5 Existing Flood Management in the Kenya

1.5.1 Flood Management in the Nyando River Basin

Flooding caused serious damages to the agriculture in the Nyando river basin and various measures were taken against flooding. This basin can be classified as the most advanced area against flood control in Kenya. This section shows flood management implemented at the Nyando river basin, lessons learnt so far and possible countermeasures to be taken from now on.

(1) Background

Flooding has occurred frequently in the rainy season at the Nyando river which flows in the lake Victoria near Kisumu. In recent years, due to climate change, daily precipitation exceeding 50 mm has been observed, and increased threat against flood. Under such phenomena, flood affection to the agriculture which is major industry there is critical and establishment of flood management is requisite.

JICA carried out Master Plan study for flood management at the Nyando river basin from 2006 to 2008, and specific flood management measures were proposed in addition to the raising of roads and refurbishment of dikes. Pilot projects for those measures were implemented at 5 villages.

Thereafter, further projects against climate change were implemented by preparing hazardous map, training for disaster, education to elementary school children by means of short play and text book, construction of evacuation facilities and ways at

24 communities located in the Nyando river basin.

NWCPC (National Water Conservation and Pipeline Corporation) constructed dikes for flooding as well.

(2) Outline of Nyando River Basin

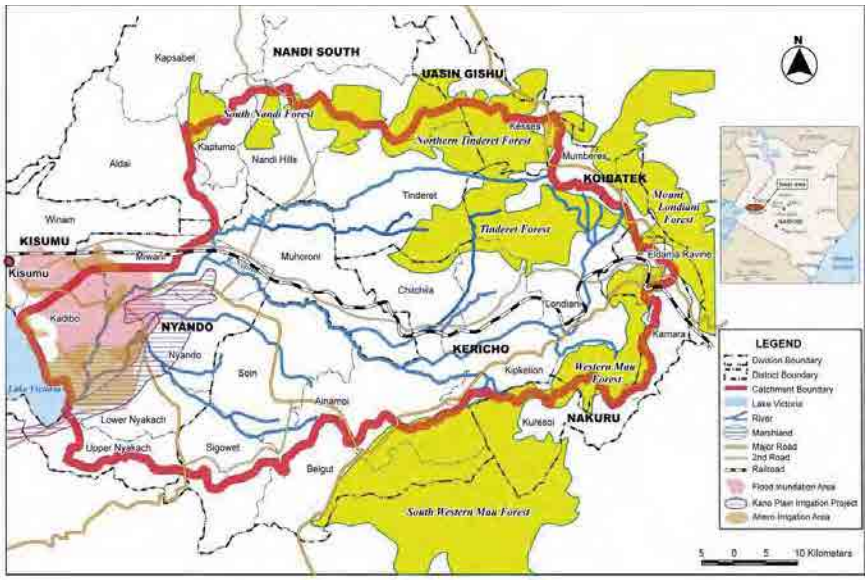
The basin expands from south-western area to eastern area at Kisumu City with basin area of 3,600 Km^2. The Nyando river has its tributaries of Ainabngetuny river and Mbogo river, which flow from Nandi hills to lake Victoria in the basin.

Upstream side of the Nyando river has elevation of EL. 1,800m to EL. 3,000m.

The basin extends 3 administration areas of Muhoroni, Kisumu East and Nyando District. Its downstream side is of flat topography called “Kano Plains”, where flooding frequently occurs in the rainy seasons twice a year.

The area where the said measures against flood were implemented is located at about 95° 40’ of east longitude and 5° 05’ to 8° 05’ of north latitude.

Annual average precipitation is 1,000mm. There are 2 rainy seasons a year in this area having long term from March to May and short term from October to November.



Source:WRMA

Fig. 1.5-1 Basin and Rivers at Nyando

The source of Nyando river is from Mau forest and Tinderet forest in the Rift Valley, and flows into various tributaries of Awach, Nyalbiego, Asawo, Ombeyi, Miriu, Sondu, Omondo and Nyaidho. Some irrigations canals flow into Nyando river en route.

Upstream side of the river basin is remarkably eroded due to steep slope topography, by which sedimentation has occurred at the downstream rivers and drainage channel.

Brooks, marshes and lakes are formed alongside the rivers. In the downstream side, the following rivers are formed where aggradation by sediments of earth and sand bringing the cause of flooding due to overflow when raining.

-River Nyando
-Awach stream
-Nyalbiego stream
-Asawo stream
-Ombeyi stream
-Miriu stream
-Sondu river
-Omondo stream
-Nyaidho stream
-Irrigation canals

Geology at the downstream side of the Nyando river is mainly of black cotton soil (clay soil) consisting of fine granular, which is likely to cause flooding because of its poor river permeability when raining.

Source: Project Team

Photo 1.5.5 River Channel at Downstream Side of the Nyando River

The slope at the downstream side is rather gentle and river velocity is low.

The river channel configuration changes due to frequent overflow on account of flow block as well as remarkable sedimentation as mentioned herein above.

(3) Project for Flood Control at Nyando River

5 pilot projects were implemented from 2006 to 2008 by JICA support in the course of master plan study for flood control and flood control projects were implemented at 24 communities as mentioned herein above.

Specific project substances are as follows.

1) Integrated Flood Management Study for Nyando River (Master Plan Study for Flood Control)
Flood control was implemented in the following 5 villages.

- Odesso Village
- Kokwaro Village
- Kasiru Village
- Kogwedhi Village
- Chilichilla Village

Only the Chilichilla Village is located at the upstream side of the river, and the remainders are located at its downstream side, where structures and non-structures were adopted in those 5 villages.

[1] Measures using structural control
Structural control adopted were as follows.

Table 1.5-1 Structural Control Adopted

Village	Structural Control Adopted	Remarks
Odesso	Revetment work, Provision of sign board	Nyamasaria river
Kokwaro	Provision of sign board	
Kasiru	Road raising, Well raising, Raising of toilet floor, Provision of sign board	
Kogwedhi	Dike construction, Provision of sign board	100m long of dike
Chilichilla	Revetment work	Kobieyet river

Revetment work and provision of sign board showing evacuation way and inundation area were done at Nyamasaria river in Odesso Village.

Sign board showing evacuation way and inundation area was provided in Kokwaro Village.

Raising of road level, raising of well elevation, raising of toilet floor were done and sign board showing evacuation way and inundation area was provided in Kasiru Village.

Dike of 100m long was constructed and sign board showing evacuation way and inundation area was provided in Kogwedhi Village.

Revetment work was done at Konieyet river in Chilichilla Village.

[2] Measures by means of non-structural control

Training and workshop were major measures done in the 5 villages as follows.

Table 1.5-2 Non-Structural Measures Done

Village	Non-Structural Control Adopted	Remarks
Odesso, Kokwaro, Kasiru, Kogwedhi	✓ Flood control for each community, Training of first rescue, Evacuation training ✓ Organization of team for operation and maintenance of structures constructed for flood control ✓ Education of flood control at primary school	Downstream villages
Chilichilla	Organization of team for operation and maintenance of structures constructed for flood control	Upstream village

Enlightenment of flood management at respective communities, training of first rescue and training of evacuation were implemented for the 4 villages at downstream area.

Team was organized for operating and maintaining the structures constructed for flood control.

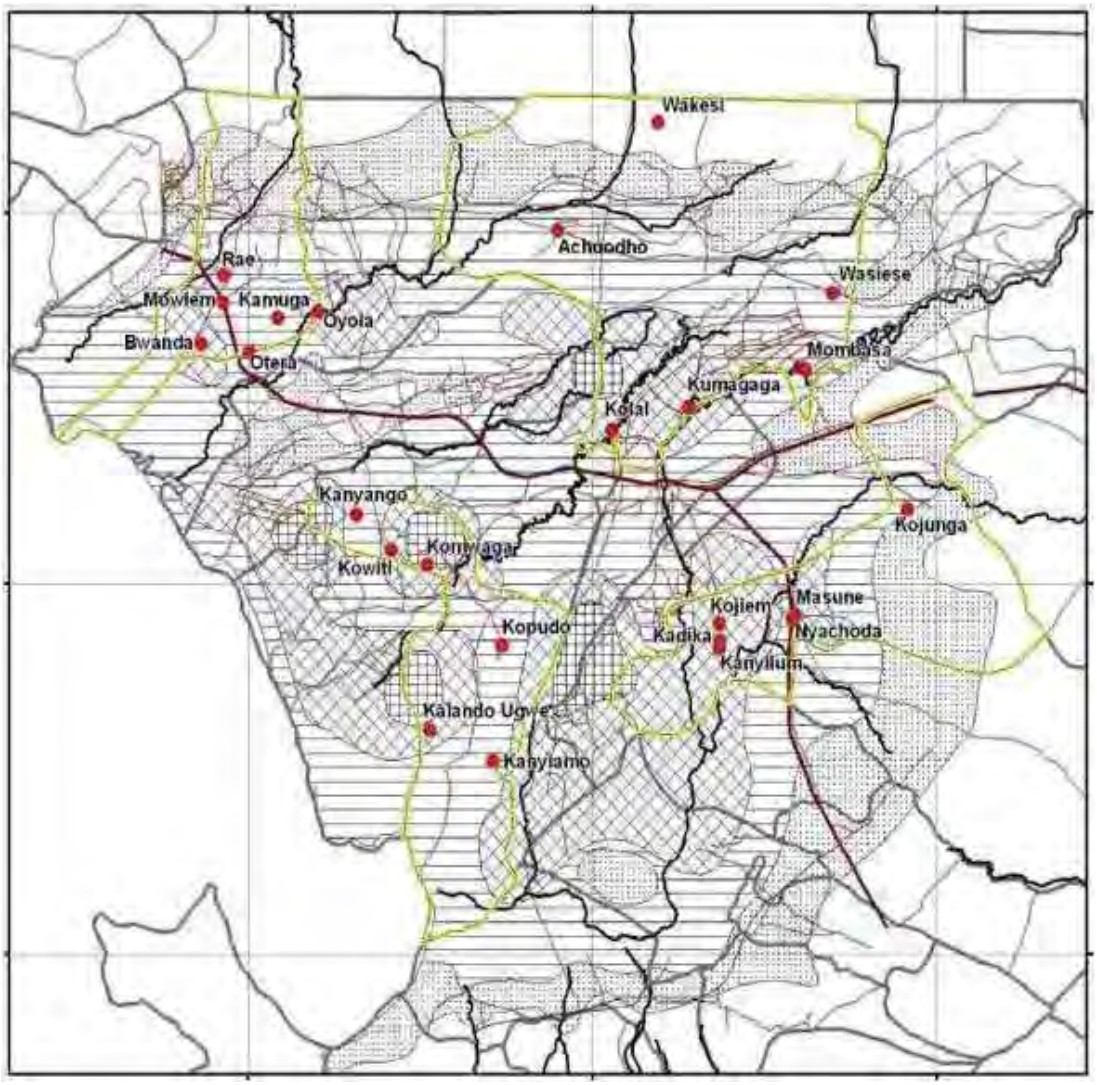
Educational program for flood management was established at primary school.

Team was organized for operating and maintaining the structures constructed for flood control in Chilichilla Village.

Flood control was implemented at 24 villages for the purpose of adapting climate change in the scheme of Flood Control Plan at Nyando river basin as follows.

Table 1.5-3 24 Villages Applied for Flood Control Plan

District	Location	Sub-Location	Village
Kisumu East	Kolwa Central	Nyalunya	01 Rae Kanyaika
			02 Mowlem
			03 Bwanda
			04 Otera
			05 Kamuga
			06 Oyola
	Bwanda	Upper Bwanda	07 Kanyango
			08 Komwaga
			09 Kowiti
		Central Bwanda	10 Kamget Ugwe
	Kanyagual	Anyuro	11 Kopudo
		Ogenya	12 Kanyiamo
Muhoroni	Ombeyi	Kore	13 Kolal
			14 Wasiese
		Rice Scheme	15 Kamagaga
			16 Wangaya Mombasa
		Kang'o	17 Achuodho
		Obumba	18 Wakesi
Nyando	Wawidhi	Magina	19 Kojiem
			20 Kanyilum
			21 Kadika
		Ayweyo	22 Nyachoda
			23 Masune
		Nyakong'o	24 Kojunga



Source: JICA O/D Study Report 2008

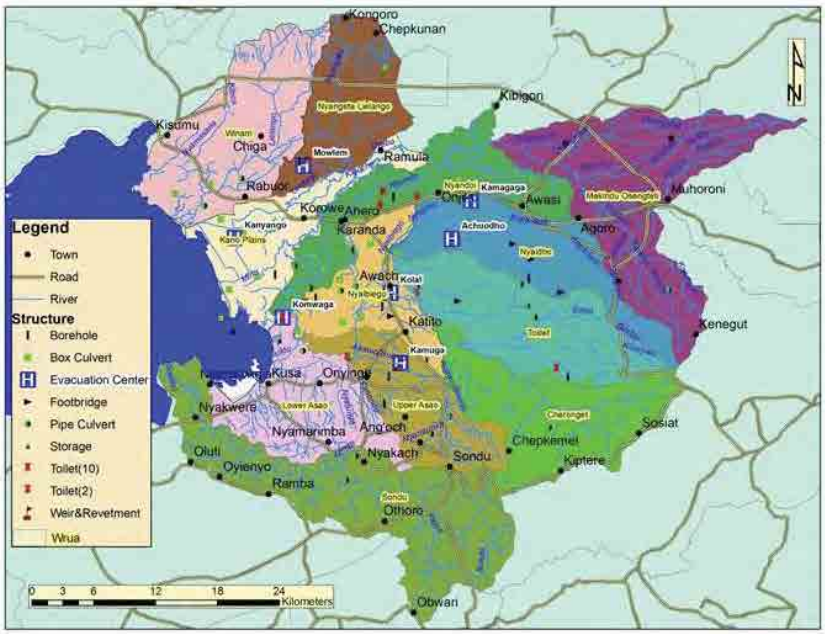
Fig. 1.5-2 Location of 24 Villages

This flood control management was implemented by Grant of Japanese Official Development Assistance aiming at forming the concept of flood control by the communities for the 24 villages as shown below.

Table 1.5-4 Flood Countermeasures Implemented in 24 Villages

Village No	Village Name	Structural measure	Code	Nonstructural measures		
		Type of Structure		Package 1	Package 2	Package 3
1	Rae Kanyaika	Box Culvert	1-RA-CV-1	Implemented	Implemented	Implemented in neighboring school in Mowlem
		Box Culvert	1-RA-CV-2			
		Pipe Culvert	1-RA-CV-3			
		Box Culvert	1-RA-CV-4			
		Pipe Culvert	1-RA-CV-5			
		Box Culvert	1-RA-CV-6			
		Box Culvert	1-RA-CV-7			
2	Mowlem	Evacuation Center	2-MW-EV-1	Implemented	Implemented	Implemented
		Toilet(10)	2-MW-T10-1			
		Borehole	2-MW-BH-1			
3	Bwanda	Box Culvert	3-BW-CV-8	Implemented	Implemented	Implemented
		Box Culvert	3-BW-CV-9			
		Box Culvert	3-BW-CV-10			
		Pipe Culvert	3-BW-CV-11			
		Box Culvert	3-BW-CV-12			
		Pipe Culvert	3-BW-CV-45			
4	Otera	Pipe Culvert	4-OT-CV-13	Implemented	Implemented	Implemented in neighboring school in Oyola and Kamuga
		Box Culvert	4-OT-CV-14			
		Box Culvert	4-OT-CV-15			
		Pipe Culvert	4-OT-CV-16			
		Box Culvert	4-OT-CV-17			
5	Kamuga	Toilet(10)	5-KM-T10-2	Implemented	Implemented	Implemented
		Box Culvert	5-KM-CV-18			
		Borehole	5-KM-BH-2			
		Evacuation Center	5-KM-EV-5			
6	Oyola	Pipe Culvert	6-0Y-CV-19	Implemented	Implemented	Implemented
		Pipe Culvert	6-0Y-CV-20			
		Box Culvert	6-0Y-CV-21			
		Box Culvert	6-0Y-CV-22			
		Pipe Culvert	6-0Y-CV-23			
		Box Culvert	6-0Y-CV-24			
		Borehole	6-0Y-BH-3			
		Footbridge	6-OY-FT-6			
7	Kanyango	Box Culvert	7-KN-CV-25	Implemented	Implemented	Implemented in neighboring school in Kowiti
		Box Culvert	7-KN-CV-26			
		Box Culvert	7-KN-CV-27			
		Weir&Revetment	7-KN-WR-1			
		Evacuation Center	7-KN-EV-6			
8	Komwaga	Evacuation Center	8-KM-EV-2	Implemented	Implemented	Implemented in neighboring school in Kowiti
		Toilet(2)	8-KM-T2-1			
9	Kowiti	Storage	9-KW-ST-1	Implemented	Implemented	Implemented
		Toilet(10)	9-KW-T10-3			
		Pipe Culvert	9-KW-CV-28			
10	Kamget Ugwe	Pipe Culvert	10-KU-CV-29	Implemented	Implemented	Implemented
		Pipe Culvert	10-KU-CV-30			
		Box Culvert	10-KU-CV-31			
11	Kopudo	Borehole	11-KP-BH-4	Implemented	Implemented	Implemented
12	Kanyiaomo	Pipe Culvert	12-KN-CV-32	Implemented	Implemented	Implemented

		Pipe Culvert	12-KN-CV-33			
13	Kolal	EvacuationCenter	13-KL-EV-3	Implemented	Implemented	Implemented in neighboring school in Kamagaga
		Toilet(2)	13-KL-T2-2			
14	Wasiese	Box Culvert	14-WS-CV-34	Implemented	Implemented	Implemented
15	Kamagaga	Evacuation Center	15-KM-EV-4	Implemented	Implemented	Implemented
		Toilet(2)	15-KM-T2-3			
		Footbridge	15-KM-FT-1			
16	Wangaya Mombasa	Pipe Culvert	16-WM-CV-35	Implemented	Implemented	Implemented
		Pipe Culvert	16-WM-CV-36			
		Pipe Culvert	16-WM-CV-37			
		Pipe Culvert	16-WM-CV-38			
		Borehole	16-WM-BH-5			
17	Achuodho	Toilet(10)	17-AC-T10-4	Implemented	Implemented	Implemented
		Pipe Culvert	17-AC-CV-39			
		Pipe Culvert	17-AC-CV-40			
		Borehole	17-AC-BH-6			
		Evacuation Center	17-AC-EV-7			
18	Wakesi	Box Culvert	18-WK-CV-41	Implemented	Implemented	Implemented
		Borehole	18-WK-BH-7			
19	Kojiem	Borehole	19-KJ-BH-8	Implemented	Implemented	Implemented in Neighboring school of Kadika and Kanyilum
20	Kanyilum	Storage	20-KN-ST-2	Implemented	Implemented	Implemented
		Toilet(10)	20-KN-T10-5			
		Borehole	20-KN-BH-9			
21	Kadika	Pipe Culvert	21-KD-CV-42	Implemented	Implemented	Implemented
		Footbridge	21-KD-FT-2			
		Borehole	21-KD-BH-10			
22	Nyachoda	Pipe Culvert	22-NY-CV-43	Implemented	Implemented	Implemented
		Box Culvert	22-NY-CV-44			
		Footbridge	22-NY-FT-3			
23	Masune	Borehole	23-MS-BH-11	Implemented	Implemented	Implemented
		Toilet(10)	23-MS-T10-6			
24	Kojunga	Footbridge	24-KJ-FT-4	Implemented	Implemented	Implemented
		Footbridge	24-KJ-FT-5			



Source: WRMA HQ

Fig. 1.5-3 Location of Structural Measures Implemented

(4) Flood Control Project Done by NWCPC (National Water Conservation and Pipeline Corporation)

NWCPC is also developing the dike arrangement for flood control at Nyando river.

According to Ahero project office, not only at Nyando river but also at Nyalbiego river and Awach river which are its left tributary the dikes are being constructed at their left bank against the flooding therefrom.

2.2 km long dike (1.6 km completed and 0.6 km partially completed) was arranged from 2011 to 2012, and it is planned to be extended toward downstream from 2012 to 2013.

Following shows dike arrangements being done by NWCPC.

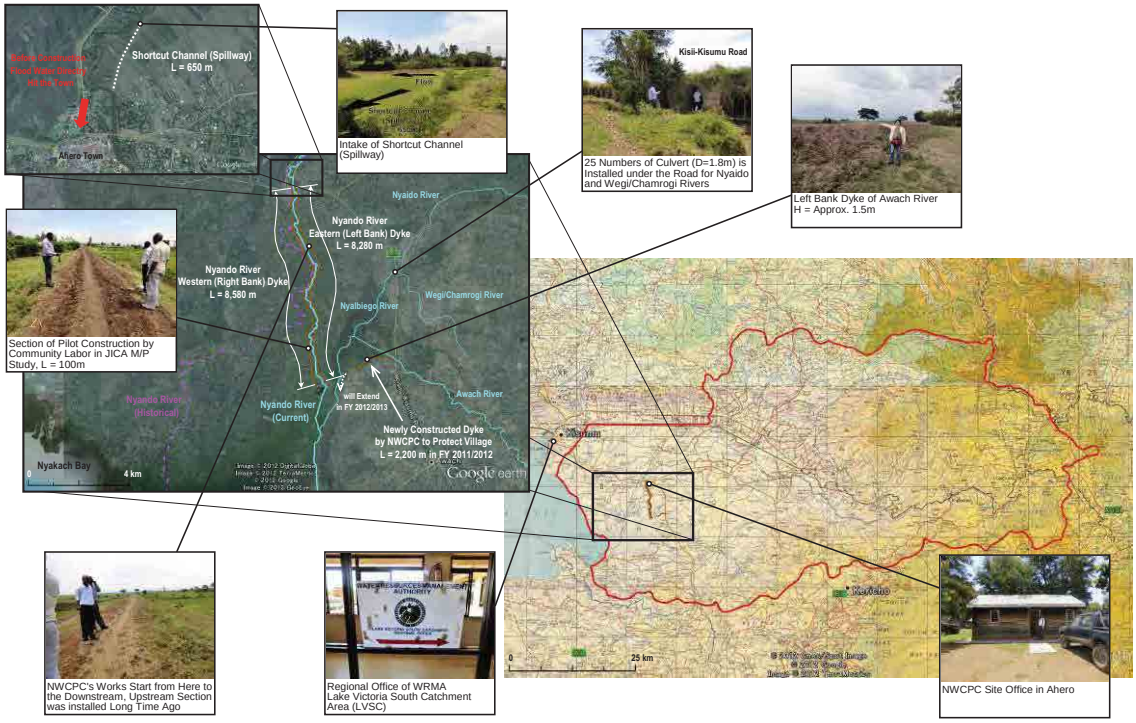


Fig. 1.5-4 Dike arrangements being done by NWCPC

1.5.2 Flood Management at the Nzoia River Basin

(1) Outline

Flood control management projects for Nzoia river being implemented by WKCDD & FMP, are as follows.

-Restoration of water retaining function and control of growing earth and sand in the upstream area

-Construction of multi-purpose dam in the middle stream area

-Rehabilitation of such river improvement structure as dike in the downstream area

These projects must not be implemented individually but be supplemented and linked each other in order to achieve consistent flood control management in the basin

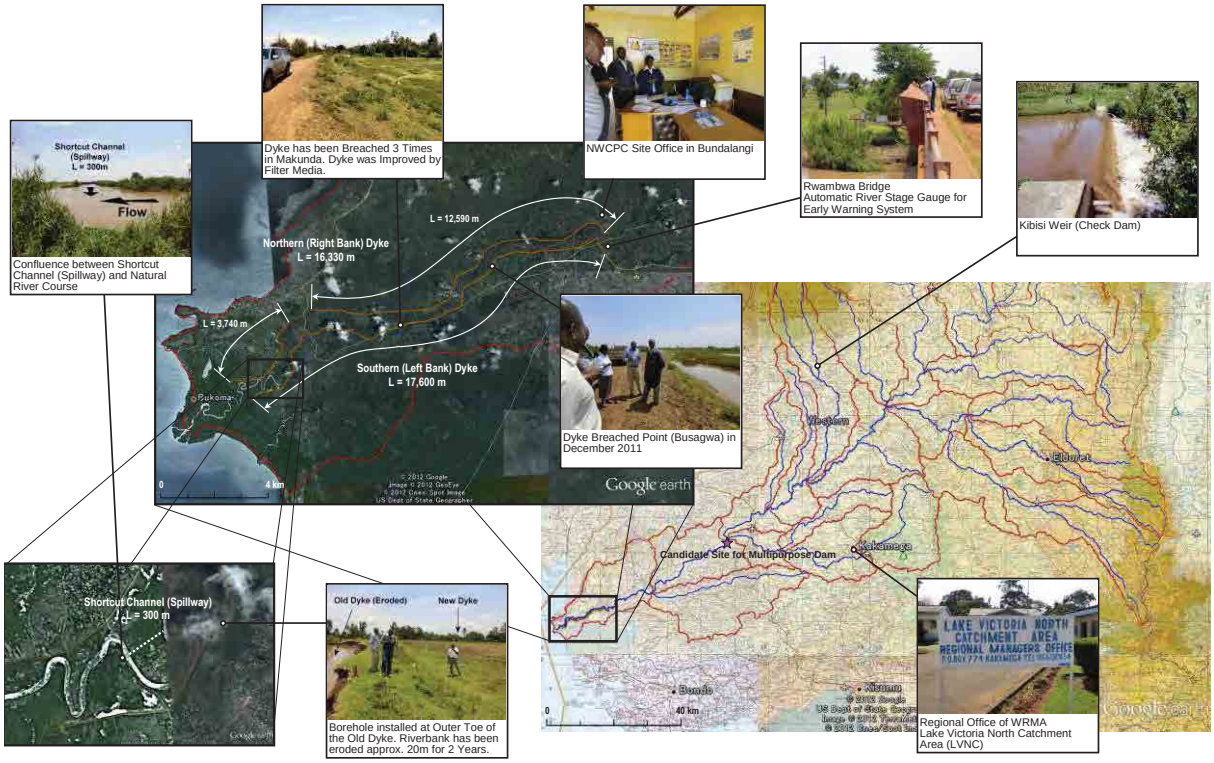
In the upstream area of Busalangi plain, forest preservation project and construction of Check dam (constructed at 5 sites so far) having flushing function of earth and sand as flood control projects.

In the middle stream area of Busalangi plain, multi-functional dam and flushing gate have been constructed as flood control projects.

Dike of 17 km long at each bank side of Nzoia river (total length of 35 km) from Rwambwa Bridge in the flood plain of Busalangi to the downstream lake Victoria, is constructed.

The Project Team with WRMA officers inspected conditions of flood control facilities including

Dikes located in the downstream area of the Nzoia river, of which inspection results are as shown below.



Current Situation of Nzoia River Basin (As of September 2012)

Fig. 1.5-5 Inspection Result of Current Situation of Nzoia River Basin

Through the hearing at the inspection sites, it revealed that above-mentioned projects were not well supplemented each other, e.g. Although the established magnitude of downstream river improvement structures of 25 years will be reviewed to 50 years, planned high water does not reflect flood peak cut of the dam under planning in the middle basin.

Whereas, WKCDD & FMP insisted that downstream area will become safer if the flood peak cut should be done when dam construction is implemented, and that all the projects are being on the way generally under the policy of consistent basin management with supplemental and due link each other.

(2) Flood Early Warning System (FEWS) by Means of Automatic Hydrological and Meteorological Observation

Automatic hydrological and meteorological observations in Kenya are generally not conducted but by visual observation by local observers, twice a day for water level observation in the morning and evening, and daily precipitation observation.

When flooding, however, the said daily observation is insufficient and flow measurement or hydrometry (high water observation) in addition to hourly observation of water level and precipitation is recommended.

WRMA takes aim at introducing automatic observation recently, and automatic hydrological and meteorological observatory has been provided at some parts of Nzoia river ahead.

3 automatic observation instruments are provided at the Nzoia river basin, by which early warning system for flood (FEWS) is established. Automatically observed data for 24 hours are transmitted every 10 minutes automatically to Busalangi branch office and head office of Kenya Meteorological Department (KMD).

KMD head office is executing discharge analysis using those data, and transmits its results to NDOC (National Disaster Operation Center) and also provide them through internet with KMD-Busalangi, District Commissioner Buslangi (DC-Busalangi), Provincial Commissioner, District Disaster Management Committee (DDMC), MWI (Ministry of Water & Irrigation), WRMA (Water Resources Management Authority), NWCPC (National Water Conservation and Pipeline Corporation), opinion leaders and so on for the purpose of flood control management.

DC-Busalangi, based on the data received from KMD head office, announces flood warning to the inhabitants by FM radio, etc. When flooding, persons of DC-Buslangi and DDMC are called to organize 24-hour-watching system. Flood warning is classified in [1] Alert Level, [2] Warning Level and [3] Evacuation Level. The inhabitants evacuate on receiving the Flood Alert.

According to the officials of DC-Busalangi, inhabitants' damage suffer has remarkably mitigated by FEWS. Whereas, according to MSSP's officials, a certain good outcome has been obtained by FEWS but there are many inhabitants who do not follow the flood alert.

Photo 1.5.2 Automatic Meteorological Observation Instrument at DC-Busalangi

FM radio station (Community Radio Network) is operating in the lot of DC-Busalangi Office.

Flood Alert announced by DC-Busalangi is transmitted by the radio station in all directions of 40 km, provided that the radio station broadcasts 19 hours a day due to license restriction although 24-hour broadcasting time is desirable.

100 units of FM radio receivers of manual generating type are supplied to the surrounding inhabitants free of charge.

Photo 1.5.3 FM Radio Station in the DC-Busakangi FM Radio Receiver

Automatic meteorological observation instruments suffer from destruction and theft so frequently that their functions are not sufficiently achieved, for which such countermeasure as covering them with thick steel plate is taken.

Photo 1.5.5 Covered Automatic Meteorological Observation Instrument

Chapter 2 Revision of National Water Resources Management Strategy (NWRMS)

WRMA shall suggest MEWNR to include flood management contents into the National Water Resources Management Strategy (NWRMS). The Project Team conducted analysis of the current NWRMS, review the goal of flood management in NWRMS and the details of flood management to be address in NWRMS, and provided advice and suggestions to MEWNR through WRMA on the revision of NWRMS.

The Project Team made comments on the draft of the revision to NWRMS prepared by a consultant of GIZ in the end of January 2012, and the final revision of the NWRMS was printed in April 2012.

2.1 Achievement of Input by the Project Team (Comparison of Old and Revised NWRMS)

2.1.1 Flood Management Contents Added to NWRMS by the Project Team

(1) Flood Management

In Chapter 1 Introduction, 1.1 General Background, a description of "Key areas to consider for better management of water resources" was revised to include “Risk reduction of water related disasters (floods and droughts)”.

Chapter 4 Strategic Objectives and Strategies was revised to include the following sentence as a target of flood management;

“4.7 Develop proactive mechanisms for implementing disaster management strategies namely floods, droughts, landslides and pollution”.

The word “proactive” in the sentence was included following the advice provided by the Project Team.

And, the strategy under the objectives included the following three items;

4.7.1 Create an enabling environment for implementation of disaster related policies

4.7.2 Support the development of projects and programmes for the implementation of the following policies and strategies

4.7.3 Develop a policy for mitigating pollution of water resources caused by disasters.

The Project Team suggested adding the following item and it was included in the final version.

4.7.4 Promote structural and non-structural counter measures to reduce flood risks

(2) River Basin Wide Approach

The Project Team made a comment that the draft revised NWRMS did not have river basin wide approach and suggested that the formulation of river basin wide planning which were reflected to Chapter 1 Introduction, 1.1 General Background, "Key areas to consider for better management of water resources" as in “The management of water resources which should be undertaken along natural catchment/ basin boundaries following an integrated approach (IWRM)”.

Also in Chapter 2 Achievements under NWRMS (2007-2009) Implementation, Project Teams input was reflected as in “Lack of basin-wide approach limits extents of coordination”.

Goals/Objectives	Achievements	Lessons learnt
(xii) Integration of sector and regional water policies	- Water sector strategic plan developed. The plan provides mechanisms for integration of the water related sectors at top policy level - At operations levels, coordination is realized through CMSs and SCMPs	- There is no clear linkage between the coordination at top policy and operations level - Lack of basin-wide approach limits extents of coordination - Lack of equity in development and access to water resources

However, regarding the river basin wide approach at the level of strategy, "4.8 Promote the implementation of trans-boundary water resources use" briefly mentions that "The national institutions are established based on water basin approach with stakeholder forums drawing participants within the Kenyan territory".

Insufficiency of river basin wide approach was recognized in MEWNR, but the issue of trans-boundary water resources was highlighted.

Chapter 3 Revision of Catchment Management Strategy (CMS)

Under Water Act 2002, GOK institutionalized Catchment Management Strategies (CMS) for each catchment with an intention to implement integrated water resources management involving stakeholders based on the CMS. However, as these strategies did not include enough description on flood management, WRMA needed to revise them to cover flood management. The Project Team examined the existing CMSs, set a goal of flood management in CMSs, and provided recommendations and advices on their revision from administrative and technical perspectives.

3.1 Recommendation of Revision of CMS

3.1.1 Setting Targets of Flood Management in CMS

Long term target:

Quantitative target should be set for flood management. For example, in Japan, setting reference points in the river course and designating design flood discharge at the reference points, flood management structures such as dams, river channels and others should be planned and designed to accommodate the design flood discharge safely. WRMA should be in an official position to regulate and guide the implementing bodies of such plans. But, in order to realize this, WRMA should be able to determine flood discharges with the probabilities of frequencies at various points along a river course.

Short term target:

WRMA selected fifteen (15) river basins as heavily flood-affected river basins and deployed Flood Management Officers to the basins. CMSs relevant to such river basins should mention the following two matters;

a) These fifteen (15) river basins are designated as target river basins for flood management and should have Integrated Flood Management Plans,

b) In the designated river basins, Integrated Flood Management Committee (IFMC) should be established, encompassing stakeholders from whole river basin.

3.1.2 Recommendations by the Project Team

The revision to CMSs was decided to include “Chapter 9 Flood and Drought Management” as shown in the following table. This follows the structure of WDC Manual version 2. The revision to three CMSs, namely LVSCA, ACA and ENNCA, were already prepared as the first draft and the stakeholder meeting with related County Governments have been held as of the end of June 2014.

Table 3.2-1 Structure of Revised CMS

CHAPTER	DESCRIPTION
PART I:	**BACKGROUND**
1	Introduction
2	Policy, Vision, Mission and Principles
3	Basin Characterization
PART II:	**STRATEGIES FOR CATCHMENT MANAGEMENT**
4	Management Approaches
5	Water Balance and Demand
6	Water Allocation and Demand Management
7	Water Resources Protection
8	Catchment Conservation and Protection
9	Flood and Drought Management
10	Climate Change Adaptation
11	Water Resources Infrastructure Development
12	Livelihoods Enhancement
13	Right Based Approaches
14	Institutional Development
15	Monitoring and Information Management
16	Financing and Implementation

Chapter 4 Establishment of Training System in WRMA

As one of the components of supporting to establish institutional framework for enhancing flood management capacity of WRMA staffs, the Project executed flood management training for WRMA staffs and the training system on flood management was established. In its process, the existing training system of WRMA staffs was examined, capacity of WRMA staffs and needs for training on flood management were assessed, and the training plan, training manual and training materials were developed. Moreover, WDC Manual, which is a manual for WRMA staffs to guide WRUA members, was revised to include flood management module/chapter and the WRMA training system was planned to link with the revised WDC Manual.

4.1 Purpose of Training

The purpose of the Project is to establish institutional framework for promoting and expanding nation-wide the community based flood managements to each level of WRMA-Head Quarter (HQ), Regional Office (RO) and Sub-Regional Office (SRO)) including newly constituted Flood Management Unit (FMU). Therefore, the training aims at development and organization strengthening of WRMA's capacity at each level, on overall flood management, and support to community based activity in the field. In addition, the training planning includes a consideration on the establishment of mechanism and organization in WRMA to spread the outcome of this Project to other part of the country.

The project purpose to be achieved in the Project period in the PDM is following.

Project Purpose
In the Project target areas, institutional framework of flood management in the context of integrated water resource management is established for effective and sustainable implementation of community based activities.

The indicator on capacity development is Indicator 2 in the PDM.

Project Purpose (Indicator 2)
WRMA's training system function covering the project target areas is established.

Following activities are implemented to achieve above purpose and Indicator 2.

(1-5-1)	Formulation of a training plan
(1-5-2)	Preparation of training manuals
(1-5-3)	Implementation of training courses for trainers
(1-5-4)	Implementation of training courses by the trainers
(1-5-5)	Evaluation and feedback of the outcomes from the training courses
(1-5-6)	Contribution to the relevant organization in terms of implementation of training courses

The training planning is a process of realization of these activities. The process and contents of the plan are explained below.

4.2 Overall Structure of the Training

As mentioned above, the project aims to establish institutional framework to develop community based flood management in Kenya at each level of WRMA. WRMA is in a position to guide WRUA in implementation of community based flood management activities. The training program was designed to consist of 3 stages.

In the 1st stage, visiting lecturers such as JICA experts and university professors in Kenya are invited as trainers. Participants in the 1st stage are expected to become trainers in the 2nd

stage. They also make core group for capacity development on effective flood management.

In the 2nd stage, WRMA members trained in the 1st stage become the trainers. The 2nd stage training is given to other technical staff of WRMA including those in ROs and SROs, to develop capacity to support community based flood management activities. Also, the 2nd stage training is aimed to become a standard flood management training program in WRMA.

In the 3rd stage, WRMA members who have been trained in the 2nd stage instruct WRUA to perform community based flood management activities at community level. The training is based on flood management module of WDC manual that has been updated to include flood management by WRMA in cooperation with the Project Team.

The training consisting of 3 stages was conducted in Kenya. It was the core of training activities in the Project. On the other hand, training in Japan was carried out as well. The target group of training in Japan was WRMA staff, Ministry of Environment, Water and Natural Resources (MEWNR) officer and WRUA leaders of the pilot sub catchments. Field studies and lectures about flood fighting and water resource management organizations and flood management facilities were the main features of the program. Especially, actual examples of entire river basin flood management in Japan that did not exist in Kenya were focused. For Ministry officer in charge of policy making on flood management and WRMA staff in charge of formulating flood management plans this offered a good occasion to understand concrete goals of flood management. For WRUA leaders, it was a chance to know actual examples of community based flood management activities. It was envisaged that their experience in Japan would enhance the effectiveness of pilot projects and improve the motivation of relevant people and the sustainability of the measures.

The details of each stage and the training in Japan are summarized in the table below.

Table 4.2-1 Program of training in Japan, Structure of training and purpose of each stage

Training	Purpose of Training
1st stage	Lectures (WRMA staffs) of 2nd stage are trained in 1st stage. They are expected to instruct WRMA staffs in capacity building to support community based flood management activities. Trainees in 1st stage play the key role in capacity development of flood management of WRMA.
2nd stage	Capacity development for WRMA regional and sub-regional office staffs is focused. They instruct WRUAs and support community based flood management activities.
3rd stage	WRMA trains WRUA to support community based flood management activities.
Training in Japan	It is intended to obtain a better understanding on flood management. Trainees participate in lecture and field study to Japanese structure, organization, facilities and community based activities on flood management and water resource management of entire river basin.

4.3 Consideration of Contents of Training

4.3.1 Flow on Consideration of Training System

The Project purpose is to establish institutional framework of flood management for effective and sustainable implementation of community-based activities. Therefore, first steps for formulating the training contents were focused on capacity assessment and needs analysis for WRMA and WRUAs. Capacity assessment and needs analysis for the training on flood management were considered to incorporate capacity development of WRMA and organizational enhancement. Together with those considerations, the contents of the training should be coordinated with existing training system in WRMA.

The content of the training should be based on the WDC Manual that is a textbook for WRMA to instruct WRUAs at community level. The chapter of the Flood Management Module was written by WRMA in cooperation with the Project Team.

Two flows mentioned above are corresponding to general ideas of needs of WRMA, though the complete picture is extensive. In addition, some needs identified require particular technical understanding on civil engineering, hydrology, information technology, etc. The contents should be prioritized on the Project purpose, which is "to support and instruct flood management activities for WRUAs". Meanwhile, those contents and topics that should be covered in the middle and the long term were summed up as the future issues on the WRMA training. Also, needs that accord with the purpose of the training in Japan should be extracted.

Consideration process of the training contents is shown in the following figure.

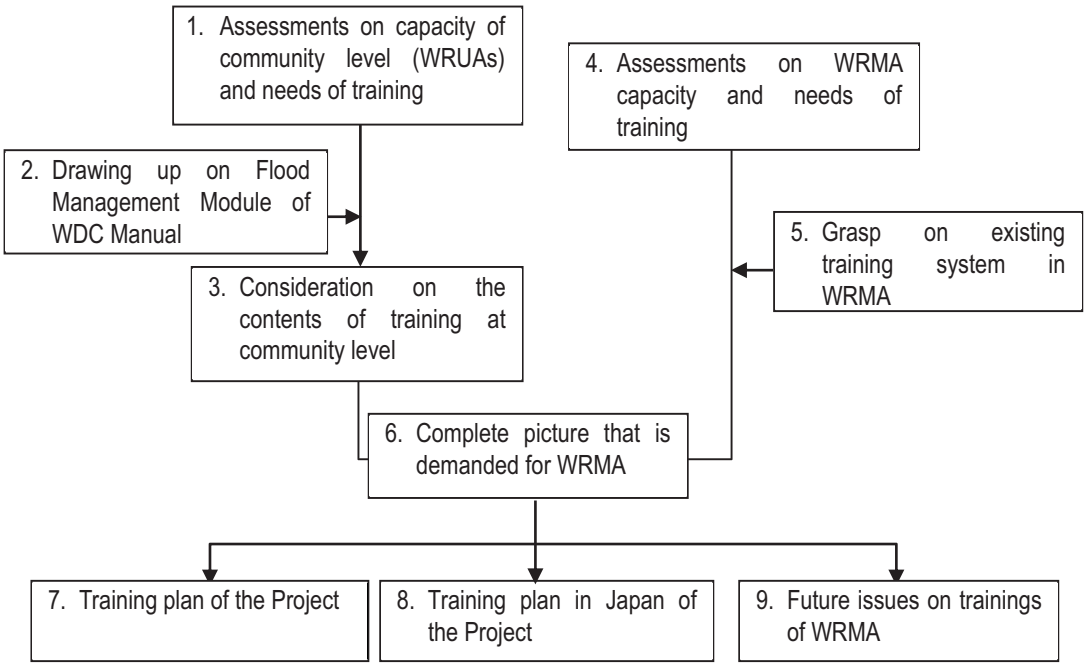


Fig. 4.3-1 Consideration flow on training system

4.3.2 Consideration of Contents of the Training

(1) Assessment of WRUA's Capacity and Needs of Training

Capacity assessment at community level was carried out for WRUAs of three pilot sub catchments. Elements of capacity necessary in flood management were classified into large and small groups in a matrix table. Those elements and classifications were derived from "Analysis on good practice of Capacity Development / Community-based Disaster Prevention from Viewpoint of Capacity Development / For Capacity Development of Community-based Disaster Response" (Japan International Co-operation Agency, JICA Research Institute, August 2008), together with contents and flow of community-based disaster prevention activities and three keys for promotion of capacity development.

Each small item was further separated for personnel, organization and institution. Current capacity of WRUAs of each element was evaluated by the Project Team as a draft. After consultation with WRMA in the 3rd working group meeting held on 30 November 2012, the evaluation for capacity of WRUAs was finalized.

Also, capacity required for WRMA that has responsibility for supporting WRUAs technically and administratively was defined. Needs for WRMA capacity development was classified by priority of the items and time scope. The Project Team proposed methodology and target group for capacity development from those considerations. Assessment of capacity and needs of the training was conducted in the same working group meetings. (Details are referred to Appendix 2-2, 2-3.)

(2) Flood Management Module of WDC Manual

WRMA possesses the WDC Manual, which has been used as a textbook for guidance for WRUAs. Current WDC Manual consists of water resources management modules. As WRMA became mandated to be in charge of flood management, WRMA staff should be able to instruct WRUAs in the field of flood management at community level.

WRMA requested the Project Team to make a draft of a WDC Flood Management Module, which was finalized in the course of the Project. The structure of the training is based on this WDC flood management modules. (Details are referred to Appendix 2-4)

(3) Consideration on Contents of Training at Community Level

Contents of the training for WRMA staff should focus on support for flood management activities at community level. From considerations of (1) and (2) above, training sessions are set in order as in the table below, derived from a context of the Flood Management Module of the WDC Manual. The table also indicates relationship between session scheme of sub-modules and capacity assessment matrix discussed in the next sub section.

Table 4.3-1 Training sessions in sub-module scheme of WDC Manual and the result of capacity assessment

No	WDC Sub-Modules	Sessions	Relevant section in capacity assessment
1	Integrated Flood Disaster Management	a) Introduction to flood disasters including sediment disasters	
		b) Introduction to Integrated River Basin Flood Management (IRBFM)	
		c) Introduction to Disaster Management Cycle (DMC)	
		d) Introduction to self-help, mutual support, public assistance	§1-2 §3-2
2	Community-based Flood Management	a) Introduction to Community Managed Disaster Risk Reduction (CMDRR)	§1-1,§1-3, §3-1,§3-3, §3-4,§3-5, §3-6,§5-1, §5-2
		b) Roles of Flood Risk Communication (FRC) between government and residents	§1-4,§1-10
		c) Introduction to measures against floods	§6-2,§6-3
3	Causes and Effects of Floods	a) Cause of floods	§2-1
		b) Effects of floods and damages	§2-1,§2-5, §2-6
4	Community-Based Flood Hazard Map	a) Collecting and arranging information about the past flood phenomena and damages	§2-2,§2-3, §6-3
		b) Providing necessary information in graphic presentation that helps communities evacuate safely and quickly	§2-4,§6-1, §6-2,§6-5
5	Rainfall and Flood Observation	a) Rainfall observation	§8-3
		b) Discharge observation	§8-3
6	Raising Public Awareness/ Enlightenment/ Education	a) Introduction to public awareness raising on floods	§4-1
		b) Introduction to flood disaster education	§3-2,§4-2, §4-3,§4-4, §4-5
7	Flood Early Warning	a) Introduction to Flood Early Warning System (FEWS)	§8-3,§8-4, §8-6
		b) Introduction to community-based Flood Early Warning	§8-4
8	Evacuation	a) Evacuation planning and drills	§2-6,§7-1, §7-2,§7-3, §8-1
		b) Evacuation centre management	§8-1
9	Cooperation and coordination with related parties	a) Roles of local government and WRMA	§1-4
		b) Roles of District Disaster Management Committee (DDMC)	§1-4
		c) Cooperation and coordination among related parties for flood management	§5-3,§5-4
10	Implementation of Flood Prevention/ Mitigation Facilities	a) Types of flood mitigation structural measures	§6-1
		b) Project cycle of implementation of structural measures	§6-4
		c) Method of implementation and Operation and Maintenance (O&M) of structural measures	§6-6,§6-7

(4) Assessment of WRMA Capacity and Training Needs

Contents of the training for WRMA should be derived from required contents of technical instruction for WRUAs because of their lack of experience on general flood management. Current flood management capacity of WRMA was evaluated at first. Secondly, required field of capacity development was discussed in the working group meetings and incorporated into

the draft of the training plan.

Assessment of WRMA capacity and needs of training was carried out by the same method as WRUAs assessment mentioned above. Large items in the left-most column in the matrix were derived from the report of JICA Project Team, that is "Action Plan for the Next Step (18 June 2012)", especially 6 items of "4.WRMA Capacity to be developed". Small items in the matrix were considered by the Project Team. Large column consists of three small columns that are personnel, organization and institution.

Analysis is firstly conducted by the Project Team to make a draft, then assessment of WRMA capacity and needs of training were discussed in the working group meetings at the same time as WRUAs capacity assessment.

(5) Understanding of Existing WRMA Training System

Human Resources Department (HRD) in WRMA has a set of original training programmes. Conforming to customary practices as governmental organization, all WRMA staffs are obligated to participate in trainings more than 5 day in a year. It is intended to improve their performance along with changing organizational roles. Participation of trainings for each staff member is set in the training committee that is organized by CEO of WRMA. The outcomes of trainings would be attributed to promotion and pay rise.

The WRMA training plan 2012 includes 40 courses and 7 degree programmes. Total number of participants is more than 3,600 and total budget Ksh.160, 000,000.

Rating form of trainees and implemented training courses is already prepared. Most of courses do not cover directory related to water resources management, but general management capacity and roles of civil officers. Only limited flood management and community-based disaster prevention related courses are as follows:

- Training in water resources data technical and information systems;
- Training on social mobilization / community participation methodologies;
- Building capacity on WRUAs and CAACs;
- Train 50 staffs on IWRM, EIA, Project Planning and Management; and
- GIS training for 40 staffs.

Although WRMA training programme is extensive and large scale, WRMA-HRD indicated that courses were not fully implemented.

Meanwhile, WRMA is instructing WRUAs at regional and sub-regional offices. Contents of the WRUA training is entrusted to each WRMA staff in charge. Activities and instruction to WRUAs are implemented based on the WDC Manual, although no WRMA training courses are based on the WDC Manual.

The training plan proposed by the Project Team contains new contents compared to the existing WRMA training programmes. Another framework was also necessary to achieve the Project purpose (Indicator-2), that is "WRMA's training system function covering the Project target areas is established". The purpose of the 1st stage training is to train central figure of WRMA's capacity development on flood management as mentioned. The 2nd stage training will be instructed by lecturers trained in the 1st stage training for keeping the training courses to be sustainable.

(6) Whole Picture of Required Contents of Training for WRMA

The result of capacity and needs assessment was rearranged into a syllabus of "WRUA Level Training (WDC)" at the 3rd stage and syllabuses of WRMA Level Training (stage-1 and

stage-2)" at the 1st stage and the 2nd stage ", respectively. In addition, "WRUA Level Training (future)" is described separately.

(7) Contents of Training in Project

As mentioned in the last subsection (6), detailed contents of the 1st stage, the 2nd stage and the 3rd stage are shown in "WRMA Level Training (stage-1 & stage-2)"and "WRUA Level Training (stage-3, WDC)". Implementation plan of those training courses are to be mentioned in next chapter.

(8) Contents of Training in Japan

Training in Japan is one of the elements to ensure the Project outcomes. The contents consist of Japanese examples for flood management, which might be new to Kenya. Lecture and field study covering disaster-related organization and facilities of flood and water resources management in a river basin were proposed.

Table 4.3-2 Contents and purposes of training in Japan

Item	Content	Purpose
1	Examples of Flood Control Activities	It is aimed to understand the importance of an entire river basin management in flood management and water resources management. The Biwa lake and the Yodo River basin are featured in lecture. Field study from upstream to downstream is expected to deepen trainees' understanding.
2	Examples of Emergency Response against Flood Disaster	It is aimed to understand how main actors (river administrators, local governments, communities and individuals) cooperate and produce an effect in case of emergency.
3	Use of Flood Hazard Map	It is aimed to understand how communities use and decrease impacts of flood hazard maps.
4	Examples of Flood Prevention Activities	It is aimed to understand community-based flood prevention activities.
5	Examples of Education on Disaster Management	It is aimed to understand how education system on disaster management is implemented in schools.
6	Examples of Traditional Construction Method	It is intended to visit traditional construction sites and aimed to understand simple structural countermeasures and resistant lifestyle to floods.

(9) Future Issues on WRMA Training

Some items beneficial to capacity development for WRMA staff cannot be included in the training plan, because these items are beyond the training courses within range of the Project. These items should be taken as the future issues to be implemented in the middle and the long term WRMA trainings.

4.3.3 Overall Plan of Implementation Process

1st stage training was planned for October 2013. Then the Project Team would evaluate with WRMA the results of the 1st stage training. At the same time, coordination of the 2nd stage training would be discussed between the team and WRMA including the 2nd stage lecturers. The 2nd stage was planned to start in December 2013. The target WRMA staff to be trained in the 2nd stage would be divided into 2 groups (15 persons each). Outcome of the training would be monitored and evaluated and the results feedback into contents and the manual of the training.

Afterward, the 3rd stage trainings would start as soon as the 2nd stage training is finished. It was planned to be started in May 2014.

Training in Japan was to be conducted in November 2013.

Overall training schedule is shown as below.

Table 4.3-3 Overall Training Schedule

	2013				2014				
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1st stage									
Evaluation/ Coordination									
2nd stage									
3rd stage									
Training in Japan									

4.4 Preparation of Training Manual and Materials

4.4.1 Training Manual

Training manual is to be prepared to support training activities to be executed by WRMA, in particular, the 2nd stage training. It would help WRMA to prepare for a training step by step, and ensure the outcome be achieved as envisaged.

Preparation of the manual was started as part of the preparation for the 1st stage training. Specifically, a check sheet for preparation of the 1st stage was drafted by the Project Team, which would provide a structure of various matters to be covered in the manual. Output and evaluations from participants' perspective were later reflected in the manual.

In addition, the status of 2nd stage training was monitored. The results were reflected in the training programs that followed.

4.4.2 Text Book for Training

Training materials were prepared as a draft by the lecturers of the 1st stage training. The materials were collected and compiled as "WRMA flood management technical training text (draft)" according to the syllabus, which follows the basic structure of the flood management module of WDC manual.

Table of Contents

Fig. 4.4-1 Flood Management Training Textbook

In the 2nd stage training, "WRMA flood management technical training text (draft)" was utilized but the lecturers in the 2nd stage were given freedom to add to, or change, the materials in the original text, as he/she considered appropriate or desirable. In addition, a reference book, a compilation of materials that respond to more advanced need study was prepared separately.

Textbook for the 3rd stage was the flood management module of WDC manual. "WRMA flood management technical training text (draft)" would be utilized as reference materials for lecturers.

4.4.3 WDC Manual Flood Management Module

WDC Manual Flood Management Module (a module in WRUA Development Cycle, "Building Effective Flood Management in Flood Prone Areas") was the text used in the 3rd stage training. At the time of this report, the version 3.2 is the latest version. The module has been revised several times, including after the results of the first stage training.

Table of Contents of the module ver3.2 is as follows.

MODULE 1: FLOOD DISASTER AND FLOOD MANAGEMENT

MODULE 2: INTEGRATED RIVER BASIN FLOOD MANAGEMENT

MODULE 3: RAINFALL AND FLOOD OBSERVATION

MODULE 4: COMMUNITY-BASED FLOOD HAZARD MAP

MODULE 5: FLOOD EARLY WARNING

MODULE 6: FLOOD DISASTER EVACUATION PROGRAMME

MODULE 7: COMMUNICATION, PUBLIC AWARENESS RAISING AND DISASTER EDUCATION

MODULE 8: PLANNING, DESIGN, CONSTRUCTION, OPERATION, AND

MAINTENANCE OF FLOOD MITIGATION FACILITIES

MODULE 9: CO-OPERATION BETWEEN UPSTREAM AND

DOWNSTREAM STAKEHOLDERS AND CO-ORDINATION

In the course of carrying on with the 2nd and 3rd stage training, WRMA took the lead in reviewing and revising.

Vol.	Title	Content	Reference	Details
1	**WDC FRAMEWORK**	Introduction to WDC Policy and Legislative Framework Overview of WDC Approach WRUAs		
			Appendix	
2	**WDC OPERATIONAL GUIDELINES**	Eligible areas and activities	A1	WSTF – WRMA Memorandum of Agreement
		WDC Funding Process		
		WDC Financial Guidelines		
			A2	WRMA-Other Development Partners Memorandum of Agreement
			A3	WRMA-WRUA Memorandum of Understanding
			B	Categorization of sub-catchments according to status
			C	WDC Standard Rates for WRUA
			D1	WDC Request for Funds (RFF)
			D2	WDC Fund Request Forwarding Form WRMA-WSTF
			E	Sub-Catchment Management Plan (outline)
			F	WDC Desk Appraisal
			G	WDC Field Appraisal
			H	WDC Activity Contract
			I	WDC Progress Report (outline)
			J	WRUA – SO contract (sample)
			K	Criteria for WRUA Registration with WRMA
			L	Implementation Plan (Excel Format)
			M	WDC Projects Monitoring Tool (Annexes A-E)
			N	Activity Monitoring Reporting Template
			Module	
3	**WDC TOOLKIT**	Instructions to WDC Toolkit		
			1	Water Sector Reforms
			2	WDC Overview
			3	Catchment Characteristics
			4	SCMP Development
			5	Water Balance & Water Demand Management
			6	Water Allocation and Use
			7	Water Resource Protection
			8	Catchment and Riparian Conservation
			9	Flood Management
			10	Climate Change
			11	Infrastructure Development
			12	Alternative Livelihood
			13	Rights Based Approach and Poverty Eradication
			14	Institutional Development
			15	Monitoring and Information
			16	Financial Management
			17	Training Module Vol 2 Operational Guidelines
			6	Water Allocation and Use
			7	Water Resource Protection
			8	Catchment and Riparian Conservation

Fig. 4.4-2 WRUA Development Cycle (WDC) Version Two (April 2014)

4.5 Execution of 1st Stage Training: To Raise Trainers for Flood Management Training in WRMA

4.5.1 Program

The first stage training was carried out for two weeks from 14 to 25 October, 2013. The program of the training is shown below.

The trainers of the first stage training consisted of a few members from the Project Team, JICA experts and external members from universities/institutions of Kenya. The main topics covered in the training were the following themes, based on the WDC flood management module.

Table 4.5-1 Training program of 1st stage

11 October 2013

Time		14-Oct (Mon)	15-Oct (Tue)	16-Oct (Wed)	17-Oct (Thu)	18-Oct (Fri)
9:00	Venue	KeWI in Nairobi	KeWI in Nairobi	KeWI in Nairobi	KeWI in Nairobi	KeWI in Nairobi
9:30	Registration					
	First Time	- Opening Address - Guidance - Initial Questionnaire on Flood Management	3-1 Integrated River Basin Flood Management (IRBFM)	2-1A Rainfall Observation 2-1B Rainfall Data and Statistical Processing	4-1 Flood Early Warning System	★ Open Lecture-Special Session: Discussion on Community-based Flood Disaster Management
11:00	15min Break					
11:15	Second Time	1-1 Cause and Effect of Floods	3-2 Community-managed Flood Disaster Risk Reduction (DRR)	2-2 Flood Discharge Observation	4-2 Community-based Flood Early Warning	★ Open Lecture-1): JICA Flood Management Project in Kenya
12:45	Lunch Break					
14:00	Third Time	1-2 Understanding Flood Management	3-3 Vulnerability Assessment	6-1 Capacity for Transmitting and Communication Skills 6-2 Communication on Desired Information to Schools	4-3 Introduction to Integraed Flood Analysis System (IFAS) and Global Flood Alert System (GFAS)	★ Open Lecture-2): Current Situation of Institutional Framework for Flood Management in Kenya
15:30	15min Break					
15:45	Fourth Time	1-3 Flood Disaster Management	3-4 Developing Community-based Flood Hazard Maps	6-3 Effective Public Awareness Raising on Floods	5-1 Evacuation Planning	★ Open Lecture-3): Current Situation of Flood Management in Kenya
16:45						
17:00	Wrap-up Time					

Time		21-Oct (Mon)	22-Oct (Tue)	23-Oct (Wed)	24-Oct (Thu)	25-Oct (Fri)
9:00	Venue	Nyando (Kisumu)	Nyando (Kisumu)	Kisumu	Kisumu	Kisumu
9:30	Registration					
	First Time	★ Field Exercise in Nyando (Day-1A) 6-4 Developing Community-based Flood Hazard Maps	★ Field Exercise in Nyando (Day-2A) 2-1 Rainfall Observation, 2-3 Discharge Observation	7-1 Planning and Design of Flood Damage Mitigation Measures	8-1 Co-operation and Co-ordination between Upstream and Downstream WRUAs in a River Basin	- Final Questionnaire on Flood Management
11:00	15min Break					
11:15	Second Time		Lunch Break	7-2 Flood Damage Mitigation for Non-Structural Measures including Community-based Measures	8-2 Role of Co-operation and Co-ordination	- Reporting and Questionnaire Survey
12:45	Lunch Break		★ Field Exercise in Nyando (Day-2B)			
14:00	Third Time	Lunch Break	7-1 Planning and Design of Flood Damage Mitigation Measures, 7-2 Flood Damage Mitigation for Non-Structural Measures including Community-based Measures, 7-3 Flood Damage Mitigation Structural Measures including Community-based Measures	7-3 Flood Damage Mitigation Structural Measures including Community-based Measures	8-3 Co-operation with County Government, WRUA and DDMC	- Discussion - Closing Remarks
15:30		★ Field Exercise in Nyando (Day-1B)				
15:45	15min Break					
	Fourth Time	- Work on Paper - Presentation from three Groups - Discussion		5-2 Evacuation Centre Management	8-4 Role of District Disaster Management Committee (DDMC)	
16:45						
17:00	Wrap-up Time					

Lectures were a mixture of explanations by lecturers with occasional group discussions and practices led by the lecturer. In particular on the final day, a discussion was held about WRMA's position in flood management, which seemed to have helped the understanding of WRMA staff on the WRMA's roles and responsibilities in flood management, and also stimulated the motivation of the participants.

Opening Address

Trainee received the training

Exercise of making Problem Tree

Presentation from each group

Presentation from JICA expert

Measuring water level and rain fall

Record picture

Photo 4.5-1 Scenes from 1st stage training

4.5.2 Outcome

The Project Team evaluated the first stage training and discussed with and helped the prospective lecturers of WRMA for the 2nd stage training. The degree of understanding of the

participants was evaluated by having them take pre- and post- training examinations. Also, they answered to questionnaire as the participant evaluation of the first stage training program.

(1) Examination

The purpose of the first stage training program was to raise the trainers in WRMA for the second stage training. Therefore, in the evaluation of participants, not only his/her understanding of the training contents but also his/her ability to explain the knowledge logically and clearly to others and positive attitude to lead the group of people are considered important. The examinations were done in essay type test, and the results were evaluated for three axes of "expression and logic", "understanding of topics covered" and "quality of answers", with eight evaluation criteria including clarity of explanation and logic, attitude in the training sessions, degree of understanding, etc.

The figure below shows the histogram of scores of seventeen participants.

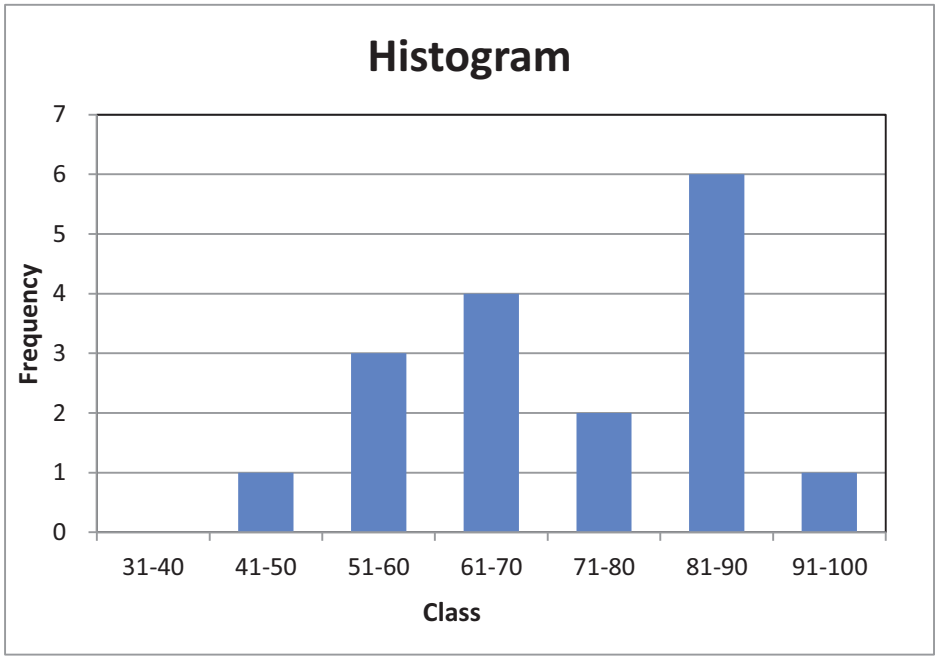


Fig. 4.5-1 Examination Scores of Participants

Considering the scores, the Project Team made a list of prospective lecturers for the second stage training, and proposed to WRMA.

(2) Selection of Trainers

The lecturers in the second stage were selected among the participants in the first stage training. However, the Project Team expect those who were not chosen as lecturers should review the contents of the training well and prepare him/herself to be a technical leader of WRMA.

The Project Team prepared a list of candidate trainers in the second stage training, by means of assessment on the reactions in the lectures and activeness in the exercises, with consideration on the job experiences in particular areas of specialties. Further, the Project Team evaluated each participant by the scores of examinations. Based upon these considerations, the Project Team proposed “recommended trainer candidates” to WRMA on November 27, 2013.

After the completion of 1st stage training, WRMA and the Project Team held a series of

discussion to prepare for the second stage. WRMA prepared budget, and chose the participants, 30 persons in total of two rounds of the training (16 plus 14). WRMA decided to conduct the first round of the 2nd stage training in December 2013, which was then informed to ten trainers and sixteen participants.

(3) Award Ceremony

On December 3, 2013, those participants who received A-rank evaluation in the first stage training were presented with a prize.

Photo 4.5-2 Prize Giving for High Scorer

4.5.3 Evaluation of 1st Stage Training

After the 1st stage training, a questionnaire survey was conducted and the participants gave their opinions about the training. The followings are the main points raised by the participants.

Q1: How do you evaluate the training?

- It was successful. I learned a lot (11 participants).
- It was eye-opening.
- Training is important to WRMA staff.

All participants gave positive remarks to the training.

Q2: Which module had a good effect on you? (multiple answer)

The result of Q2 is shown in the table below: "3-4 Developing Community-based Flood Hazard Maps" and "3-1 Integrated River Basin Flood Management (IRBFM)" received highest scores but in general the choices were diversified, which suggests that the interest of participants were also diversified. Meanwhile, those modules that were not chosen by any participants may require scrutiny.

Table 4.5-2 Modules that had a good effect on participants

Module	Number of participants
1-1 Cause and Effect of Floods	3
1-2 Understanding Flood Management	1
1-3 Flood Disaster Management	2
2-1A Rainfall Observation	4
2-1B Rainfall Data and Statistical Processing	1
2-2 Flood Discharge Observation	4

3-1 Integrated River Basin Flood Management (IRBFM)	5
3-2 Community-managed Flood Disaster Risk Reduction (DRR)	1
3-3 Vulnerability Assessment	
3-4 Developing Community-based Flood Hazard Maps	6
4-1 Flood Early Warning System	2
4-2 Community-based Flood Early Warning	4
4-3 Introduction to Integrated Flood Analysis System (IFAS) and Global Flood Alert System (GFAS)	4
5-1 Evacuation Planning	1
5-2 Evacuation Centre Management	1
6-1 Capacity for Transmitting and Communication Skills	1
6-2 Communication on Desired Information to Schools	
6-3 Effective Public Awareness Raising on Floods	
7-1 Planning and Design of Flood Damage Mitigation Measures	1
7-2 Flood Damage Mitigation for Non-Structural Measures including Community-based Measures	4
7-3 Flood Damage Mitigation Structural Measures including Community-based Measures	4
8-1 Co-operation and Co-ordination between Upstream and Downstream WRUAs in a River Basin	4
8-2 Roles of Co-operation and Co-ordination	3
8-3 Co-operation with County Government, WRUA and DDMC	1
8-4 Roles of District Disaster Management Committee (DDMC)	
Open Lecture: Current situation of institutional framework for flood management in Kenya	1

Q3: Modules that require improvement or modules which should be added

The remarks effective as evaluation of the program include,

Overall program

- Some modules are too interrelated.

Duration of training

- More time should be allocated for discussion among participants

Field exercises

- Rainfall and rive flow measurement can be improved by inclusion of such activities as data downloading, calculation of results and making presentation.

Flood Hazard Map

- Mapping exercises can include a conversion to data plotting on satellite images and/or topographic maps

Each module

- If participants carry their regional meteorological records to the lecture, the lecture can be developed to IFAS training,
- Community-based flood early warning system should be demonstrated with the actual instruments,
- Safety measures for staff and evacuees during flood event should be added.

Q4: What do you expect from the second stage training?

Participants

- Water Quality and Pollution Control Officer should also participate.

Lecturers

- Techniques and countermeasures he/she learned should be customized for regional conditions.

Field exercises

- More hand-on training is expected,
- WRUA members should be involved in community-based flood hazard map exercises,
- Clearer methodology should be presented in hazard map making

Overall program

- The topics and contents of the first stage training should be replicated in the second stage training,
- Allocation of responsibilities among related parties should be understood by the participants,
- WRMA's roles in flood management should be clearly presented.

4.6 Execution of 2nd Stage Training by WRMA

4.6.1 Program

(1) First Round

The 1st round of the second stage training was carried out for one week from 9 to 13 December, 2013. The program of the training is shown in the table below.

Table 4.6-1 Training program of 2nd stage (First Round)

9 December 2013

Time		DEC 9 (DEC 16) (Mon)	DEC 10 (DEC 17) (Tue)	DEC 11(DEC 18) (Wed)	DEC 12 (DEC 19) (Thu)	DEC 13 (DEC 20) (Fri)
8:00	Venue	Sunset Hotel in Kisumu	Sunset Hotel in Kisumu	Sunset Hotel in Kisumu	Sunset Hotel in Kisumu	Sunset Hotel in Kisumu
8:15		**Registration**				
9:15	Session 1	8.30 Opening Address 8.45 Guidance by Eng. Kimanga	3-3 Vulnerability Assessment by Mr. Mwangi	4-2 Community-based Flood Early Warning by Mr. Joseph Maina	Field Exercise in Nyando by Ngessa 3-4 Developing Community-based Flood Hazard Maps by Joseph Boit	8-1 Co-operation and Co-ordination between Upstream and Downstream WRUAs in a River Basin by Elizabeth Diego
9:30		**15min Break**				
10:30	Session 2	Initial Questionnaire on Flood Management by Eng. Kimanga	3-4 Developing Community-based Flood Hazard Maps by Mr.Joseph Boit	4-3 Introduction to Integraed Flood Analysis System (IFAS) and Global Flood Alert System (GFAS) by Mr. Simon Mwangi	same as above	8-2 Role of Co-operation and Co-ordination by Eng. Matagaro
10:45		**Tea Break**				
11:45	Session 3	1-1 Cause and Effect of Floods by Eng. Kimanga	2-1A Rainfall Observation by Mr. Lawrence Thooko 2-1B Rainfall Data and Statistical Processing by Mr. Lawrence Thooko	5-1 Evacuation Planning by Mr. Maina	same as above	8-3 Co-operation with County Government, WRUA and DDMC by Willis Memo 8-4 Role of District Disaster Management Committee (DDMC) by
12:00		**15min Break**				
13:00	Session 4	1-2 Understanding Flood Management by Mr. Nzyuko	2-2 Flood Discharge Observation by Mr. Ruben Ngessa	7-1 Planning and Design of Flood Damage Mitigation Measures by Eng. Matagaro	same as above	- Final Questionnaire on Flood Management by Eng. Kimanga
		Lunch Break				
14:00	Session 5	1-3 Flood Disaster Management by Eng. Kimanga	6-1 Capacity for Transmitting and Communication Skills by Mr. Willis Memo 6-2 Communication on Desired Information to Schools by Willis Memo	7-2 Flood Damage Mitigation for Non-Structural Measures including Community-based Measures by Mr. Simon Mwangi	same as above	- Discussion - Closing Remarks
15:00		**15 min Break**				
15:15	Session 6	3-1 Integrated River Basin Flood Management (IRBFM) by Eng. Kimanga	6-3 Effective Public Awareness Raising on Floods by Ms. Elizabeth Diego	7-3 Flood Damage Mitigation Structural Measures including Community-based Measures by Eng. Kimanga	same as above	Handover of Certification
16:15		**Tea Break**				
16:30	Session 7	3-2 Community-managed Flood Disaster Risk Reduction (DRR) by Mr. Joseph Boit	4-1 Flood Early Warning System by Mr. Simon Mwangi	5-2 Evacuation Centre Management by Mr. Willis Memo	same as above	

Trainers are 10 people who were selected by the process described above. Participants were 16 people selected from Flood Management Officers, Surface Water Officers and Community Development Officers of SROs.

(2) Second Round

The 2nd round of the second stage training was carried out for one week from 17 to 21 February 2014. The program of the training was mostly the same as in the 1st round, and is shown below.

Table 4.6-2 Training program of 2nd stage (Second Round)

Time		17-Feb (Mon)	18-Feb (Tue)	19-Feb (Wed)	20-Feb (Thu)	21-Feb (Fri)
8:00	Venue	Sunset Hotel in Kisumu	Sunset Hotel in Kisumu	Sunset Hotel in Kisumu	Sunset Hotel in Kisumu	Sunset Hotel in Kisumu
8:15	Registration					
9:15	Session 1	8.30 Opening Address 8.45 Guidance by Eng. Kimanga	3-3 Vulnerability Assessment by Mr. Mwangi	4-2 Community-based Flood Early Warning by Mr. Joseph Maina	Field Exercise in Nyando by Ngessa 3-4 Developing Community-based Flood Hazard Maps by Joseph Boit	8-1 Co-operation and Co-ordination between Upstream and Downstream WRUAs in a River Basin by Elizabeth Diego
9:30	15min Break					
10:30	Session 2	Initial Questionnaire on Flood Management by Eng. Kimanga	3-4 Developing Community-based Flood Hazard Maps by Mr.Joseph Boit	4-3 Introduction to Integraed Flood Analysis System (IFAS) and Global Flood Alert System (GFAS) by Mr. Simon Mwangi	same as above	8-2 Role of Co-operation and Co-ordination by Eng. Matagaro
10:45	Tea Breack					
11:45	Session 3	1-1 Cause and Effect of Floods by Eng. Kimanga	2-1A Rainfall Observation by Mr. Lawrence Thooko 2-1B Rainfall Data and Statistical Processing by Mr. Lawrence Thooko	5-1 Evacuation Planning by Mr. Maina	same as above	8-3 Co-operation with County Government, WRUA and DDMC by Willis Memo 8-4 Role of District Disaster Management Committee (DDMC) by Willis Memo
12:00	15min Break					
13:00	Session 4	1-2 Understanding Flood Management by Mr. Nzyuko	2-2 Flood Discharge Observation by Mr. Ruben Ngessa	7-1 Planning and Design of Flood Damage Mitigation Measures by Eng. Matagaro	same as above	- Final Questionnaire on Flood Management by Eng. Kimanga
	Lunch Break					
14:00	Session 5	1-3 Flood Disaster Management by Eng. Kimanga	6-1 Capacity for Transmitting and Communication Skills by Mr. Willis Memo 6-2 Communication on Desired Information to Schools by Willis Memo	7-2 Flood Damage Mitigation for Non-Structural Measures including Community-based Measures by Mr. Simon Mwangi	same as above	- Discussion - Closing Remarks
15:00	15 min Break					
15:15	Session 6	3-1 Integrated River Basin Flood Management (IRBFM) by Eng. Kimanga	6-3 Effective Public Awareness Raising on Floods by Ms. Elizabeth Diego	7-3 Flood Damage Mitigation Structural Measures including Community-based Measures by Eng. Kimanga	same as above	Handover of Certification
16:15	Tea Break					
16:30	Session 7	3-2 Community-managed Flood Disaster Risk Reduction (DRR) by Mr. Joseph Boit	4-1 Flood Early Warning System by Mr. Simon Mwangi	5-2 Evacuation Centre Management by Mr. Willis Memo	same as above	
17:30						

Lecturers were the same ten WRMA trainers as in the 1st round. Participants were selected among SWOs, CMOs, CDOs of six regional offices and fifteen sub-regional offices where there have been flood occurrences.

4.6.2 Outcome of 2nd Stage Training

The most important outcome of the 2nd stage training (the 1st round) was that the lecturers trained in the 1st stage successfully played their roles. As the announcement of the start of the 2nd stage was made just before the commencement, the preparedness of lecturers were seen a little poor. However, from the second day and onward, this was improved and the lecturers made adjustments to their own presentation materials. Further, the questions from the participants were answered not only by the lecturer asked, but also by other lecturers. This kind of active and spontaneous reactions gave the Project Team an impression that the training system in WRMA could develop on its own in the future.

As for the provision of budget and selection of participants, WRMA-FMD staff played a

central role. Meanwhile, practical matters such as securing the venue, making copies of handouts, and reserving the transportation and meals, etc. were arranged by HRD of WRMA. The Project Team judged a little more contribution is desirable from HRD for WRMA's own training programs to continue sustainably.

The second training also provided a chance to furnish flood management related knowledge to newly appointed Flood Management Officers of WRMA. This fact should be valued as a contribution of the Project to human resource development in WRMA, as well.

4.6.3 Evaluation of 2nd Stage Training

On the last day of the first round of the second stage training, there was a discussion held between the group of WRMA lecturers and the Project Team on such topics as the evaluation of the training and possible improvement, etc. The summary of discussion is shown below;

About Lecturers

- The lecturers did very good jobs in that they absorbed the contents of the 1st stage training and led the second stage with their own words.

About Contents of Training

- Participants commented that there should be more practical contents to the training,
- TOR of Flood Management Officers should be made clear,
- Practical matters on the field should be included in the program more.
- Training must be one that responds to WRUA's needs,
- More detailed case studies are desirable,
- It is important to highlight professional part of FMO,
- More practices in the field were desirable.

About Participants

- It is important that the training affects the attitude of the participants, and that it gives confidence to the participants.

About the Period of Training

- It is also important to teach basic theories of flood. One week is too short for that.

For some of the comments given such as, "TOR of Flood Management Officers should be made clear", and "Practical matters on the field should be included in the program more", the Project Team considers that preparation of flood hazard maps and introduction of FEWS can be good candidate tasks to be given to FMOs. In particular, as the installation of FEWS equipment carried out in the Project attracted attention of many people, it may be a good idea to hold another "Rain Gauge Assembling Work Shop" and invite some of newly appointed FMO to the workshop.

4.7 Feedback of 1st and 2nd Stage Training Evaluation

The summary of evaluation of 1st and 2nd stage training that are considered important are shown below.

(1) Trainers

- In the second round of 2nd stage training, lecturers seemed to be more used to lecturing. Some of them had edited the presentation with his/her own materials, which was very good sign of being able to handle the topic.
- To be a good teacher requires some experiences. Trainers should continue the practice.

(2) Contents of Training

- Training contents prepared cover necessary and sufficient topics for giving flood management training to WRMA staff.
- Presentation materials should be added with elements of Kenyan cases gradually.
- It should be considered to include fabrication and installation of community-based flood early warning systems.
- For the training of WRUA people, those topics and materials too technical for them should be avoided.

(3) Participants

- Sub-regional office managers of the Pilot areas should have participated in the training. They have been a focal point of flood management activities of the Project.

(4) Duration of Training

- One week program was too short for the 2nd stage training. However, longer training period would make difficult for both trainers and participants.
- The 2nd stage training may be improved if a little more time is allocated for field exercise activities.

(5) Overall Comments

- WRMA should be aware that there are new appointments every year of its staff to regional and sub-regional offices where there are flood events. The 2nd stage training should be executed periodically, once a year.

4.8 Contribution to Relevant Organization as Part of Training Activities (3rd Stage Training)

4.8.1 Formulation of Execution Plan for 3rd Stage Training

In the 3rd stage training, WRMA staff who received flood management training in the 2nd stage training gives guidance to WRUA people who are the main actors of community-based flood management activities. Training contents are based on WDC manual flood management modules that have been prepared by WRMA with assistance from the Project.

Training program was developed with an objective to enhance the capacity on community disaster management of leading members of WRUAs, through lectures and exercises on flood management.

(1) Organization

The 3rd stage training actually held in the Project was a first trial for WRMA to give WRUA the flood management training. Therefore, for WRMA to take initiative was considered most important in the process. WRMA would have to have a specific plan to have training to many WRMAs who experience flood and therefore are in need of flood management training. The

Project Team gave assistance to WRMA to prepare the execution plan for the 3rd stage training. Also, within the period of the Project, the Project Team attended the training sessions to monitor, gave advices in identifying problems and improving, which was reflected in the training manual.

1) Lecturers

As mentioned above, this 3rd stage training was the first trial for WRMA to give guidance on flood management to WRUA. WRUA selected to receive training was Lower Gucha Migori WRUA, within a jurisdiction of Kisii Sub-Regional Office. In Kisii SRO, there were only two people who have received either 1st or 2nd stage training, namely, one FMO and one WRO. It was obvious that these two people were not enough to form a group of lecturers for the 3rd stage training. It would have been ideal if each sub-regional office had staff necessary to train WRUAs in its jurisdiction. But it would take many years before there would be sufficient number of WRMA staff at each sub-regional office who had been trained to guide WRUAs in flood management.

Therefore, the Project Team and WRMA discussed and decided to form a group of trainers with trained WRMA staff of LVSCA Regional Office and its subsidiary sub-regional offices. There were nine of such staff found, as shown below.

Table 4.8-1 WRMA staff who received 1st or 2nd stage training in LVSCA jurisdiction

	Office name	position	Received training
1	LVSCA Regional Office	ATCM	2nd stage(1st round) *
2	Ditto	Senior SWO	1st stage *
3	Ditto	CDO	1st stage *
4	Kisumu Sub-Regional Office	FMO	2nd stage(1st round) *
5	Ditto	CMO	2nd stage(2ndround)
6	Kisii Sub-Regional Office	FMO	1st stage *
7	Ditto	WRO	2nd stage(2nd round)
8	Kericho Sub-Regional Office	SWO	2nd stage(1st round)
9	Ditto	CMO	2nd stage(2ndround)

Among these nine people, five people (with "*" mark in the table above) were selected to be the trainers for the 3rd stage training to Lower Gucha Migori WRUA

(2) Formulating training plan and time table

The 3rd stage training plan was made on the basis of durations specified in WDC flood management modules. Meanwhile, WRMA has its experiences of WRUA trainings for community development, mostly targeted at formulating SCMPs, where three week program is a standard. After the discussion and trial scheduling, one week program was developed, consisting of lectures for three days, field exercise of flood mapping, flood early warning and evacuation for two days, discussion and exercise on flood management plan for one day, and evaluation drill involving local communities for one day. The resulting time table is shown in the tables below.

Table 4.8-2 3rd stage training time table

DAY 1: MONDAY 19TH MAY		
DAY 1	**ACTIVITY**	**FACILITATOR**

MONDAY		
08.00-08.15	Registration	
08.15-09.15	Opening address and guidance	HQ
15min break		
09.30-10.30	Introductions and explanation of WDC module Review	Ms. Lencer
10:30-10:45 Tea Break		
10.45-11.45	Cause and effect of floods	Ms. Lencer
11.45-12.00	Energizer Break	
12.00-13.00	Understanding Flood Management	Mr. Njihia
13.00 -14.00	Lunch Break	
14.00-15.00	Flood Disaster Management	Mr. Gesengi
15.00-15.15 Health break		
15.15-16.15	2-1A Rainfall Observation 2-1B Rainfall Data and Statistical Processing	Mr. Ngessa
16.15-16.30 Break		
16.30-17.30	2-2 Flood Discharge Observation	Mr. Ngessa
17.30-17.45 Break		
17.45-18.45	3-1 Integrated River Basin Flood Management (IRBFM)	Eng. Dienya
DAY 2: TUESDAY 20TH MAY 2014		
DAY 2 TUESDAY	**ACTIVITY**	**FACILITATOR**
08.00-08.15	Registration	
08.15-09.15	3-2 Community-managed Flood Disaster Risk Reduction (DRR)	Ms. Lencer
15min break		
09.30-10.30	3-3 Vulnerability Assessment Management	Ms. Lencer
Health Break		
10.45-11.45	3-4 Developing Community-based Flood Hazard Maps	Mr. Gesengi
Break		
12.00-1300	4-1 Flood Early Warning System	Eng. Dienya
1300 -1400 Lunch Break		
1400-1500	4-2 Community-based Flood Early Warning	Eng. Dienya
1500- 15.15 Health break		
1515-1615	4-3 Introduction to Integrated Flood Analysis System (IFAS) and Global Flood Alert System (GFAS)	Mr. Ngessa
Tea Break 1615-1630		
1630-1730	5-1 Evacuation Planning	Mr. Njihia
1730-1745 break		
1745-1845	5-2 Evacuation Centre Management (IRBFM)	Mr. Njihia
DAY3 WEDNESDAY 21ST MAY 2014		
DAY 3 WEDNESDAY	**ACTIVITY**	**FACILITATOR**
08.00-08.15	Registration	
08.15-09.15	6-1 Capacity for Transmitting and Communication Skills 6-2 Communication on Desired Information to Schools	Ms. Lencer
15min Energizer break		
09.30-10.30	6-3 Effective Public Awareness Raising on Floods	Mr. Njihia
1030-1045 Tea Break		
10.45-11.45	7-1 Planning and Design of Flood Damage Mitigation Measures	Eng. Dienya
1145-1200 Energizer Break		
12.00-1300	7-2 Flood Damage Mitigation for Non-Structural Measures including Community-based Measures	Mr. Gesengi
Lunch Break 1300 -1400		

1400-1500	7-3 Flood Damage Mitigation Structural Measures including Community-based Measures	Eng. Dienya
Energizer break 1500- 15.15		
1515-1615	8-1 Co-operation and Co-ordination between Upstream and Downstream WRUAs in a River Basin	Mr. Gesengi
1615-1630 Tea Break		
1630-1730	8-2 Role of Co-operation and Co-ordination	Mr. Njihia
1745-1845	8-3 Co-operation with County Government, WRUA and DDMC 8-4 Role of District Disaster Management Committee (DDMC)	Mr. Ngessa
DAY 4 THURSDAY 22ND MAY 2014		
DAY 4 THURSDAY	**ACTIVITY**	**FACILITATOR**
08.00-08.15	Registration	
08.30-16:30	Travel to LOGUMI SC for Field exercise for Flood Hazard Mapping	ALL
16:30 Departure to Migori town		
DAY 5 FRIDAY 23RD MAY 2014		
DAY 5 FRIDAY	**ACTIVITY**	**FACILITATOR**
07.00-07:20	Registration	
07.20-14.20	Evacuation drill	ALL
14:30- Departure to Migori town		
DAY 6 SATURDAY 24TH 2014		
DAY 6 SATURDAY	**ACTIVITY**	**FACILITATOR**
08.00-08.15	Registration	
08.15-09.15	Guidance for discussion on Flood Management in Gucha Migori	Eng. Dienya and Mr. Njihia
15min break		
09.30-10.30	Group discussion: causes and effects per block	
Health Break		
10.45-11.45	Group discussion: Flood Damages per block	
Break		
12.00-1300	Group discussion: Current coping strategies	
1300 -1400 Lunch Break		
1400-1500	Group discussion: Possible countermeasures for damage per block	
1500- 15.15 Health break		
1515-1615	Preparation for presentation	
1615-1630 break		
1630-1730	presentation by group	
1730-1745 'plenary discussion		
End of day six activities		
DAY 7 SUNDAY 25TH MAY 2014		
DAY 7 SUNDAY	**ACTIVITY**	**FACILITATOR**
08.00-09.00	Registration Recap of the six days activities	Eng. Dienya
09.00-10.00	discussion for way forward	Mr. Njihia
Tea break		
10.30- 11:30	Questionnaire: Lesson Learnt experiences	Mr. Ngessa
Health Break		
11.30-12:30	Wrap up	
12:30 -13:30 Lunch Break		
13:30	Departure	

Table 4.8-3 Detailed schedule of Day 4 Flood Hazard Mapping

Place	Activity	Time	
		Start	end
Field Exercise in LOGUMI SC: Flood Hazard Mapping			
Migori	Depart to Wath Onger	08:30	10:30
Wath Onger	Visit FEWS installed at the R. Gucha Migori	10:30	10:40
WRUA Office	Explanation on how to draw flood hazard map	10:45	11:05
WRUA Office	Explanation and discussion on executing evacuation drill	11:05	11:35
Move to Nyakwere, Sere and Angugo for transect walk		11:35	12:30
Nyakwere	Drawing of Flood Hazard Map	12:30	13:30
WRUA Office	Lunch	13:30	14:30
WRUA Office	Presentation of the Flood Hazard Maps	14:30	15:30
WRUA Office	Discussions on continuous improvement of flood hazard maps on regular basis	15:30	16:00
Departures		16:00	

Table 4.8-4 Detailed schedule of Day 5 Evacuation Drill

Place	Activity	Time	
		start	end
Field Exercise in LOGUMI SC: Execution of Evacuation Drill			
Migori	Trainees and trainers assemble at the venue and leave for LOGUMI WRUA	07:20	07:30
	Travelling to Nyora Primary School in LOGUMI SC	07:30	09:00
Nyora	Participants assemble at Nyora Primary School	09:00	09:15
Nyora	Brief description of the schedule by LOGUMI Secretary	09:15	09:25
Nyora	Execution of the evacuation drill	09:30	11:30
Nyora	Wrap up meeting: Speeches from Provincial Administration, JICA and WRMA	11:30	12:30
WRUA Office	Lunch	12:50	13:50
WRUA Office	Discussion on the future plan for implementation of evacuation drills	13:50	14:20
Departures		14:20	-

(3) Time of 3rd stage training

WRUA members are mostly engaged in farming business. Therefore, as a rule, high season, October to November, March to May, should be avoided for the timing of WRUA training. However, as there was not much time remaining for the Project, late May was selected after the discussion with Lower Gucha Migori WRUA.

(4) Budget

Assuming the number of participant being 45 people, the budget requirements for WRUA (or WDC as a source) was estimated at Ksh 1.4million, and for WRMA Ksh 400thousand. The unit costs of the estimation were derived from WDC for the year 2014. The estimation and unit costs are shown in the tables below.

Table 4.8-5 Budget estimation for 3rd stage training

(Unit currency: Kenyan Schillings)

Item of expenditure	Unit price (Ksh)	Unit	Number	Duration (day)	Sub total	Cost Allocation
Lunches /Meals /Water	700	person	45	8	252,000	WDC
Acomodation	2,000	person	45	7	630,000	WDC
Transport	1,000	person	45	1	45,000	WDC
Hire of Transport	45,000	vehicle	4	2	360,000	WDC
Hall Hire	5,000	room	1	5	25,000	WDC
Stationary	10,000	L/S	1	1	10,000	WDC
Report Reproduction	15,000	L/S	1	1	15,000	WDC
Report Preparation	30000	L/S	1	1	30,000	WDC
Sub Total for WDC					**1,367,000**	
Perdiem for WRMA	5000	person	8	8	320,000	WRMA
Perdiem for driver	3500	person	2	8	56,000	WRMA
Fuel	100	km	100	1	10,000	WRMA
Fuel	100	km	150	1	15,000	WRMA
Sub Total for WRMA					**401,000**	
Total					**1,768,000**	

Source: Project Team

Table 4.8-6 WDC unit cost for 2014

	Kshs	Remarks
Lunches /Meals /Water	700	
Transport	1,000	
Hall Hire	5,000	
Accommodation	2,000	
Hire of Transport	45,000	Per day
Stationary	10,000	
Report Reproduction	15,000	
Report Preparation	30,000	
Workshop facilitator	20,000	
Local Contribution	15%	
Unskilled Labour	500	

Source: WRMA

(5) WRUA to participate in the 3rd stage training

It was Lower Gucha Migori (LOGUMI) WRUA that was selected to be participating in the 3rd stage training. WRUAs are in general at various developing stages. The table below summarizes the current status of WRUAs in the pilot sub-catchments of the Project.

Table 4.8-7 Current status of three WRUAs in the pilot sub-catchments.

	Lower Gucha Migori WRUA	Isiolo WRUA	Lower Lumi WRUA
SCMP formulation and revision status	First edition: May 2012 Approved by WRMA-HQ (5 years plan)	First Edition: March 2009 (3 years plan) No revision	First edition: Dec. 2009 (3 years plan) No revision
Description of flood issues in the SCMP	Yes.	No	Yes
WDC Level (*1)	Level 2	Level 3	Level 2
Application of WSTF	1st application: 13/01/2010: Apply 21/04/2010: Approve 21/10/2010: Complete 2nd application: 04/06/2012: Apply 06/11/2012: WRMA approved and forward it to WSTF.	Approved(4,994,600ksh) Disbursement will be three times. The first disbursement of 771,000 ksh was made and used for afforestation and finished.	Application was approved. Following Projects are being conducted; - Dredging of canal - Protection of water source spring from flood water
Status of Integrated Flood Management Plan	Under formulation and will be finalized on 10th April through 3rd IFMC	Drafted and will be finalized on 21st May 2014 through 3rd IFMC	Drafted and will be finalized on 7th April through 3rd IFMC
Other related information	GIZ is assisting SCMP formulation by WRUA. WRUA want to add their current flood management activities into the SCMP such as formulating CFMOs, FEWS, promoting raised toilet, etc.		

LOGUMI WRUA was a little ahead of other two WRUAs in terms of flood management. However, the current SCMP of the WRUA did not include those flood management activities as IFMC formation, developing CFMOs, executing flood management structures, etc. Giving training to the WRUA would help himself update his SCMP that proposes flood management activities to be funded by WSTF. Also, LOGUMI WRUA was scheduled to have IFMP finalized in the 4th IFMC meeting to be held soon. The training would greatly help the members of WRUA to understand IFMP of their own.

(6) Venue

For WRUA training, public facilities should be selected as the venue. In and around LOGUMI WRUA, there is a public facility called Migori Teacher's College, which was unfortunately unavailable for the period the training had been planned. Therefore, a private facility, a conference room of Calabash Hotel, was chosen to be the venue for the 3rd stage training.

4.8.2 Execution of 3rd Stage Training

The first trial of WRUA training on flood management, the 3rd stage training, was held for seven days, from May 19 to 25, 2014. Participants were selected from members of Management Committee and Flood Management Sub-Committee of LOGUMI WRUA, members of eleven Community-based Flood Management Organizations (CFMOs), and one representative from each of three WRUAs in mid- to up-stream Gucha Migori river basin.

There were participations from KRCS, who helped the training by providing demonstration of first aid in the evacuation drill, and also observing the exercise of flood hazard mapping.

(1) Day 1 to Day 3: lectures

Community Development Officer (CDO) of WRMA sub-regional office opened the training with explanation on updated WDC manual, that there were three additional contents in WDC , namely, flood management, climate change and livelihood improvement. He also explained that WRMA had a plan to give training on climate change and livelihood improvement, before the next update of SCMPs to be made. A series of lectures followed as scheduled in the

aforementioned table.


Photo 4.8-1 Scenes from Lectures in 3rd stage training

(2) Day 4: Flood Hazard Mapping exercise

Participants were grouped into two, and developed flood hazard maps of Sere village and Angugo village. Before the actual mapping, each group made reconnaissance of the subject area, drafted the map "on ground". Final maps include such information as evacuation routes, danger points, public facilities, evacuation facility, inundation depth and duration, etc.

(3) Day 5: Evacuation Drill

Evacuation drill was executed in and around Nyora Primary School, Kabuto, Migori County. There were external participation, approximately 300 people from nearby communities and 400 pupils, and total number reached 800.

1) Scenario

There was a scenario made to simulate a flood event:

a) An observer at Wath Onger point informs WRUA chair lady that the water level is rising,

b) WRUA forwards the information to Location Chief,

c) Location Chief forwards the information to District Commissioner and WRMA. Siren wails to warn people,

d) People hears the siren, start evacuation to Nyora Primary School,

e) Those people who gathered at the school register themselves.

2) Activities in sequence

08:30 WRUA and WRMA members leave Migori to gather at Nyora Primary School,
10:00 WRUA and WRMA members arrive at Nyora PS,
11:00 KRCS explains the scenario to facilitators,
11:30 Facilitators move to villages,
11:45 Siren wails, people start to evacuate,
11:55 People arrive at Nyora PS, register their names,
12:05 KRCS gives demonstration of First Aid,
12:35 Primary school pupils presents short play on flood evacuation,
12:45 Closing remarks from WRUA chair lady, school master, District Education Officer, Location chief, and WRMA.

	
Guidance by Flood Management Sub Committee of WRUA	Participants one go back home
	
Siren wails	Start evacuation
	
They carry household stuff	Arrive at Nyora Primary School

Photo 4.8-1 Evacuation Drill 1

Registration at evacuation place

Elderly are assisted

Help those who have fallen

Demonstration of First Aid

Evacuation place Nyora Primary School

Photo 4.8-2 Evacuation Drill 2

	
Short play by pupils	Closing remark by WRUA chair lady
	
Raised toilet completed	Teaching room and rain harvest tank

Photo 4.8-3 Evacuation Drill 3

(4) Day 6: Discussion on flood management plan

WRMA-ATCM facilitated the session, starting with a guide on structural measures including levee, flood walls, river bed excavation, flood proofing, channel digging, ground sill, spur dike, evacuation place, etc. WRMA-FRO followed to explain cooperation and coordination in flood management. He also presented what he learned in his participation in the training in Japan.

Group discussion took up such topics as cause and effect, damage and remedy of flood. The results of the discussion were presented by leaders of the groups.


WRUA chair lady opens the session


WRMA FMO gives lecture


Group discussion


Presentation of group discussion


Closing remark from WRUA secretary


Closing remark from CDTF

Photo 4.8-4 Scene from Day 6 Group discussion

(5) Day 7: Wrap up

There was a presentation from group discussion remaining from the day before, followed by questions and answers, and exchange of opinions and comments on the training program. Some of the comments given were;

- WRUA's flood management capacity should be improved before it revises SCMP,
- What was learnt in the training should be passed on to other community members,
- CAAC has three flood management related committees, to which WRUAs are advised to participate,
- Although there was no pilot project provided by the Project in Gucha Migori, the training

was satisfactory to members.


Presentation from Block 3 Group


Presentation from Block 2 Group


Exchange of opinions and comments


Wrapping up


Closing remark by WRUA chair lady


Presenting a gift of Flood Early Warning Kit from LOGUMI WRUA to upstream WRUA

Photo 4.8-5 Day 7 Wrapping Up

4.8.3 Evaluation of 3rd Stage Training

(1) Evaluation by WRMA members

Questionnaire survey was conducted after the 3rd stage training to lecturers and supporting members of WRMA. The result can be summarized as follows.

1) Contents of the training

- Training was good enough to enlighten WRUA members in integrated flood management,
- Training contents were all related to flood management and encompassing,
- Training contents were relevant to situations in flood affected Lower Gucha Migori,
- Training contents, however, should be revised to match community level, and to include Kenyan cases,
- Some topics may have been too technical for WRUA members,
- Modules may be improved by incorporating experiences of making integrated flood management plans, which would greatly enrich the knowledge of participants.

2) Participants

- Participants were willing to learn flood management in an intensive course, and were active and enjoying at the same time,
- There was a good relationship between participants and lecturers,
- Selection of participants were good, representing each generation, with appropriate gender balance,
- Participants were willing to exercise the knowledge they learned in the training,
- Participants were well representing flood affected communities,
- Participants received lectures well, and completed exercised successfully,
- Participants were enthusiastic and willing to take roles they would have to play in flood management.

3) Lecturers

- Lecturers did up to the expectations,
- Lecturers prepared themselves sufficiently.

4) Period of training

- Length of training was appropriate, long enough for WRUA members to work with WRMA to study the problems in the field,
- Training was too long. It should have been planned within week days,
- The period was not sufficient to cover revision to SCMP with flood management activities. 10 days may be necessary, while the weekend should be respected,
- The program was too intensive. Participants were not accustomed to such lessons,
- One session should be as long as 30 to 35 minutes.

(2) Evaluation by Participants

1) Contents

- Topics taken were appropriate.

2) Participants

- It was a good idea to include people from upstream WRUAs,

3) Lecturers

- They were helpful,

4) Time table

- Time table was too tight,
- Weekend should be respected.

5) Overall

- Kenyan society takes certificates seriously. Presenting certificate was desirable,
- Appropriate lodging allowance was desirable,
- Good environment was provided,

- Knowledge given should be passed on to other community members.

6) Some things missing

- First aid
- Review of SCMP
- Cooperation and coordination with County Government,
- Field study should be increased,
- More visual information, such as photos of flood, desirable,
- Tsunami disaster video should be played,
- Livelihood of WRUA and communities should be considered.

(3) Evaluation by the Project Team

1) Contents

- Some of the topics were too technical for community members,
- More Kenyan information should be included,
- Evacuation drill can be more effective once a good evacuation plan has been formulated and responsibilities allocated to parties and positions,

2) Participants

- Participants were eager to learn, well selected to represent diversity of community,
- Inviting members of mid- and up-stream three WRUA would be beneficial in future endeavor to install and manage early warning systems,

3) Lecturers

- Lecturers trained in the 1st stage training seemed to have advantage, possibly because of more experience in teaching or experience of participation to training in Japan,
- For capacity development of lectures trained in the 2nd stage training, the Project Team proposed the followings:
  (a) Lecturers to give actual lecture so that they will be able to have more experience of lecturer in order to develop their explanation capacity;
  (b) Lecturers to conduct actual work related to flood management such as flood survey in order to develop their working abilities on flood management;
  (c) WRMA to hold workshops for knowledge sharing among lecturers in order to share actual flood management activities in other areas within Kenya;

4) Duration and time table

(a) Duration of the training

- To aim at revising SCMP, training should be structured with such elements as lectures, field study, exercises, discussions, planning and finalization. 7 days would not long enough to cover all these activities in full.

(b) Sessions and allocations in the time table

- Flood hazard map making exercise for a flood prone area cannot be fully covered in one day. LOGUMI WRUA has prepared flood maps for a few areas, and in this 3rd stage training maps for two villages were added. There are other villages without flood maps remaining. Flood hazard map is very basic information on which flood management plan can be discussed. Therefore, it is more efficient as a flood management training to allocate enough time to complete a flood map within the training period, to field survey and mapping exercises in particular.
- There should not be activities planned on weekends. It is inefficient.
- All of lectures, field exercises and discussion of flood management done in one training program may be too much to take for a participant,
- When the final target is to formulate a flood management plan, WRMA also needs time to evaluate the ideas of communities,

(c) Time for a session, and time management

- The length of one session was appropriate. However, some lecturers took too much time for lecturing, leaving insufficient time for discussion, questions and answers, and exchange of opinions, etc.

5) WDC manuals

- Some explanations should be revised into a simpler manner, with pictures and photos, to help the understanding of community members,
- More photos and topics derived from Kenyan cases are desirable.

(4) Feedback on training contents, time table and WDC modules

A flood management training to WRUA has its ultimate goal in formulating flood management activity plan to be incorporated in SCMPs. With this goal in mind, the result of evaluation are reviewed and recommendations are made, as follows,

1) Flood management training program should be given in separate installment,
2) Contents should be grouped in three phases, such as general conceptualization, study and investigation, planning and implementation,
3) Methods of training are basically three; lecture, field exercise, discussion and consensus building,
4) Continuous program improvement should be considered in WRMA, like "learning by doing".

Following the classification above, we could structure the training in five elements as shown below;

Table 4.8-8 Structure of training

		Contents (phase)		
		General conceptualization	Study and investigation	Planning and implementation
Method	Lecture	1	2	4
	Field exercise	-	3	-
	Discussion and consensus building	-	-	5

Contents should be ordered in the sequence of execution of flood management project, while methods should be chosen in order of lectures, exercises and planning and implementation.

Summarizing the discussion above, structuring the training program is proposed as follows;

1) Lectures on general conceptualization (GC),
2) Lectures on study and investigation (S&I)
3) Exercises on study and investigation
4) Lectures on planning and implementation (P&I)
5) Discussion and consensus building on planning and implementation

The current revised WDC flood management modules are structured in nine modules, each of which can be classified in the same manner as shown in the table below.

Table 4.8-9 Classification of sub-module of current WDC flood management modules

No	Session Title	contents	Number of topics
1	Flood Disaster And Flood Management	GC	3
2	Integrated River Basin Flood Management	GC	4
3	Rainfall and Flood Observation	S&I	3
4	Community-Based Flood Hazard Map	S&I	3
5	Flood Early Warning	P&I	2
6	Flood Disaster Evacuation Programme	P&I	2
7	Communication, Public Awareness Raising and Disaster Education	P&I	4
8	Planning, Design, Construction, Operation, and Maintenance Of Flood Mitigation Facilities	P&I	3
9	Co-Operation between Upstream and Downstream Stakeholders And Co-Ordination	P&I	3

With these considerations, a model structure for flood management training for WRUA can be proposed. The first and second weeks can be executed separately, while the second and third weeks should be done in continuation.

Table 4.8-10 Model structure for flood management training for WRUA

	Monday	Tuesday	Wednesday	Thursday	Friday
1st week	Lectures on GC WDC Session 1 WDC Session 2 7 hours	Lectures on S&I WDC Session 3 WDC Session 4 6 hours	Exercise on S&I (rain and river flow observation, flood hazard mapping)	Exercise on S&I (flood hazard mapping)	Exercise on S&I (flood hazard mapping, if necessary)
2nd week	Lectures on P&I WDC session 5 WDC session 6 WDC session 7 8hours	Lectures on P&I WDC session 8 WDC session 9 6hours	Discussion on planning and implementation	Discussion on planning and implementation	Reserved for WRMA to evaluate and summarize the outcome of discussion of participants
3rd week	Consensus building on planning and implementation				

Further, this could be developed into a model time table as shown in the table below.

Table 4.8-11 Model time table for flood management training for WRUA

No	Session Title	Topics
1st Week		
Monday		
1	Flood Disaster And Flood Management	1. Introduction to the Causes and Effects of Floods 2. Understanding Flood Management 3. Flood Disaster Management
2	Integrated River Basin Flood Management	1. Integrated River Basin Flood Management (IRBFM) 2. Introduction to Community Managed Flood Disaster Risk Reduction (CMFDRR) 3. Vulnerability Assessment 4. Flood Mitigation Non-Structural Measures including Community-based Measures
Tuesday		
3	Rainfall and Flood Observation	1. Rainfall Observation 2. Data and Statistical Processing of Rainfall 3. Flood Discharge Observation
4	Community-Based Flood Hazard Map	1. Meaning and Purpose of Flood Hazard Map (FHM) 2. Community-based Flood Hazard Map (CFHM) 3. Preparations for Developing Community-based Flood Hazard Map
Wednesday Field Exercise on Rainfall and Discharge Observation and Community-based Flood Hazard Map		
Thursday Field Exercise on Community-based Flood Hazard Map		
Friday Field Exercise on Community-based Flood Hazard Map (if necessary)		
2nd Week		
Monday		
5	Flood Early Warning	1. Flood Early Warning System (FEWS) 2. Community-based Flood Early Warning (CFEW)
6	Flood Disaster Evacuation Programme	1. Evacuation Planning 2. Evacuation Centre Management
7	Communication, Public Awareness Raising and Disaster Education	1. Capacity of Transmitting and Communication Skills 2. Communication of Desired Information to Schools 3. Effective Public Awareness Raising on Floods 4. Roles of Effective Communication Channels between the Government and Community in Mitigating Flood Risks
Tuesday		
8	Planning, Design, Construction, Operation, and Maintenance Of Flood Mitigation Facilities	1. Planning and Designing of Flood Mitigation Measures 2. Flood Mitigation Structural Measures including Community-based Measures 3. Operation and Maintenance of Flood Mitigation Structural Measures
9	Co-Operation between Upstream and Downstream Stakeholders And Co-Ordination	1. Co-operation and Co-ordination between Upstream and Downstream WRUAs in a River Basin 2. Roles of Co-operation and Co-ordination 3. Co-operation with County Government, WRUA and Sub County Disaster Management Committee (SCDMC)
Wednesday: Discussion on Flood Management Activity		
Thursday Discussion on Flood Management Activity		
Friday: <Drafting Flood Management Plan by WRMA>		
3rd Week		
Monday (or another day) Adoption of Flood Management Plan by WRUA		

4.9 Training in Japan

The training in Japan was carried out for the period from 11 to 26 November, 2013. The participants to the training in Japan consisted of WRMA officers, a MEWNR officer, and leaders of WRUAs in the pilot areas of the Project. The training program included site visiting at the real river management facilities, lectures and exercises on topics related to flood management and community based flood management activities.

4.9.1 Purpose of Training in Japan

The purpose of the training in Japan was set to give chances to counterparts of the Project to learn from actual flood management facilities and organizations in Japan, that were not observable in Kenya, and to give them clear picture of flood management related activities, and to promote the flood management activities of the Project

4.9.2 Participants

The participants were fifteen, which consist of officers of WRMA Head Quarter (HQ), Regional Offices (ROs) and Sub-Regional Offices (SROs), and an officer of MEWNR, and leaders of WRUAs in the pilot areas of the Project. Participants were divided into four groups, one group consisted of members from MEWNR and WRMA-HQ and the other group consisted of members from WRMA ROs, SROs, and WRUA from each of the pilot areas. These groups were the groups for exercises, and the action plan report making.

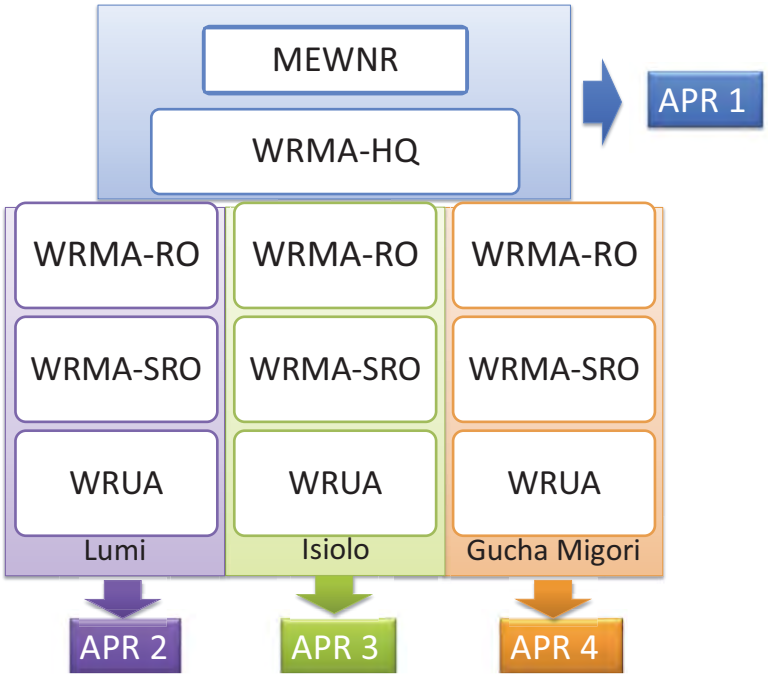


Fig. 4.9-1 Participant Grouping Structure in Training Japan

Table 4.9-1 List of Participants to Training in Japan

Name	Position and Institution	Group
Ms. Nancy Cherono Koech	Hydrologist, MEWNR	1
Mr. Wilfred Ochenge Matagaro	Dep. Tech. Cord. Manager, WRMA-HQ	1
Ms. Rose Akinyi Nyamori	Ass. Tech. Cord. Manager, WRMA-HQ	1
Mr. Alexander Nzyuko	Dep. Tech. Cord. Manager, WRMA-HQ	2
Mr. Stephen Ngao	Ass. Tech. Cord. Manager, WRMA-RO	2
Mr. Joseph Maina	Catchment Man. Officer, WRMA-SRO	2
Mr. Fredy Emanuel Reuna	Secretary, Lower Lumi WRUA	2
Mr. Peterson Njiru	Ass. Tech. Cord. Manager , WRMA-HQ	3
Mr. Timothy Mutie	Ass. Tech. Cord. Manager, WRMA-RO	3
Mr. Abraham Gitonga	Catchment Man. Officer, WRMA-SRO	3
Mr. David Nabea Mwiti	Secretary, Isiolo WRUA	3
Ms. Elizabeth Akinyi Diego	Ass. Tech. Cord. Manager, WRMA-HQ	4
Mr. Joseph Boit	Catchment Man. Officer, WRMA-RO	4
Mr. Samuel Njihia	Catchment Man. Officer, WRMA-SRO	4
Mr. Joshua Ouma Ojwang	Secretary, Lower Gucha Migori WRUA	4

4.9.3 Training Program

The Program for the training in Japan consisted of lectures, practices and site visiting. Trainers consisted of members of the Project Team, and a director of Non-Profit Organization (NPO), a university professor and an officer of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). The topics of lectures from trainers from outside the Project Team were “Disaster mitigation education”, “Supporting for improvement of self-help and mutual assistance” and “River Law and flood management in Japan”.

As site visits related to the flood management, the participants visited river management facilities and on-going river improvement work projects, and learned river improvement planning, function of the river management facilities and flood prevention activities, making community based flood map, etc. Most of site visits were made possible by kind support from the MLIT.

In particular, the contents that the participants showed interest were followings;

- River management under river classification and its framework,
- The roles and responsibilities in river management and flood management of each river administrator, local governments, local communities, etc.,
- Traditional river works in Japan, which are used regionally available natural materials,
- Exercise of community based flood map which was made by river administrator, local government and local communities,
- Disaster mitigation education which is easy to understand by pupils.

It was observed that the participants were highly interested in roll and responsibility of river management and flood management, and their implementation framework, and structural and non-structural measures which could be adopted under Kenyan conditions.

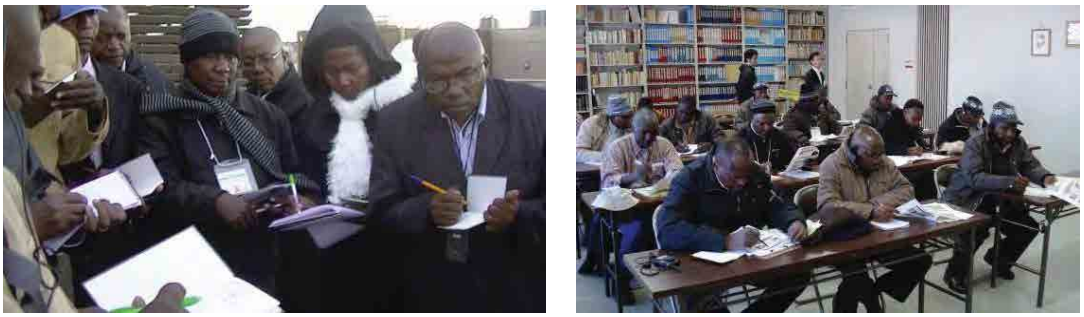


Fig. 4.9-2 Trainees were learning the Flood management

The program is shown below.

Table 4.9-2 Program of training in Japan

Date	Activities	Lecturer	
		Name	Duty position
10-Nov-13	Arrival to Narita Move to JICA Tokyo	-	-
11-Nov-13	Briefing & Orientation	-	JICA Tokyo
	Program Orientation by NEWJEC	Naonori OKAWA	Civil Engineering Group, International Operations, NEWJEC Inc.
	Ara River downstream area - Disaster Prevention office and Disaster Measure Supporting Ship -	-	Arakawa-Karyu Office, Kanto Regional Development Bureau, Ministry of Land, Infrastructure and Transport (MLIT)
12-Nov-13	Institutional Arrangement of Flood Management in Kenya	-	-
	River law in Japan and Flood management	Hajime KOBAYASHI	Construction Management Division, Research Center for Land and Construction Management, National Institute for Land and Infrastructure Management, Ministry of Land, Infrastructure and Transport (MLIT)
	Supporting for Improving Self-help and mutual assistance activities	Koji ASAI	Associate professor, Hydraulic and Environmental Engineering, Department of Civil and Environmental Engineering, Yamaguchi University
	Case examples and lessons of Community based activities	Masaru ARAKIDA	Asian Disaster Reduction Center
13-Nov-13	Preparing Action Plan Reports (APR)	Yukihiro MIKUMO	Manager, Civil Engineering Group, International Operations, NEWJEC Inc.
	Disaster Mitigation Education Experience of Disaster Mitigation Education Practice of the Planning Disaster Mitigation Education	Hirokazu Nagata	Plus Arts NPO/ Chairperson
14-Nov-13	River basin management1 (Comprehensive Flood Management)	Tatsuo HAMAGUCHI	Executive Vice President, NEWJEC Inc.
	River basin management2 (Flood damage mitigation structural measures)	Taketoshi MATSUNAGA	Civil Engineering Group, International Operations, NEWJEC Inc.
	River basin management3 (Practice of selection of measures)	Taketoshi MATSUNAGA	Civil Engineering Group, International Operations, NEWJEC Inc.
	River basin management4 (Practice of Run off analysis)	Naonori OKAWA	Civil Engineering Group, International Operations, NEWJEC Inc.
	Briefing of Fuji river	Yukihiro MIKUMO	Manager, Civil Engineering Group, International Operations, NEWJEC Inc.
	Preparing APR	Yukihiro MIKUMO	Manager, Civil Engineering Group, International Operations, NEWJEC Inc.
15-Nov-13	Fuji River basin - Traditional flood management -	-	Kofu Work Office, Kanto Regional Development Bureau, Ministry of Land, Infrastructure and
16-Nov-13	Holiday	-	-
17-Nov-13	Holiday	-	-
18-Nov-13	Move from Tokyo to Osaka (by Train)	-	-
	River basin management in Japan	Tatsuo, HAMAGUCHI	Executive Vice President, NEWJEC Inc.
	Briefing of Yodo river and Ibo river	Yukihiro MIKUMO	Manager, Civil Engineering Group, International Operations, NEWJEC Inc.
	Preparing APR	Yukihiro MIKUMO	Manager, Civil Engineering Group, International Operations, NEWJEC Inc.
19-Nov-13	Yodo River basin (Yodo River) - Flood management at the Typhoon No.18 -	-	Yodo River Integrated Dams control office, Kinki Regional Development Bureau, Ministry of Land, Infrastructure and Transport (MLIT)
	Yodo River basin basin (Yodo River) - Confluence point and Yodo River Weir -	-	Yodogawa river office, Kinki Regional Development Bureau, Ministry of Land,
20-Nov-13	Yodo River basin (Seta River) - Setagawa River Submerged Weir -	-	Lake Biwa River Office, Kinki Regional Development Bureau, Ministry of Land,
	Preparing APR(Midterm presentation of APR)	Yukihiro MIKUMO	Manager, Civil Engineering Group, International Operations, NEWJEC Inc.
21-Nov-13	Ibo Rover - Community based activities; Tatami dyke, Community based flood map -	-	Himeji Work office, Kinki Regional Development Bureau, Ministry of Land, Infrastructure, Transport and Tourism (MLIT).
22-Nov-13	Follow-up site visits	Yukihiro MIKUMO	Manager, Civil Engineering Group, International Operations, NEWJEC Inc.
	Community based flood map	Naonori OKAWA	Civil Engineering Group, International Operations, NEWJEC Inc.
	Preparing APR	Yukihiro MIKUMO	Manager, Civil Engineering Group, International Operations, NEWJEC Inc.
23-Nov-13	Yodo River basin (Katsura river)	Yukihiro MIKUMO	Manager, Civil Engineering Group, International Operations, NEWJEC Inc.
	Move from Osaka to Tokyo (by Train)	-	-
24-Nov-13	Holiday	-	-
25-Nov-13	Look back on pilot activities	Masaru NISHIDA	Group Manager, Civil Engineering Group, International Operations, NEWJEC Inc.
	Preparing APR	Yukihiro MIKUMO	Manager, Civil Engineering Group, International Operations, NEWJEC Inc.
26-Nov-13	Presentation of APR		
	Certificate Hand-over Ceremony	Kai KIKUIRI	Deputy Director, Disaster Management Division 1, Global Environment Department, JICA
	Move from Narita to Dubai (by Air)(PM)	-	-

4.9.4 Outcome of the Training in Japan

During the training in Japan, the participants were given an assignment to create the action plan reports as their own subject. In the action plan reports, the participants were asked to organize the knowledge obtained from this training, and consider river management of the project areas and the current state of flood management in Kenya. Next, they were asked to examine how to apply the obtained knowledge to flood management in Kenya. As a result, following actions were proposed as the action plan by the participants.

(1) Group One (MEWNR and WRMA-HQ officers)

"Policy proposals on flood management organization in WRMA in the future and measures necessary to enable such an organization"

Based on the lectures, exercises and discussions, knowledge obtained from training in Japan, and analysis of the current flood management system in Kenya, the group members examined the ideal situation in flood management with respect to WRMA, and proposed concrete measures containing the items necessary to realize it.

(2) Group Two, Three and Four (WRMA-RO and SRO officers and a WRUA leader in each river basin)

"Proposal of flood management measures to be adopted and community disaster prevention activities in each basin"

Based on the lectures, exercises and discussions, knowledge obtained from training in Japan, the members of each group proposed a policy on community disaster prevention activities and flood management in the future, which were to be integrated into Sub Catchment Management Plan (SCMP) of each basin.

(3) Summarization of group presentation as in Action Plan

Following the presentations from all groups mentioned above, the action plan was presented by the leader of the participants as a summary of the training in Japan.

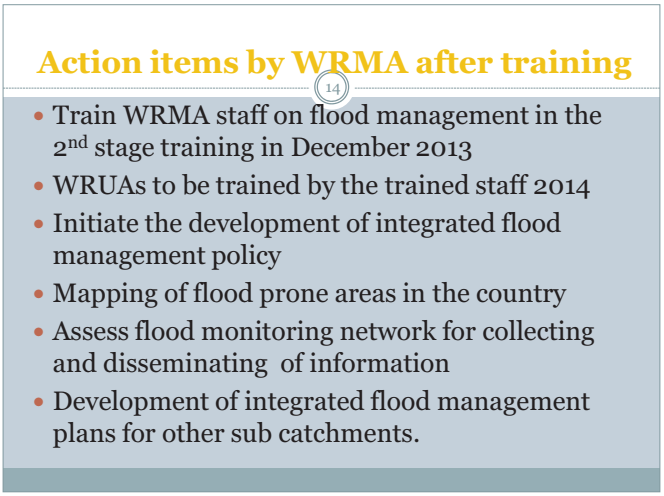


Fig. 4.9-3 Action plan report Summary 1

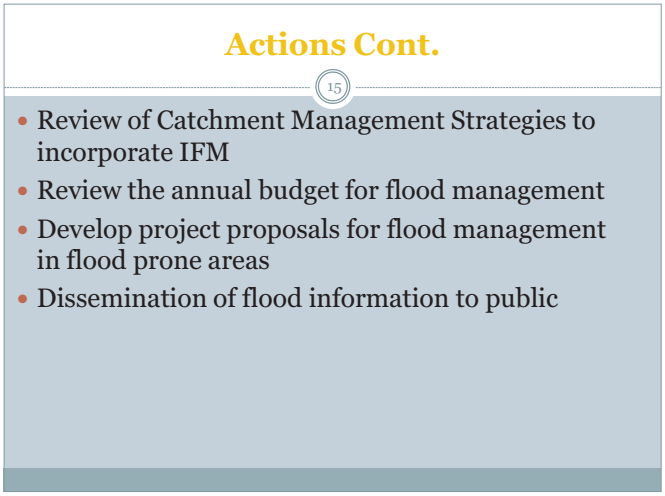


Fig. 4.9-4 Action plan report Summary 2

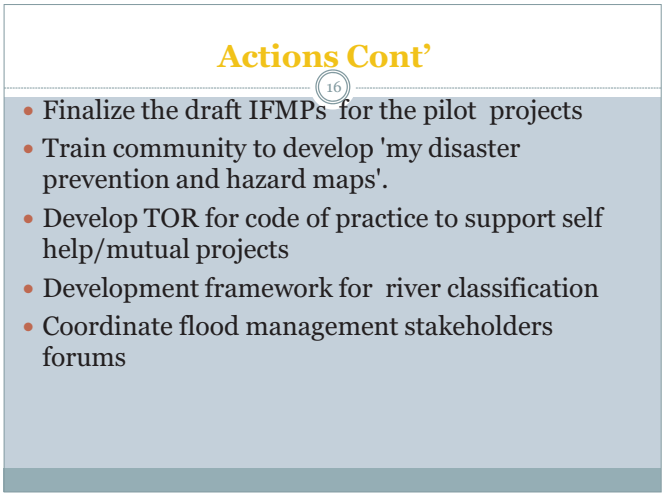


Fig. 4.9-5 Action plan report Summary 3

Photo 4.9-1 Scene from presentation of Action Plan Report

Achievements of the training in Japan are summarized as follows.

- A MEWNR officer in charge of policy and legislation related to flood management, and WRMA officers in charge of flood management planning,

obtained knowledge on flood management and deepen their understanding thereof.

- WRUA leaders, who will work between WRMA and the community, obtained hand-on knowledge on flood fighting and other activities that communities can execute for themselves.

- This knowledge would promote pilot project activities to success, and also provide a motive to the participants to consider and implement their own flood management activities in the future.

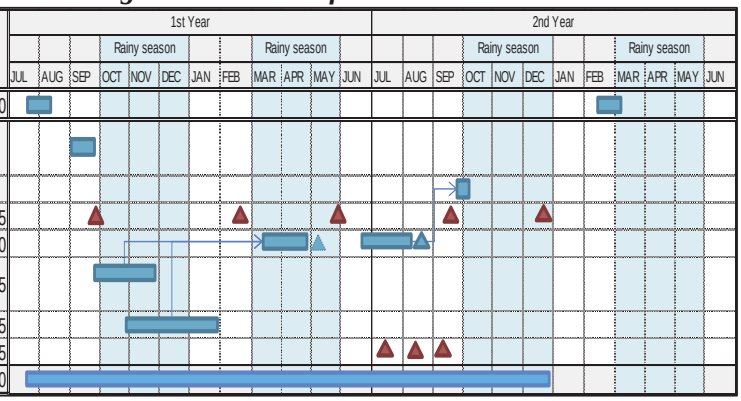
4.10 Establishment of Flood Management Training in WRMA

On the basis of capacity assessment and needs assessment conducted for WRMA staff, flood management training plan was formulated, and the training manual and materials were prepared. The 1st stage training, as a training of trainers (TOT) raised trainers among WRMA staff, who then became trainers for the 2nd stage training. The result of the 2nd stage proved that, after this Project, flood management training will be able to be organized and executed by WRMA alone. Through these activities of the Project, the training plan, manual, materials and trainers, as the flood management training system of WRMA were established.

WRMA is very much aware that he will have to continue providing flood management training to its technical staff at a regular interval. Annual flood management training is now fabricated into the execution plan of flood management activities for a river basin as shown below. This requires the budget provision of approximately Ksh 2,000,000 for one-week, fifteen-participant training program as experienced in the Project.

Table 4.10-1 Execution plan of flood management activities for one river basin

	Activities for IFM at a river basin	Budget (Mil. KSH)
	Execution of training for WRMA	2.00
1	Execution of training for WRUA (Including drawing Community based hazard map)	WSTF
2	Reflecting IFM to SCMP	WSTF
3	Formurating and holding of IFMC	1.25
4	Drafting IFMP (Including plan of flood counter measures)	1.00
5	Site survey and Collecting river basin data (Natural and Socio-economic condition, Development plan)	0.05
6	Site survey for flood damage data and Analysis of flood characteristics	0.05
7	Fabrication and installation of FEWS	0.15
	Total	2.50



Chapter 5 Eestablishment of Institution and Budgetary Systems to Address Flood Issues

Activities done by the Project Team for the PDM (Project Design Matrix) as to 1-2) WRMA's preparation of the future plan in the flood management consisting of 1-2-1) Flood Management Plan and Project Development Plan, 1-2-2) Organization Plan of the Personnel and Budget Plan, 1-2-3) Approximate Project Cost and Fund Plan, and as to 1-6) WRMA's sustainable establishment of flood management in terms of organization, personnel, budget and fund acquisition, are described in this Chapter.

Also the institutional orientations done by the Project Team for WRMA to establish sustainable activities of the flood management by its own endeavor so that WRMA should study on the system which should be sustainably fixed in the regional and sub-regional community level including substances extended by the Project Team therefor, are described herein.

It is stipulated in the Specifications to examine the method for securing specific activity budget for implementing flood management especially in the Kisii sub-region, of which outline is shown herein, which is described in CHAPTER 7 of PART 3 as well.

5.1 Support on Revision of WRMA Strategic Plan

In general semi-governmental organizations in Kenya prepare the organizational mid-term strategy for 5-year, WRMA established its first strategy from 2005 to 2008 when it was founded in 2005. Thereafter WRMA established the second strategic plan for 2009 - 2012 in 2009 before commencing this Project, which was based on Water Bill (1999), Water Law (2002) and NWRMS (National Water Resource Management Strategy) 2007 - 2009.

In the course of implementation of this Project, the said Plan was to be revised as the 5-year Plan for 2012-2017. It was examined in consideration of progress of the Water Bill law having been revised on account of new Constitution 2010 and introduction of County System, and the initial draft of WRMA Strategic Plan 2012-2017 which was Prepared by the local consultant employed by WRMA, was proposed on June 22, 2012.

The Project Team supported WRMA in cooperation with JICA head office by giving comments on it so that the flood management plan should be properly reflected in the future plan of organization, system and project activity of WRMA according to the coping policy as mentioned below.

5.1.1 Coping Policy

Following shows contents and coping policy of the initial draft of WRMA Strategic Plan 2-12-2017.

Table of Contents

7. Performance Review and Lessons Learned
8. Strategic Approach
9. SWOT Analysis and Key Issues
10. Strategic Objectives and Strategies
11. Stakeholder Analysis
12. Implementation Framework
13. Resource Needs
14. Monitoring and Evaluation
15. Annexes

Coping Policy

- Substances of flood shall be added to National Challenge in Chapter 5.
- Viewpoint of flood-damage-mitigation shall be additionally described for "Better Land Use" in Chapter 5 National Challenge where "Land Degradation" is only described as to the relationship between land and water.
- The Project Team suggested to describe the flooding characteristics in respective basins in Chapter 5 Six Catchment Areas.
- Strategy for flood shall be described in Chapter 6.2 Strategy.
- New organization of Flood Management Department shall be included in ANNEX-1.
- Action for flood shall be added to Action below the Strategy in ANNEX-2 in consideration of the comments on Chapter 10.

-ANNEX-3 and 4 shall be supplemented in accordance with the comments on Chapter 10.

5.1.2 Comments on the Draft WRMA Strategic Plan

The Project Team commented on the initial draft WRMA Strategic Plan based on the above-mentioned coping policy to the local consultant as follows.

Table 5.1-1 Comments (1) Presented on June 26, 2012

Page	Chapter/ section	Original	Proposed
All			What WRMA have achieved in the past five years and what WRMA should accomplish in the next five years are not shown explicitly. Since this is 5-years plan, what should be achieved in the next five years should be described basically.
All			Comparison table of the New Plan and the Old Plan should be made. If there are comparison table, it is easy to understand what has changed and what has not changed.
	Table of Contents		Chap.1 ~ 7 seems to be “Background information”, and Chap.8 ~ 13 seems to be “Body”. How about making the two big chapters such as "Chapter.1 Background" and "Chapter.2 WRMA Strategic Plan".
8-40	Chap.2, Chap.4, Chap.6.2, Chap.8, Chap.9, Chap.10.	There are “WRMA Mandate” and “WRMA Roles and Functions” in Chap.2. There is “Goal” in Chap.4. There is “Strategy” in Chap.6.2. There are “Vision”, “Mission”, “Core Values” and “Motto” in Chap.8. There is “Theme” in Chap.9. There is “Strategic objectives” in Chap.10.	These relationships should be described on a cleanup. Chap.8 is most fundamental, but its description is too little.
4-30	Chap.1-2, Chap.3, Chap.5, Chap.6.2	"Challenge" of Chap.1-2, "Challenge" of Chap.3, “National Challenge” of Chap.5 and “Strategy” of Chap.6.2 are overlapping. The title of “Strategy” of Chap.6.2 is “Strategy”, but more than half its description is describing the issue.	These should be organized.
5	Chap.1-2		"1.2.2 Water related disaster" shall be mentioned.
8	Chap.2.1 WRMA Mandate		“Flood management” should be added.
8	Chap.2.2 WRMA Roles and Functions		“- Integrate data and analyze cause and effect relationship of flood” “- Formulate River Basin Flood Management Plan” “- Develop resilient community to floods (or water-related disasters)” should be added.

Page	Chapter/ section	Original	Proposed
10- 11	Chap.4	While "Goal 1" is describing the outcomes for society, "Goal 2" and "Goal 3" are describing the means for achieving the outcome.	"Goal" should be the outcomes for society.
31- 35	Chap.7, Chap.8- Chap.14		We cannot understand the relationship between the review of Chap.7 and the plan Chap.8 - Chap.14. What does the review of Chap.7 contribute to the Plan of Chap.8- Chap.14?
36	Chap.8		Have not the draft of 8.1 and 8.2 been done yet?
36- 37	Chap.8	"Developing the second Strategic Plan" is just describing the formulating history.	How about transferring "Developing the second Strategic Plan" to "Background" such as the end of the Chap.1?
38- 39	Chap.9		We cannot understand the intent of the Chap.9. Chap.9 dose not play a role in connecting "concept" of Chap.8 and "Strategic Objectives" of Chap.10.
40	Chap.10	Strategic Objective 1: Strengthen monitoring networks to enhance data collection and improve information management system	"- Conduct high water discharge observation" "- Integrate data and analyze cause and effect relationship of flood" should be added.
40	Chap.10	Strategic Objective 2: Improve the use of tools for effective water resources planning and allocation	"- Formulate River Basin Flood Management Plan" should be added.
40	Chap.10	Strategic Objective 4: Strengthen tools and collaboration for effective catchment management	"- Develop resilient community to floods (or water-related disasters)" should be added.
40	Chap.10	Strategic Objective 5: Build staff capacity and improve working environment	"- Implement training programs for flood management" should be added.
41- 42	Chap.11	"Chap.11 Stakeholder Analysis" is not analysis.	Chap.11 Expected Stakeholder Participation in Water Resources Management
41	Chap.11	"Stakeholders Expectations" of "WRUA's"	"- Water resources management" should be added.
41- 42	Chap.11		"- National Water Conservation and Pipeline Corporation (NWCPC)" should be added as follows.

Table 5.1-2 Comments (2) Presented on June 26, 2012

Name of stakeholders	Stakeholders Expectation	WRMA's Expectations	How WRMA Relates with Stakeholders
National Water Conservation and Pipeline Corporation(NWCPC)	Dam construction for water supplies and flood control - Land drainage - Construction of dykes - Ground water recharge	- Creating an overall master plan - Regulation	Cooperation

Table 5.1-3 Comments Presented on June 27, 2012

Page	Chapter/ section	Original	Proposed
12-13	Chap.5	"National Challenge"	"Flood" should be added in "National Challenge".
12-13	Chap.5	In "National Challenge" , only "Land Degradation" is described about the relationship between land and water.	Description of the point of view to reduce flood damage by "the Better Land Use" should be added.
13-24	Chap.5	"Water Resources situation in the Six Catchment Areas"	"The characteristics of the Flood of each Catchment" should be added.
26-29	Chap.6.2	6.2 Strategy	The strategy for "flood" should be added.

38- 40	Chap.9	It is funny to describe "SWOT analysis" in the body.	"Chap.9 SWOT analysis" should be moved to the Annex as a reference for this Strategic Plan. The background information such as "Who", "How many persons" and "Where did you hear" should be added.
52- 57	Annex.1	Summary of proposed staff establishment	A new organization called "Flood Management Department" should be included.
58- 69	Annex.2	Implementation Matrix	Action about the "Flood" such as - Conduct high water discharge observation"; - Integrate data and analyze cause and effect relationship of flood; - Formulate River Basin Flood Management Plan; - Develop resilient community to floods (or water-related disasters); - Implement training programs for flood management; should be added.
70- 72	Annex.3	Result Matrix	The table should be complemented in the form along to comments on Chap.10, - Conduct high water discharge observation; - Integrate data and analyze cause and effect relationship of flood; - Formulate River Basin Flood Management Plan; - Develop resilient community to floods (or water-related disasters); - Implement training programs for flood management; should be added.
73	Annex.4	Risk Matrix	The table should be complemented in the form along to comments on Chap.10, - Conduct high water discharge observation; - Integrate data and analyze cause and effect relationship of flood; - Formulate River Basin Flood Management Plan; - Develop resilient community to floods (or water-related disasters); - Implement training programs for flood management; should be added.

Table 5.1-4 Comments Presented on July 5, 2012

Page	Chapter/ section	Original	Proposed
13-24	Chap.5	"Water Resources situation in the Six Catchment Areas"	"The characteristics of the Flood of each Catchment" should be added as follows.

Athi Catchment

The Athi catchment area (especially in the Thwake and Tsavo management units) has variable surface water flows. This can be explained by the fact that there are occasional flash floods and very little percolation (due largely to Basement geology). Athi catchment suffers from past catchment degradation as a result of tree-felling in forest and reserve areas. Encroachment in and cultivation of wetlands has also exacerbated this situation further. Sand harvesting has adversely affected the bank stability of the rivers. These activities destroy surface cover resulting in increased surface run-off and soil erosion. Eroded soils are carried by the surface run-off and deposited in rivers, lakes and dams, resulting in reduced storage capacity. Increased surface run-off increases flood frequency and its associated consequences – a case in point is the Lumi River.

Ewaso Ngiro North Catchment

Ewaso Ngiro North Catchment area suffers from past catchment degradation as a result of deforestation. Encroachment and cultivation in wetlands have further worsened this situation. These activities destroy surface cover resulting in increased surface run-off and soil erosion. The eroded soils are carried by surface flow and deposited in the rivers, dams and pans resulting in reduced storage capacity. The increased surface run-off causes increased potential flooding and its associated consequences.

Lake Victoria South Catchment

Flooding is a common phenomenon in parts of the Lake Victoria South Catchment Area such as Kano Plains and Nyakach in Nyando District and the lower parts of Rachuonyo district. Floods occur regularly in the catchment with devastating effects causing havoc to the human population, crops and livestock and grossly undermining the socio-economic status of the local population. Nyando and parts of Rachuonyo Districts experience devastating floods during rainy seasons leading to loss of livelihoods through damage to crops and loss of livestock. The region continues to experience natural calamities of floods almost on an annual basis. It is notable that the highest floods experienced in the catchment were caused by the El Nino associated rains of 1962, followed by 1997-1998 and 2006-2007. The flooding phenomena are synonymous with the Kano plains, Lower Gucha-Migori, Lower Awach Kibuon and Lower Awach Tende plains. Communities living in the flood plains have lost life and property, yet they can't vacate the plains due to land tenure systems and because the soils in the plains are fertile. The major cause of catchment degradation is population pressure, requiring land for settlement, farming, timber and charcoal burning, which has caused increased flash floods in rivers such as Nyando, Mara, Gucha-Migori, Sondu, Nyamasaria, Awach Kibuon and Awach Tende. The eroded soils are carried by overland flow and deposited in the rivers, lakes and dams/pans impacting negatively on storage capacity. The increased surface run-offs has been the main reason for the perennial floods affecting the Lower Nyando, Sondu, Awach Tende, Awach Kibuon and Lower Gucha-Migori at Kadem.

Lake Victoria North Catchment

Most of Lake Victoria North catchment area lies within high rainfall area with mean annual rainfall of 1300 mm. Floods frequently cause disasters in Lake Victoria North catchment area. The Lower Nzoia and Yala Catchment Management Units are the areas susceptible to floods and flash floods. In 1997/98, the El Nino phenomenon affected many parts causing millions of shillings of damage, destruction to property, loss of lives, famine and waterborne disease epidemics. Lake Victoria North catchment area has experienced catchment degradation as a result of cutting down of trees in the forest and reserve areas. Encroachment and cultivation on wetlands have worsened this situation further. These activities destroy surface cover resulting in increased surface runoff and soil erosion. The eroded soils are carried by overland flow and deposited in the rivers, lakes and ponds resulting in reduction in storage capacity. The increased surface runoff causes increased potential flooding and its associated consequences.

Rift Valley Catchment

Floods frequently cause disasters in Rift Valley Catchment Area. There are pockets of areas susceptible to floods and flash floods. In 1997/98, the El Nino phenomenon affected many parts causing millions of shillings of damage, destruction to property, loss of lives, famine and waterborne disease epidemics. Due to overgrazing, the soil is usually left bare and compacted with loose particles resulting from livestock movement. The falling raindrops splash the loose soils which are carried away in overland flow. The eroded soils are deposited in river channels which reduces their capacity resulting in high incidence of floods. In these areas, usually the rainfall is of very high intensity. This

coupled with compacted ground surface results in high surface runoff and hence high potential for flooding.

Tana Catchment

Floods occasionally cause disasters in Tana. Within the Lower Tana Catchment Management Unit, the areas susceptible to flood are stretching along the Tana river. Arid and semi-arid areas of the Lower Tana also experience flash floods. In 1997/98, the El Nino phenomenon affected many parts causing millions of shillings of damage, destruction to property, loss of lives, famine and waterborne disease epidemics. Coupled with variable weather patterns and erratic rainfall, this region experiences frequent droughts and floods which, under extreme conditions, unfortunately lead to loss of lives of human beings and livestock. Tana catchment area suffers from past catchment degradation as a result of cutting down of trees in the forest and reserve areas. Encroachment and cultivation on wetlands have further worsened this situation. These activities destroy surface cover resulting in reduced recharge, increased surface runoff and soil erosion. The eroded soils are carried by overland flow and deposited in the rivers, lakes and ponds resulting in reduction in storage capacity. The increased surface runoff causes increase in potential for flooding and its associated consequences.

Table 5.1-5 Comments Presented on July 12, 2012

Page	Chapter/ section	Original	Proposed
14-23	Chap.5	"Monitoring of water resources"	The numbers of monitoring stations differ from the numbers that JICA obtained from WRMA recently. "The right numbers should be put in after a check."

5.1.3 Descriptions for Flood Management Reflected to WRMA Strategic Plan 2012-2017

Pursuant to the Project Team's support for revising the Plan, final Plan was issued in March 2013 incorporating appropriate flood management substances in the future plan concerning organization, institutional system and activities of WRMA.

"Earlier warning of flood and drought, Coordination among related authorities for mitigation of flood/drought damages, Promotion of participation of the stakeholders in the water resources control including resilience establishment" was added to the role of WRMA in WRMA Strategic Plan 2012-2017.

Further, "Preparation of effective strategy on flood management inclusive of integration and analysis of the data concerning flood causes and influences and preparation of Catchment Flood Management Plan for the areas where flood frequently occurs" was described as the strategic target

Following strategies were established as to the flood management:

[1] Project development to mitigate and cope with the influences by climate change including flood and drought

[2] Enhancement of involvement and cooperation of the stakeholders inclusive of establishment of resilience against flood damage

Contents and descriptions regarding the flood management in the final Strategic Plan

2012-2017 are as follows. Flood management components were included into the underlined chapters/sections.

WRMA Strategic Plan 2012-2017

Table of Contents

(1) Incorporation of Flood in "National Challenge"

Following description was added to 1.3.1 National Challenges

Floods

Floods have continued to increase in magnitude in the recent past with dire consequences in the national economy and on the people at ground level. All the six major drainage basins in Kenya in one way or another experience these natural phenomena although at different

magnitudes. Statistics indicate that in 1982 and 1985, floods mainly affected Nyanza and Western Kenya affecting about 14000 people. Areas worst affected in these two regions were the lower reaches of Nyando and Nzoia Rivers. Worst Floods however were experienced in 1997/1998 El Nino Floods which covered the entire Country resulting to about 1.5 Million people being affected through displacement, loss of property and lives as well. Although this is considered to be the worst ever floods which also heavily destroyed infrastructure, floods still continued to occur in later years including 2012 where the long rains delayed but caused heavy floods that resulted in loss of property and lives including displacements. As rains continued into the month of May 2012, more than 100,000 people were displaced and 65 people lost their lives according to reports by Kenya Red Cross Society. Worst hit areas this time round were Nyanza, Nairobi metropolitan area, Rift valley and Coastal area. Several rivers burst their banks and this could be attributed to increasing siltation which made the rivers become shallow and hence not able to contain the flows.

(2) Description of Current Flood Characteristics for 6 Basins

Although the current conditions of the 6 basins are described in 2.1 Water Resources Issues and Challenges, above-mentioned comments of the Project Team have been entirely incorporated.

(3) Description of Flood Management in WRMA Mandate

"*Flood and drought management*" was described in WRMA Mandate of 2.2 Management of Water Resources.

(4) Description of Flood Management in the Strategy

Strengthening of monitoring networks in consideration of earlier warning announcement of flooding, was described as Strategic Objective 1 in 6.1 Data Acquisition and Management of 6. Strategic Objectives and Strategies.

6.1 Data Acquisition and Management

This thematic area emphasizes consistent acquisition of water resources data as a pre-requisite to sustainable water resources management. Reliable data also enables development of information which is useful in planning, development and management of water resources. It also enables WRMA to know the amount of water available as it plans allocation to various demand areas, and to provide necessary information on early warning on floods and droughts. To address the data issue, the following strategic objective has been formulated.

Strategic objective1: Strengthen monitoring networks to enhance data collection and improve information management system

Strategies:

- *Develop collaborative arrangements with other stakeholders for improved information management*
- *Operationalize an optimal monitoring network for consistent data collection*
- *Improve systems for data storage, quality control, analysis and dissemination*
- *Develop mechanisms to address destruction of monitoring network*

Importance of coping countermeasures for flood and drought management in the

approaches to river basin, "Strengthening of cooperation with the stakeholders to enhance the coping actions for water storage and impact by climate change", and "Mitigation of climate change impact including flood and drought and development of coping project" were described in 6.3 Adequate Quantity and Quality of Water Resources, as follows.

6.3 Adequate Quantity and Quality of Water Resources

Water resources have a tendency of declining both in quality and quantity due to increasing demand by the growing population and environmental changes which over a long period of time culminates into climate change. Both temporal and spatial variability of these changes have resulted in inadequate good quality water. Approaches needed to address this chronic problem, should not emphasize on mitigation measure through storage development but also adaptation programmes of flood and drought management on river basin approach. In this context, the following strategic objective and strategies have been proposed

Strategic Objective 3: Strengthen stakeholder collaboration to enhance water storage and adaptation to climate change impacts

Strategies:

- *Establish a mechanism for stakeholder collaboration for enhancing water storage*
- *Establish Resource Quality Objectives and how to achieve them*
- *Develop programs to mitigate and adapt to climate change impacts including floods and droughts*

(5) Deployment of Personnel for Flood and Drought Management

28 persons are deployed for Flood and Drought Management.

Table 5.1-6 Deployment of Personnel for Flood and Drought Management

	Designation		Station	Scale	Approved Establishment
		Water Conservation Officer	Headquarters/Regions/Sub-Regions	6	33
		Water Conservation Assistants	Headquarters/Regions/Sub-Regions	7	33
	Flood and Drought Management	To be defined	To be defined	To be defined	28
	Water Resources Data	ATCM- Water Resources Data	Headquarters/Regions	4	7

Source: WRMA Strategic Plan 2012-2017, 11. Appendices Annex 1: Staff Establishment 2012

5.2 Organization and Budget Proposed for Flood Management

5.2.1 Foundation of Flood Management Department and Deployment of Its Personnel

It was approved at WRMA Governing Board held in January 2013 to establish the Flood Management Department under the technical division of WRMA, to deploy Flood Management Officer (FMO) at 6 regional offices and 14 sub-regional offices.

Table 5.2-1 Areas to Establish Flood Management Officers

Region	Sub Region
Athi Catchment Are	1. Coastal Athi; Monbasa 2. Noltresh Lumi; Loitokitok
Tana Catchment Area	3. Lower Tana; Garissa
Ewaso Ng'iro North Catchment Area	4. Middle Ewaso Ng'iro; Isiolo 5. Engare Narok Melghis; Rumuruti 6. Ewaso Daua; Mandera
Rift Valley Catchment Area	7. South Rift Valley; Narok 8. Lakes Baringo Bogoria; Kabarnet 9. Lower Tukwel; Lodwar
Lake Victoria North Catchment Area	10. Mt Elgon Cheragany; Kitale 11. Lower Nzoia; Siaya
Lake Victoria South Catchment Area	12. Northern Shoreline Nyando; Kisumu 13. Mara Sondu; Kericho 14. Southern Shoreline Gucha-Migori; Kisii

Following shows deployment of FMO and personal cost proposed at the said WRMA Governing Board.

Table 5.2-2 Deployment of Flood Management Officer, Personal Cost

No.	Position	Scale	HQ	Region	Sub Region	Total	Finance (shs000) P.a
1	ATCM Flood Management Officer (Civil Engineer/Hydrologist)	4	1	0	0	1	1,872
2	Senior Flood Management Officer (Hydrologist)	5	1	0	0	1	1,416
3	Flood Management Officer (Hydrologist Ass.)	6	1	6	6	13	10,608
4	Senior Flood Management Officer (Civil Engineer)	6	0	6	0	6	4,896
5	Flood Management Officer (Civil Engineer)	6	0	0	8	8	6,528
Total			**3**	**12**	**14**	**29**	**25,320**

Despite of the above personnel deployment plan, following personnel was actually assigned in July 2013.

Table 5.2-3Actual Deployment of FMO

	HQ	RO	SRO
Deputy Technical Coordination Manager: (DTCM)	1		
ATCM Flood Management Officer (ATCM)	1	6	
Flood Management Officer (FMO)			14

5.3 Estimated Project Cost and Fund Plan Proposed for Country-wide Promotion of Flood Management

The budget for fiscal year 2014 (July 2014 to June 2015) is Ksh. 34,870,000. (Approx. Japanese Yen 45 million). Disbursement plan for specific projects are, however, not Studied. The Project Team and WRMA discussed and prepared the work plan and schedule for promotion of the Flood Management in whole country.

Table 5.3-1 Budget of WRMA for Fiscal Year 2014

B		DEVELOPMENT BUDGET FY 2014/2015				
	WRMA ITEM CODE	ITEM DESCRIPTION	APPROVED BUDGET (Revised) FY 2013/2014 Kshs.	ESTIMATES FY 2014/2015 Kshs.	PROJECTED ESTIMATES 2014/2015 Kshs.	PROJECTED ESTIMATES 2015/2016 Kshs.
B (i)		**130 - DEVELOPMENT EXPENDITURE**				
1		**Office Establishment and Set up Facilities**				
	470	Land Acquisition	150,000,000	66,000,000	60,000,000	20,000,000
	481	Construction of Office Buildings	110,000,000	113,000,000	150,000,000	200,000,000
	482	Refurbishment/Renovation of office Buildings	23,594,000	22,630,000	30,000,000	30,000,000
	490	Purchase of Motor Vehicles	20,000,000	20,000,000	30,000,000	30,000,000
	500	Purchase of Bicycles and Motor Cycles	500,000	500,000	3,000,000	3,000,000
	510	Purchase of Office Furniture and Fittings	40,640,000	37,490,000	40,000,000	30,000,000
	521	Purchase of Photocopiers and other Ofice Equipmer	24,033,215	23,480,000	20,000,000	20,000,000
	525	Purchase of Computers, Printers and Other IT Equip	20,350,000	46,260,000	30,000,000	25,000,000
	531	ICT Networking and Communication Equipment	22,500,000	44,800,000	20,000,000	10,000,000
		sub Total	**411,617,215**	**374,160,000**	**383,000,000**	**368,000,000**
2		**Data Acquisition and Management**				
	200	Laboratory Materials, Supplies and small equipment	0	5,463,500	10,000,000	10,000,000
	454	Water Resources Data Acquisition and Managemer	38,331,000	75,203,000	80,000,000	80,000,000
	484	Drilling and Equiping of Dedicated GW Monitoring B	30,000,000	30,000,000	15,000,000	10,000,000
	484	Construction of Water Monitoring Stations	23,300,000	26,760,000	30,000,000	25,000,000
	485	Rehabilitation of Water Monitoring Stations	38,500,000	40,920,000	40,000,000	35,000,000
	526	Procurement and Installation of Data Base Software	31,750,000	41,600,000	35,000,000	30,000,000
	532	Equipment for Water Monitoring	47,400,000	51,900,000	40,000,000	40,000,000
	533	Purchase of Laboratory Equipment	20,500,000	26,300,000	30,000,000	30,000,000
		sub Total	**229,781,000**	**298,146,500**	**280,000,000**	**260,000,000**
3		**Catchment Conservation and Management**				
	391	Catchment Protection and Conservation Programme	87,720,000	101,400,000	150,000,000	200,000,000
	392	Support to Water Resource Users Associations (WF	277,700,000	104,415,000	110,000,000	120,000,000
	394	Rehabilitation/Restoration of degraded Water Catch	31,530,000	79,200,000	100,000,000	150,000,000
	395	Livehood Based Investiments/Micro Projects	119,500,000	179,460,000	150,000,000	150,000,000
	396	Transboundary Water Management Programmes	4,000,000	6,000,000	6,000,000	6,000,000
		sub Total	**520,450,000**	**470,475,000**	**516,000,000**	**626,000,000**
4		**Water Resources Planning and Allocation**				
	334	CAAC Regulatory Activities	1,850,000	4,720,000	5,000,000	5,000,000
	393	Enforcement Programmes	38,200,000	53,175,000	55,000,000	60,000,000
	453	Development of Water Allocation Plans	29,800,000	29,510,000	30,000,000	30,000,000
	465	Water Abstraction Surveys and Pollution Control Pro	30,780,000	38,750,000	35,000,000	30,000,000
	466	Ground Water Assessment and Mapping	23,887,200	13,600,000	25,000,000	25,000,000
	534	Acquisition and Installation of Water Measuring devi	14,600,000	14,000,000	15,000,000	20,000,000
		sub Total	**139,117,200**	**153,755,000**	**165,000,000**	**170,000,000**
5		**Design, Planning and Establishment of Water Storage facilities**				
	462	Design and Planning for Water Conservation and St	19,620,000	18,540,000	20,000,000	20,000,000
	463	Project Supervision and Inspections	9,300,000	12,850,000	15,000,000	20,000,000
	486	Construction of Water Conservation Structures	20,380,000	24,920,000	30,000,000	30,000,000
	487	Rehabilitation of Water Conservation Structures - Desilting of dams and pans	16,900,000	25,300,000	30,000,000	30,000,000
	488	Roof and Rock Catchment Structures - Water Tanks	1,900,000	5,600,000	10,000,000	10,000,000
		sub Total	**68,100,000**	**87,210,000**	**105,000,000**	**110,000,000**
6		**Corporate Planning and Institutional Development Programmes**				
	060	Staff Training	44,870,000	45,953,500	30,000,000	25,000,000
	275	Information Dissemination and awareness creation	23,047,800	28,950,000	30,000,000	30,000,000
	315	Cross Cutting Issues	7,500,000	8,800,000	15,000,000	15,000,000
	450	Improved Institutional Capacity	53,570,000	143,300,000	80,000,000	50,000,000
	455	QMS Implementation Programmes	15,700,000	16,070,000	20,000,000	20,000,000
	456	Corporate Planning and Monitoring & Evaluation Pro	30,450,000	38,120,000	40,000,000	40,000,000
	461	Feasibility and Appraisal studies	35,000,000	43,300,000	30,000,000	30,000,000
		sub Total	**210,137,800**	**324,493,500**	**245,000,000**	**210,000,000**
7		**Flood & Drought Management Programmes**				
	457	Flood Early Warning Systems and other non structura	3,600,000	3,600,000	15,000,000	20,000,000
	458	Maintenance of Operation Control Centers	3,600,000	3,600,000	10,000,000	10,000,000
	459	Development of Flood Control Structures and other s	15,600,000	20,200,000	30,000,000	30,000,000
	464	Intergrated River Basin Flood Management Plans	7,200,000	7,470,000	15,000,000	15,000,000
		sub Total	**30,000,000**	**34,870,000**	**70,000,000**	**75,000,000**
		TOTAL - DEVELOPMENT EXPENDITURE	**1,609,203,215**	**1,743,110,000**	**1,764,000,000**	**1,819,000,000**

5.3.1 Work Plan and Schedule of Flood Management

Following 7 works are essential at respective river basins for the flood management to be

performed by WRMA which are prepared according to the experience and knowledge acquired through this Project.

[1] Implementation of training on flood management to WRUA

[2] Support for incorporating IFM (Integrated Flood Management) to SCMP (Sub-Catchment Management Plan)

[3] Establishment and opening of IFMC (Integrated Flood Management Committee)

[4] Preparation of IFMP (Integrated Flood Management Plan)

[5] Collection and analysis of information on natural and social environment in the river basins

[6] Collection and analysis of information on flood damage

[7] Provision and installation of FEWS (Flood Early Warning System)

[8] Implementation of technical training on flood management to WRMA personnel, to be performed by WRMA periodically and continuously

Work schedule for above-mentioned works is envisaged as follows.

[1] Approximately 2 weeks.

[2] WRMA will support WRUA so that flood countermeasure to be taken and incorporated in SCMP by WRUA should be achieved.

[3] About 2 months for such preparatory works as analysis of the stakeholder, then the first IFMC will be held. 5 times of IFMC meetings will be held in total.

[4] Interview of the stakeholders about the flood countermeasures taken by them. Then, alternative countermeasure plans will be prepared based on the interview of the stakeholders, and discussed about the validity and priority of those plans at the fourth IFMC meeting. Those plans modified from the discussion in the 4th IFMC meeting will be proposed at the 5th IFMC meeting to obtain approval.

[5] Current analysis to be reported in the second IFMC meeting to share the conditions of the respective river basins among the stakeholders.

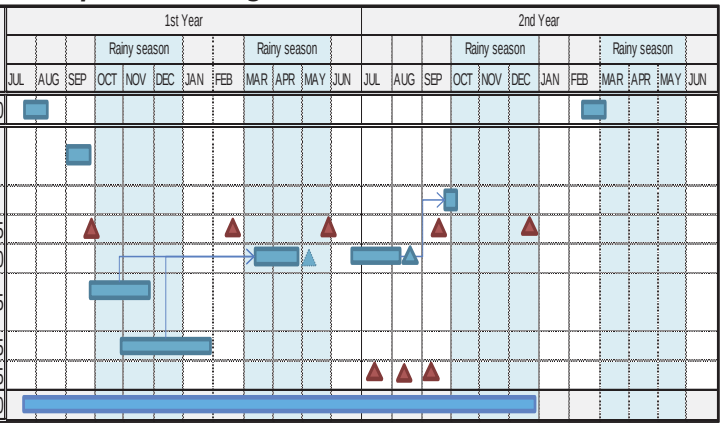
[6] Flood causes and influences will be analysed through the information collection by means of reconnaissance and local interviews, then, presented at the third IFMC meeting.

[7] Equipment of FEWS will be manufactured and installed at the location to be agreed between observation personnel and data receivers.

Total period for above-mentioned works will be about 1.5 years (18 months) as shown below.

Table 5.3-2 Implementation Schedule of Flood Management in River Basins

	Activities for IFM at a river basin	Budget (Mil. KSH)
	Execution of training for WRMA	2.00
1	Execution of training for WRUA (Including drawing Community based hazard map)	WSTF
2	Reflecting IFM to SCMP	WSTF
3	Formurating and holding of IFMC	1.25
4	Drafting IFMP (Including plan of flood counter measures)	1.00
5	Site survey and Collecting river basin data (Natural and Socio-economic condition, Development plan)	0.05
6	Site survey for flood damage data and Analysis of flood characteristics	0.05
7	Fabrication and installation of FEWS	0.15
	Total	2.50



The Project Team discussed with WRMA about the objective river basins to which above-mentioned works should be applied country-wide and reached consensus to select 12 river basins according to the following selection criteria.

- 2 river basins will be selected by one regional office to become 12 in total.
- 12 basins will be divided in 2 groups consisting of 6 basins each.
- 1 regional office is responsible for 6 basins.
- First 6 basins will be implemented in 18 months, followed by remaining 6 basins in another 18 months.

Above-mentioned criteria were discussed at the working group meeting held on June 4 and 5, 2014 and at the flood management forum on June 24 and 25, 2014, and 12 river basins were selected eventually as follows.

Table 5.3-3 Selected 12 River Basins for Implementing IFMP in 36 months

	Batch	River Basins	WRMA Regions	Counties	Cities/Towns affected
1	I	Lower Sabaki	Athi	Kilifi	Mombasa
2		Engare Narok Melhis(Rumuruti)	Ewaso Nyiro North Catchment Area	Nyandarua and Laikipia	Rumuruti
3		Yala	Lake Victoria North Catchment Area	Siaya, Kakamega, Vihiga, Nandi, Nandi, Ewasin Gichu	Yala Swamp
4		Awach Kano	Lake Victoria South Catchment Area	Kericho & Kisumu	Shoreline
5		Perkerra	Rift Valley Catchment Area	Nakuru, Baringo & Laikipia	Mogotio
6		Lower Tana	Tana	Garissa & Tana River	Garissa, Garsen
7	II	Mbagathi	Athi	Nairobi	Nairobi & Kitengela
8		Daua	Ewaso Nyiro North Catchment Area	Mandera	Mandera
9		Sabwani Trib of Nzoia	Lake Victoria North Catchment Area	Trans Nzoia	Kitale
10		Sondu	Lake Victoria South Catchment Area	Kericho, Kisumu	
11		Ewaso Ngiro South (Narok urban centre)	Rift Valley Catchment Area	Narok	Narok
12		Thiba	Tana	Embu	Mwea

5.3.2 Fund Resource Plan for Promoting Flood Management Country-wide

Estimated project cost is as follows.

Table 5.3-4 Estimated Project Cost for Flood Management in 12

No.	Item	Unit Rate (Ksh.) (Million)	Q'ty	Amount (Ksh.) (Million)
1	Training to WRUA on Flood Management			
2	Support of SCMP on IFM			
3	Foundation & Opening of IFMC	0.25	5 times	1.25
4	Preparation of IFMP		L.S.	1.00
5	Collection & Analysis of Information on Natural & Social Environment in River Basin		L.S.	0.05
6	Collection & Analysis of Flood Damage		L.S.	0.05
7	Manufacture & Installation of FEWS Equipment	0.05	3 sites	0.15
	Sub-total for river basin unit (1.5 years)			**2.50**
	Total for 6 river basins (1.5 years)			**15.00**
	Total for 12 river basins (1.5 years)			**30.00**
8	Technical Training to WRMA Personnel on Flood Management (1 year)			2.00
	Total Training Cost for 3 years			**6.00**
Total Cost for 3 Years				**36.00**

5.4 Support on Sustainable Establishment of Institutional System for WRMA's Flood Management

5.4.1 Organization

Flood Management Department was founded at 15 sub-regional offices including project areas in September 2013, and Assistant Technical Coordination Manager (ATCM) has been deployed in all the sub-regional offices.

Those persons are responsible for unit management at WRMA head office under Deputy Technical Coordination Manager (DTCM) who is chief executive, by which personal organization responsible for implementing WRMA's flood management has been arranged. ATCM in charge of flood management is also deployed at the head office.

ATCM at the head office was also in charge of Catchment Management at the time when the project completion was finally evaluated in March 2014, therefore, his cooperative works with the project sites were likely to be delayed.

WRMA corresponded to the strong request of the Project Team and JICA head office to improve ATCM's responsive duties by letting ATCM be exclusive responsible person of the flood management since June 2014. Through this arrangement, cooperation among ATCM, project site and the Project Team has been remarkably improved, and the organizational system has been strengthened and has become firm.

Cooperative works among the responsible parties has been maintained by the flood management unit so far in due consideration of lateral correspondence among related fields for flood management.

In the course of project implementation, weekly meeting of the flood management unit was held, and DTCM has intention to hold it continuously even after absence of Japanese experts.

5.4.2 Budget Securing

As mentioned hereinabove, the Project Team and WRMA jointly prepared the budget plan and work schedule to proceed with the flood management plan for the 12 river basins starting from the fiscal year 2014 for 3 years with the establishment and operation of IFMC, which was approved by CEO as well.

5.4.3 Sustainable Operation of Flood Early Warning System (FEWS)

Manufacture method of FEWS equipment using locally available parts and operation manual have been successfully achieved through the mutual works of the long-term expert and volunteers from KRCS, by which the equipment can be manufactured and installed at Ksh. 50,000 per equipment excluding solar panel and other special device and sustainable operation of FEWS can be started.

5.4.4 Allocation of Activity Fund at Kisii Sub-Region

Since necessary budget for constructing structural measures is not allocated to Lower Gucha Migori WRUA at Kisii sub-region, it is planned to assist for this fund.

Personnel concerned at Lower Gucha Migori sub-region have become aware through the capacity building of the WRUA members that evacuation system should be requisite for this region in the manner of level-raised evacuation places, toilets and wells as the structural measures and evacuation training as non-structural measures, since the flood has caused inundation in vast areas in this region.

Under such acknowledgement, WRUA members got information that toilets of the school in this region would be arranged by “World Vision”, and they negotiated with the World Vision and successfully modified the existing toilets to be level-raised structures.

Arrangement of the evacuation places was applied to the “grass-root grant aid” of the Japanese Embassy, and the Project Team assisted in this aid by delivering manual for fund-raising having been prepared for Nyando Project, rendering instruction to prepare the manual and showing the sample of level-raised evacuation place being constructed at Lower Lumi WRUA of which cost is cheaper than that for Nyando Project. Although any result of the assistance has not come out yet, it can be identified that the personnel concerned in Kisii sub-region of WRUA have reached understanding as to the fund acquisition from not only WSTF but also foreign donor by themselves.

Chapter 6 Institutionalization of Knowledge Management in WRMA

In this project, flood damage reduction and "Resilience" enhancement is implemented by developing the flood management in Kenya through the capacity development for WRMA and WRUA. In order to make it true, WRMA and WRUA should perform, and then it obtained the new various information, findings or lessons learnt from the performance results. It will be necessary to establish the scheme of feedback information, findings or lessons learnt to the next step.

Good practice or bad practice will be nourishments for improvement and development by making it reference for next activities. Unless there are no knowledge management such as arrangements and storage of information, findings or lessons learnt, the information etc. will be scattered and lost, and same failures will be repeated unless learning from bitter experiences.

Development of the "Knowledge Management System" as a scheme of the activity feedback-system is required. Based on this, the project team implemented to establish the scheme to store the activity experience and lessons learnt of WRMA-RO and SRO in community level with quick and accuracy in WRMA HQ.

6.1 Current Situation and Problems of Knowledge - Information Management in WRMA -

6.1.1 Present Situation of Knowledge – Information Collection and Usage in WRMA

The "Knowledge" mentioned in this chapter means the systematically arranged condition of scattered information by order of each relevancy. In order to make the flood management operation efficient, it required that information should be systemized and newly valued information such as findings or lessons learnt could be feedback to the next step.

The knowledge image WRMA has is shown below.

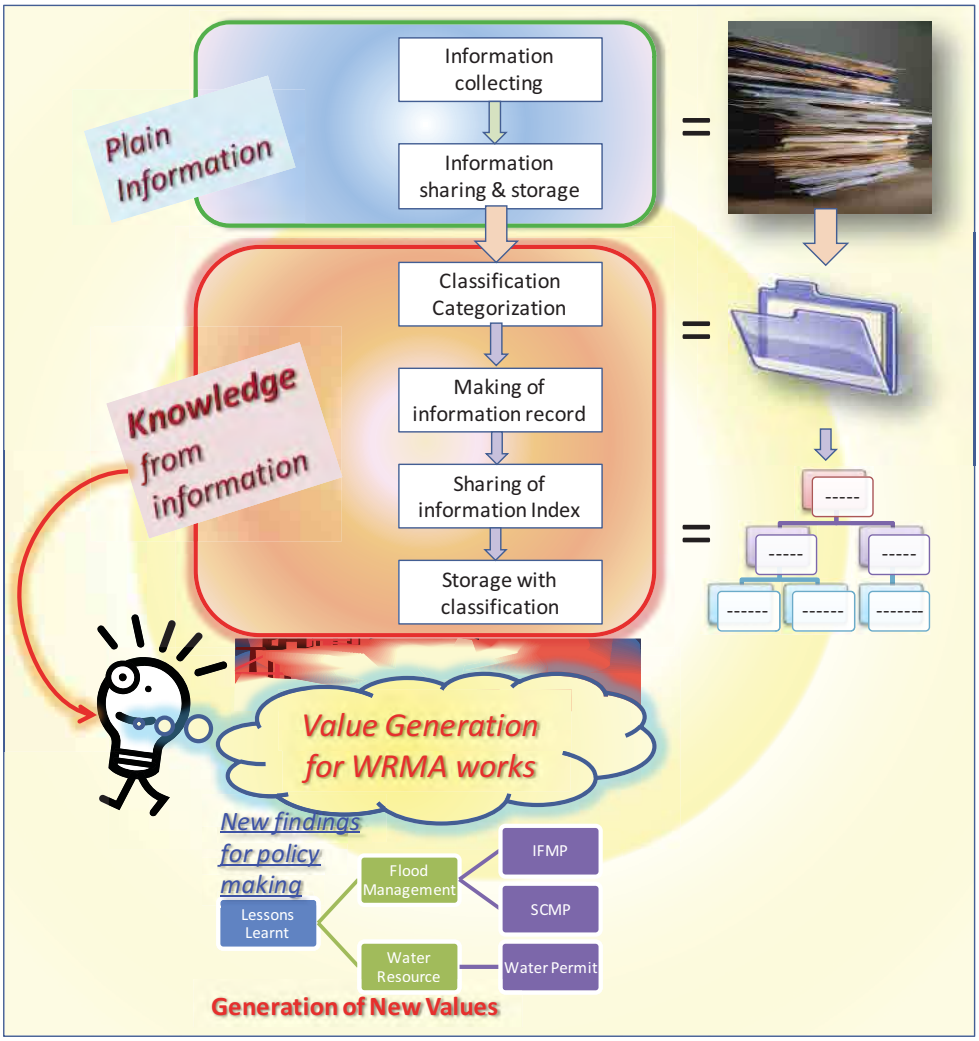


Fig. 6.1-1 The image of "Knowledge" for WRMA

(1) Current situation of integrated information in WRMA

According to "ANNUAL WATER RESOURCES SITUATION REPORT 2012-2013" published by WRMA and interview to WRMA staff, the collected information are shown below.

- Water permit
- Water Resource
- Aquifer
- Water quality
- Rainfall
- Underground water level
- Borehole

This information is basically integrated as table format on paper materials. And also part of this information is stored in the Database as electronic data.

(2) Information usage in WRMA

Information usage and flow in WRMA can be explained as follows by referring the example of PDB (Permit Database) developed for water permit operation.

Table 6.1-1 The example of knowledge and information flow in WRMA（Water permit）

Step	Procedure
Step 1:	The client picks the forms from WRMA SRO and fills with assistance from WRMA staff;
Step 2:	The client makes payment at the accounts office in the WRMA SRO,
Step 3:	The WRMA staff at SRO does data entry using the filled forms,
Step 4:	The WRMA staff at SRO exports the data sheet (filled information) to WRMA RO via email,
Step 5:	The WRMA staff at RO confirms the specifics on the data sheet are appropriately filled,
Step 6:	The WRMA staff at RO thereafter converts the data sheet into not-editable format (soft copy permit) and then sends to Nairobi,
Step 7:	The WRMA staff at HQ consolidate all the not-editable data sheet in the database
Step 8:	After one week of exporting to RO that is send back via email, the WRMA staff at SRO imports the soft copy permit that is in a compressed folder that has a password that the database officer has;
Step 9:	The WRMA staff at SRO shares the softcopy of the permit with WRMA SRM.
Step 10:	WRMA SRM prints the softcopy permit and signs and hands back to database officer
Step 11:	the database officer calls the client who picks the signed hard copy permit

The outline of flow is shown below.

First of all, the client picks the forms from WRMA SRO and fills (Step1), and then makes payment (Step2). WRMA staff types the information on the form and prepare the data sheet (Step3). The data sheet will be sent from SRO to RO via e-mail with attached file (Step4). RO will confirm and modify according to necessity (Step3). RO will send the sheet to WRMA Head Quarter after the confirmation (Step 6). At the Head Quarter, data sheets sent from ROs of Kenya nation will be integrated and entered into the database (Step7).

After one week from the transmittal from RO to Head Quarter, Head Quarter will send back the integrated data sheet to RO and SRO via e-mail with attached file (Step8). SRM also can share the information (Step9). SRM will make hard copies of this permission information and then sign (Step10). The staff in charge will call the client and hand the document copy (Step11).

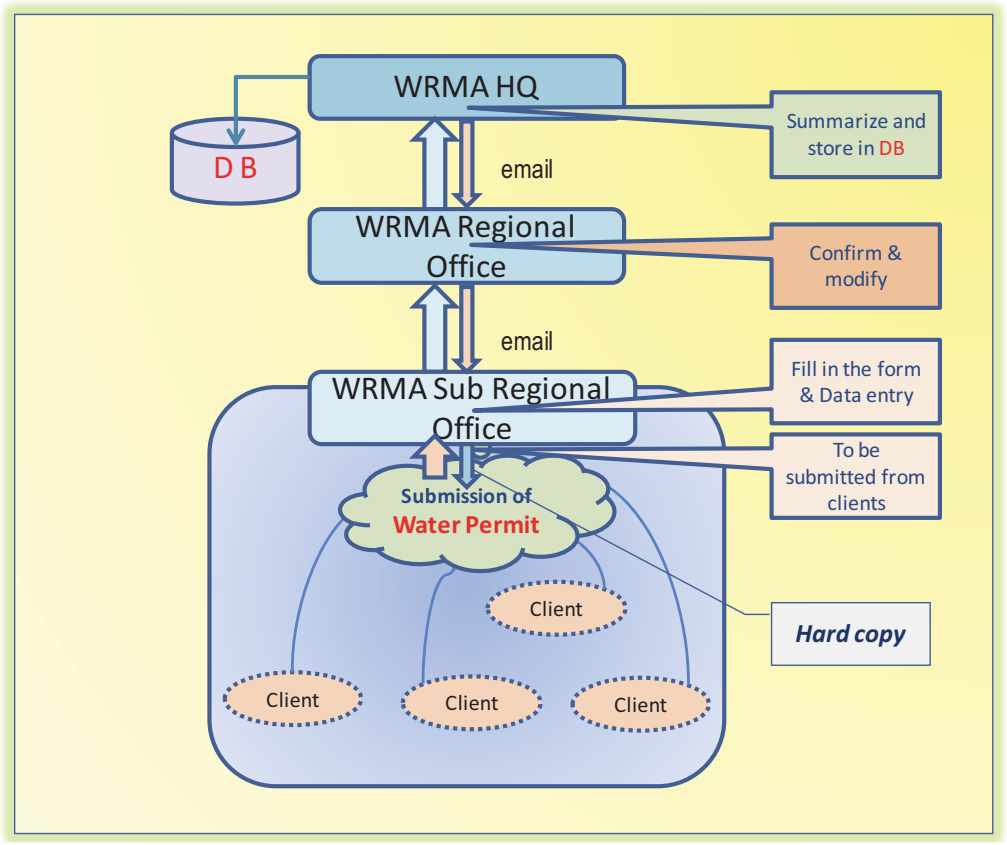
Water Permits issued with Effluent conditions during the FY 2012/13

S/No.	Name of Effluent Discharger	Type of Effluent treatment plant	GPS Coordinates		Locality	Point source category	Permit No.	Date of issue	Receiving water body	Class
1.	Narok district hosp	lagoon	E35.86983	S01.08528	Narok	Effluent	WRMA/20/NAR/2KA/10090 /E	26/6/2013	Ewaso Ngiro through a lagoon	
1.	Tenwek Hospital	Conventional			Bomet County		WRMA/12/KCO/1LA1/69/E	26/6/13	R. Nyangores	C
2.	KEWASCO	Pond system			Kericho town		WRMA/12/KCO/1LA1/68/E	26/6/13	R. Dionsoyet	C
3.	Universal	Septic	Long	Lat	Kikuyu	FC2	WRMA/30/NRB/	14-10-	Nairobi	B

Source: WRMA:"ANNUAL WATER RESOURCES SITUATION REPORT 2012-2013"

Fig 6.1-2 The image of data sheet

Illustrated image of the information flow is shown below.



Source: Interview to WRMA staff done by the Project Team

Fig 6.1-3 Information flow in "Water permit" operation

Furthermore all information is stored in the database on the server of Head Quarter, on the other hand, the information sent from Head Quarter is stored in the PC belongs to the staff in charge in SRO and RO as compressed data. The paper material of water permit with SRM's sign will be numbered according to the following rule for management, and then will be stored in the shelf located in the storage room of SRM.

7) Send the information to RO copy to HQ-FMU by email

6) Enter the information data into the Data storage sheet

5) Make reports

4) Bring the information back to office

Fig. 6.1-4 Rule for allocation of management code

The shelf for storage

A scene of people at work

Fig. 6.1-5 The storage room and shelf

Observation information previously mentioned such as water quality, rainfall and groundwater level are collected by different method, but all of them are entered by SRO staffs in charge from the information described on papers. The information flow after this entry process is almost same manner as "Water permit" procedure. Other information is stored as documents in various places without unification.

WRMA try to exchange the information from rural areas to electronic data and store in database, and then facilitate the information sharing and effective use by unification in Head Quarter. Concerning observation information, WRMA extract the information for operation use, then they utilize for reporting or data analysis. Concerning the information of "Water permit", WRMA implement the process such as conversion of documents to electronic data, information integration, and storage into database through the procedure of "Permit" in SRO, RO and Head Quarter. After the final permission at Head Quarter, the information will be back to RO and SRO. The information management is practiced in the procession flow of "Permit". By operation of this information management scheme, WRMA can confirm the income information based on "Water permit", and compile the budgets, and utilize the information to operation planning.

6.1.2 Problems to be solved in the Knowledge - Information Collection and Usage in WRMA

The problems to be solved in the knowledge – information collection and usage in WRMA are shown below.

(1) Problems in collection of Knowledge - Information

- The information for flood management are not collected in the same method of other information
- The problems on the structure of observation or data check -missing or mistakes on transcription-
- Establishment of work model and stylized task

(2) The problems on the usage of Knowledge - Information

- There are time lags in the Knowledge – Information between HQ and the rural office such as SRO or RO, and data updating delayed.
- Reference of various materials such as books, reports, manuals or technical standards is required.

6.2 Knowledge Management System to be established in WRMA

6.2.1 Planning of Knowledge Management System Development for WRMA

According to the current situation and problems in WRMA as previously described, WRMA stored various kind of information. For instance, in the part of "Water permit", the tasks from information collection to information sharing and storage between each office are securely established through the operation process. However in the field of flood management operation, there are no work models or management processes.

Then, in order to establish Knowledge Management System to be required in WRMA, the approach will be necessary shown below.

- Preparation of "Knowledge" by reorganizing and systemizing the collected information.
- Establishment of work model for flood management and analysis by storing necessary information

At first, in order to practice of first point, the conversion scheme of information to knowledge will be organized. And then, in order to practice of second point, the collection and sharing scheme of flood situation as necessary information and operation model will be organized. In the organization of operation model, the contents of survey will be stylized in order to make the flood survey operation routine business. Furthermore in the organization of operation model, the existing operation model and management process in WRMA will be followed their procedure. Specifically, the scheme of information use and application for "Water permit" scheme will be modified in order to apply for flood management.

And also it will be necessary to establish the scheme for downloading the information from the server in Head Quarter so that the time lag in information sharing via e-mail as described

above will be small.

In this way, by establishing 2 types of schemes, the necessary information for flood management will be stored, and these information will be systemized and then established as "Knowledge". And the findings and lessons learnt will be brought by the discussion or analysis on them based on the "Knowledge". The findings and lessons learnt will be feedback to the next measures or planning.

The current situation of information use and application flow in WRMA operation, and conception diagram of "Knowledge Management System" are shown below. Development of "Knowledge Management System" will be completed by "Knowledge" preparation based on the establishment of operation model in the field of flood management information use and application, and also establishment of information systemization.

(Current situation)

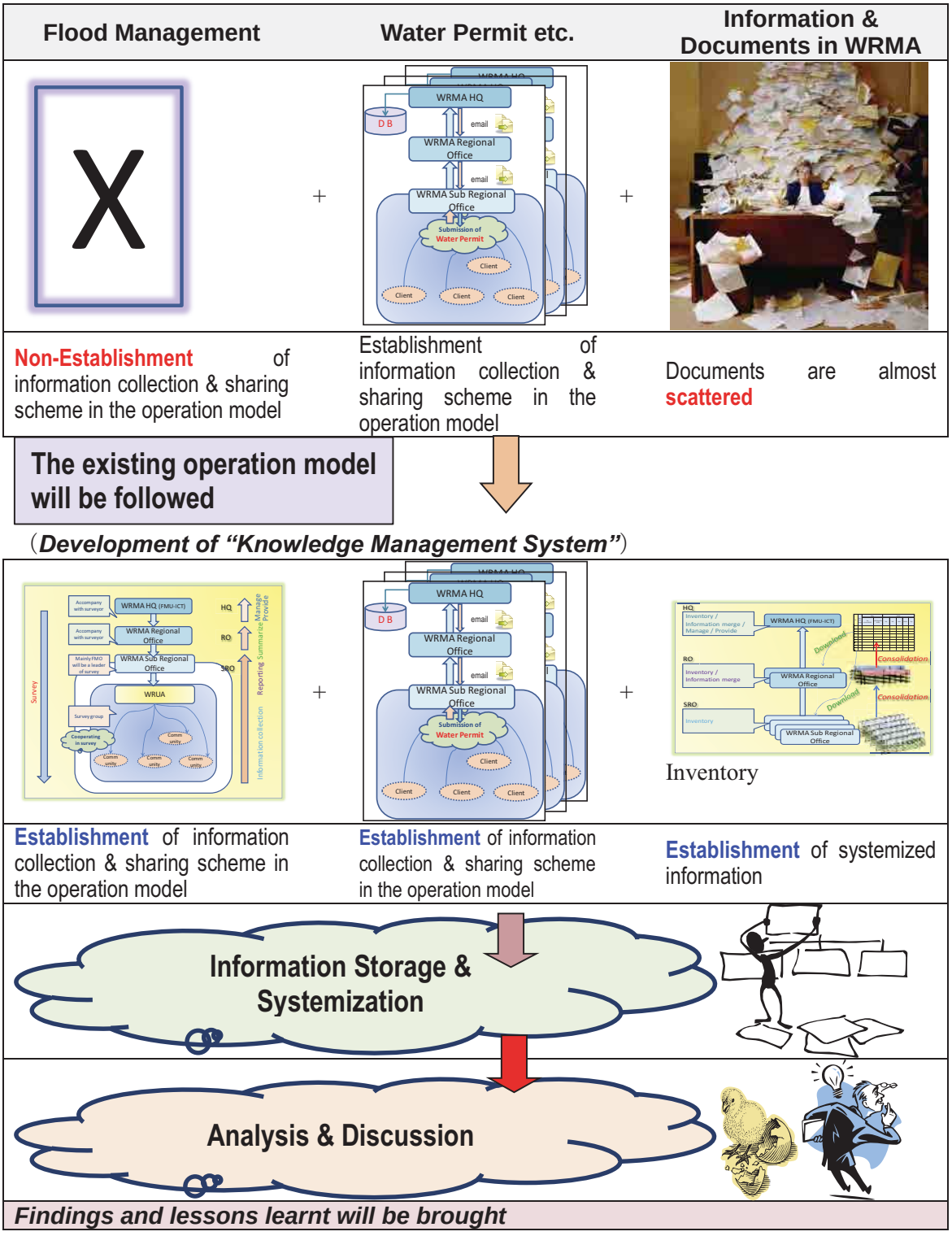


Fig. 6.2-1 Concept of "Knowledge Management Development"

6.2.2 "Knowledge" Preparation by Reorganization and Systemization of Stored Information

For preparation, scattered information should be arranged by time order, category and relevancy. Namely, conversion of information to "Knowledge" will be aimed. According to this, the findings and lessons learnt will be brought from the stored information.

(1) **Main objective**

If the documents that WRMA possesses can been seen easily, it could contribute to operational efficiency. In addition, if WRMA can share those documents within whole the organization, "Information" could be converted to "Knowledge" because WRMA staffs could raise the common sense of useful contents and could refer the documents to make paper or reports efficiently.

For instance, when there are some documents that WRMA staff would like to refer, if the staff could not know the exact title of the documents, it will take a long time to obtain or read the documents with searching on shelves. And sometimes WRMA staffs might give up obtaining the information. In this way, there are some cases that cannot be reached the information, and that is true situation of WRMA.

Situations like this can be improve sufficiently without development of the library database, by implementing classification of documents genre such as "Large", "Middle" and "Small", by description and managing the inventory. .

(2) **Way of thinking in documents management**

Documents can be managed as follows. The management flow and each action item are shown as Fig. 6.2-2

(a) Determination of documents classification

This idea is to make it clear of exact location of documents in the stack. Classification is defined as following table. Furthermore the class "Small" is able to be changed according to the storage progress by addition, deletion and replacement.

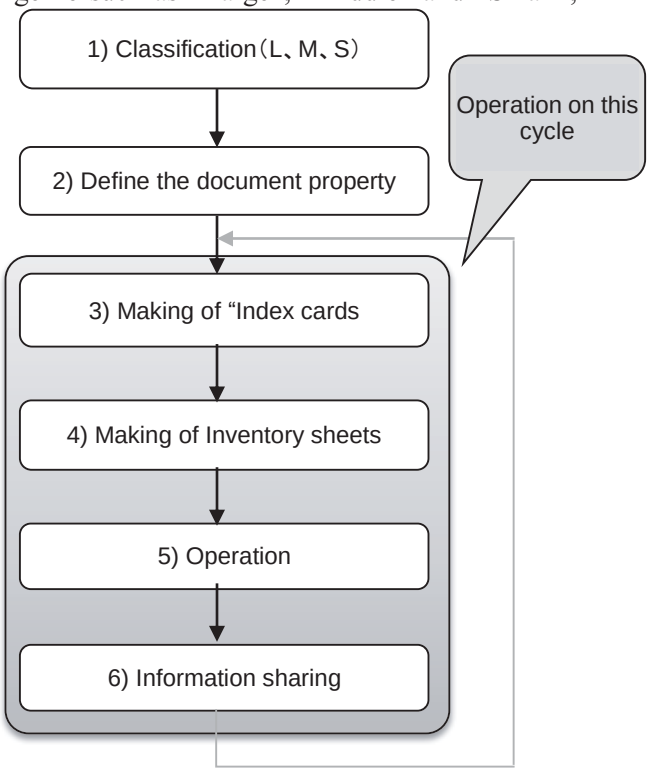


Fig.6.2-2 Documents management flow

Table 6.2-1 Candidate words for classification

Candidate words for Class. Large	Candidate words for Class. Middle	Candidate words for Class. Small
General book,	Natural science	Meteorology
		Geomorphology
		Analytical chemistry
		Microbiology
	Social science	Population, Land, Resources
		Manners and customs
		Education
Technical document,	Water resource	Surface water
		Groundwater
		Water allocation
	Irrigation	
	Flood	Countermeasures
		Flood management plan
Administrative document,	CMS	
	Service charter	
	Development plan	
	Catchment management plan	
Business report,	Investigation report	Flood survey
		Drought survey
	Internal report	
Publicity material,	Brochure	
	Newsletter	
	Bulletin	
Statistical book/Year book,	Annual report	Hydrological year book
	Almanac	
Observational data,	Water level	
	Rainfall	
Legal document,	Water	Water act
	Environment	
	Agriculture	
Licensing document,	WSTF	
	Water resource	
Human resource,	Performance contract	
	Training	Training book
		Evaluation record
Instruction manuals	General	
	Water resource	WDC
	Irrigation	
	Flood	WDC
	Community	WDC
Newspaper,	General	
	Water resource	
	Irrigation	
	Flood	
	Community	
Others		

(b) Determination of document properties

It is necessary that documents can be referred actually in addition to be stored in shelves. In order to do that, systemization of document properties and preparedness of properties to be able to access the target document will be necessary.

The project team established the following categories as the document properties in consideration that WRMA is an organization focusing on the water resource matters.

Each property item and their data format are shown below.

Table 6.2-2 Property item

No	Property item	Data format	Remarks
1	Title	in words	
2	Author	in words	
3	Publisher	in words	Publishing organization
4	Relevant area	in words	
5	Owing office	in words	
6	Administrator	in words	
7	Year of Issue	yyyy	
8	Date of acquisition	dd/mm/yy	
9	Format	in words	
10	Language	in words	
11	Classification Large	in words	WRMA can modify. It means WRMA can add, delete or replace the words for classification according to operating situation
12	Classification Middle	in words	
13	Classification Small	in words	
14	Keywords	in words	
15	Remarks	in sentences	

(c) Establishment of Index cards

Labeling will be required to manage documents, and then index card will be necessary. Especially, in order to store the documents in the shelves, the index cards classified by colors of “Large” classification category should be prepared. And then colored partitions according to “Middle” classification category will be put between each boundary of document bundles of each category.

(d) Establishment of management ledger

In addition to existing documents, there will be some removable or additional documents by progress of the time. In order to comprehend the actual situation of documents, the document information will be managed by using spread sheets like “Excel”. The sheet for management is shown below.

Table 6.2-3 Screen of management ledger

Explanation of information to be entered	Document name	Name	Name	Enter the relevant word according to "National, Catchment, Sub-catchment and River basin"	Enter the relebant word according to "HQ, Athi, Ewason'giro, LVS, Kisumu, Loitokitok, Isiolo etc."	Name	Enter the year	Enter the date, month and year of acquisition	Enter the media type	Enter "English" or "Swahili"	Enter the suitable word for classification "Large" Please refer the tab named "Classification details"	Enter the suitable word for classification "Middle" Please refer the tab named "Classification details"	Enter the suitable word for classification "Small" Please refer the tab named "Classification details"	Enter 3 keywords. (Available to use free words)	Enter free sentences.
Data type	in words	in words	in words	in words	in words	in words	yyyy	dd/mm/yy	in words	in words	in words	in words	in words	in words	in sentences
Item No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Item name	Title	Author	Publisher	Relevant area	Owing office	Administrator	Year of Issue	Date of acquisition	Format	Language	Classification Large	Classification Middle	Classification Small	Keywords	Remarks
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
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20															
21															
22															
23															
24															
25															
26															
27															
28															

(e) Operation

Concerning the data entry, a record that is to say as "Row" in spread sheets will be added when WRMA obtain a new document. And then the WRMA staff will enter the relevant information in cells for every category. Applying this kind of sheets can make WRMA to narrow down the location of documents by using the classifications mentioned above such as "Large", "Middle" and "Small".

And also, WRMA staff can search the target document by sorting records "Rows" according to relevant category. It is possible to access the target documents by using the "search" function with "Key word" that spread sheet has.

(f) Information sharing

This spread sheets will be prepared basically at every storage point of documents such as "HQ", "RO" and "SRO". After the completion of documents rearrangement by labeling or index preparation, the information sharing can be established within the point.

Expansion of this information sharing scheme to whole WRMA can be implemented by sending each sheet from each office to WRMA HQ, completing the integrated management ledger and replacing the electronic file of ledger. One month interval for replacement will be efficient, and the new record will be sent from each office to WRMA HQ for addition via e-mail with attaché file.

After the procedure described above, WRMA staff can repeat the cycle that a staff make a new index card for newly obtained document and then revise the information.

6.2.3 Flood Survey

There are 2 major rainy seasons in Kenya, and various flood as large or small have occurred. Hence WRMA should establish the "IFMP" -Integrated Flood Management Plan- , and then implement the activities continuously. In order to revise this "IFMP" appropriately, it will be necessary to efficient analysis flood "Cause & Effect" led by yearly climate changes. The records of flood occurrence situation and the flood effects is necessary for the analysis, and the project team established the scheme of flood survey implementation as follows. The procedure of survey is shown below.

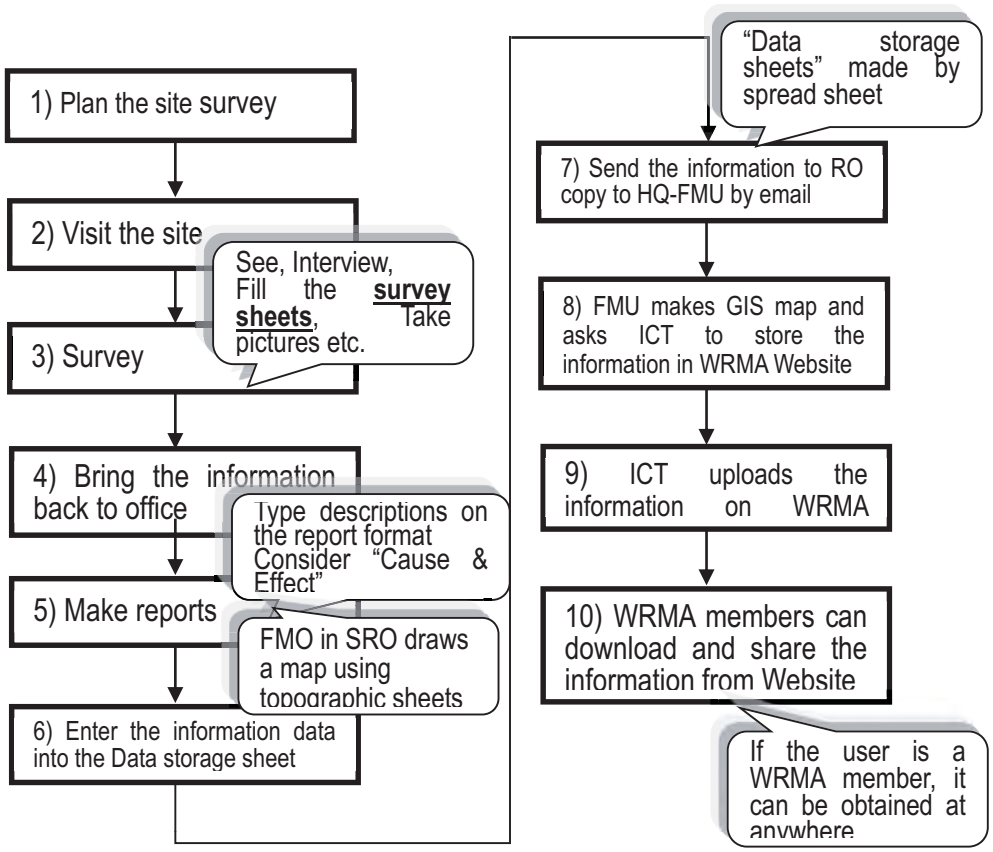


Fig 6.2-3 The procedure of flood situation survey

(1) **Survey planning -preparation of survey-**

After the flood occurrence, when it considered that site condition is sufficiently safe, survey crew can plan of activities at site and prepare. The important point is guarantee of cooperative residents concerning interview or pilot. Survey team will communicate with WRUA, County and school members in advance, and then will prepare the action plan and negotiation to local community members. And it will be very important to comprehend the site location information by planning from maps etc.

Furthermore it will be impossible to visit all affected site. The survey team should ask WRUA to implement local survey. Especially some WRUA has "CFMO - Community driven Flood Management Organization -" as a sub organization, and this organization is expected to be a supporter for site survey.

The structure of survey is shown below.

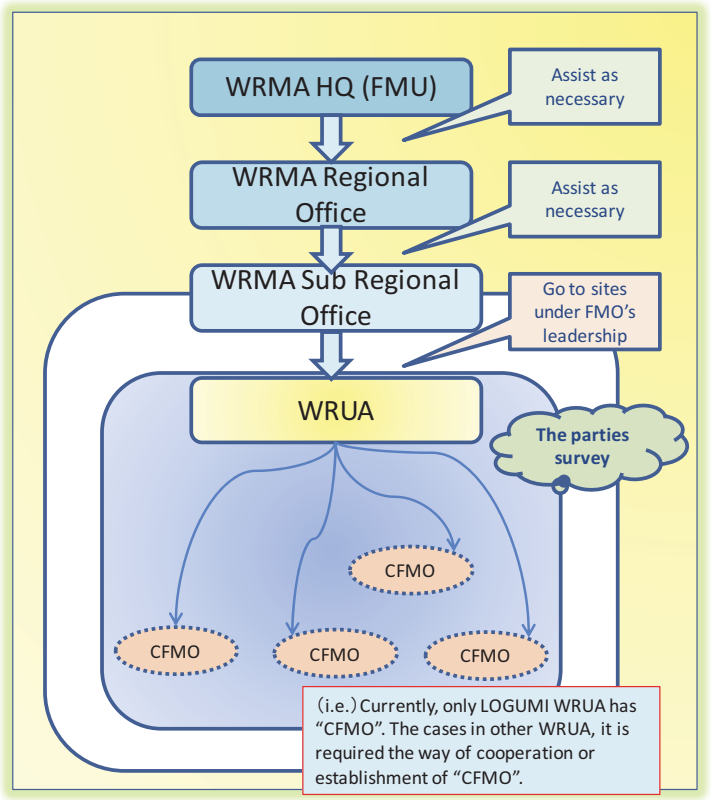


Fig 6.2-4 The implementation structure for flood survey

(2) **Transportation to actual site**

After the survey planning, the survey team member will move to the site.

(3) **Site survey**

In order to comprehend the flood situation, the survey team member collect the information and write down on the survey sheets by interviewing, measuring, taking pictures and drawing etc.

The disaster information to be managed as "Knowledge" is shown below.

Table 6.2-4 Disaster information to be managed as Knowledge

No.	Information item	Description	Remarks
1	Surveyor	Name of surveyor, Affiliation -WRMA XXX SRO XXX-	Basically, done by WRMA staff. Sometimes done by WRUA member.
2	Survey Area	County, District, Location, Sub-location and Village	
3	Survey Date	Date of implementation	Starting date and Ending data
4	Survey Schedule	Actual schedule for site visiting and investigation	Record the date and visited place along the timeline
5	Duration of Flood	The interval between the flood start and end	
6	Location map	Maps of the site, sketch map or drawing etc.	Use geographical map or free hand drawing
7	Target place and details Interview Sheet	Questionnaire	Use 1 sheet by1interview
8	Any Findings on "Cause & Effect" of the flood and damage	The information or analysis of "Cause & Effect" concerning the flood	Free description
9	Any Other Remarks	Relevant any other information to the flood	Free description
10	Pictures	Various pictures taken at the actual sites such as damages in river related facilities, the situation of affected area	Describe the caption under the picture

Questionnaire "Flood survey sheet" is shown below.

Flood Survey sheet

1. Surveyor _____WRMA XXXXX Office
2. Survey Area County: _____

District: _____

Location: _____

Sub-location: _____

Village: _____

3. Survey Date Day: From to Month: _____ Year: _____
4. Survey Schedule

Date, time	Visiting sites	Accompanying person

5. Duration of Flood: From: Day: ____ Month: _____ Year: _____

To: Day: _____ Month: _____ Year: _____

6. Location map (show areas inundated and depth of inundation, if information acquired)

Draw or Attach map below (Including free hand drawings)

Caption

Fig. 6.2-2 Flood survey sheet -Part1-

7. Target place and details Interview Sheet (use one sheet for each interview)

Name of Village		**Location and sub-location**	

Item	**Description**
Detail of Flood situation	
When did inundation start	Date:_____ Hour: _____
How deep?	
How long?	
Flood Damage	
Casualties	
Damages to infrastructures	
Damage to crops and live stocks	
Others	
Evacuation	Did you evacuate? Yes/No
(If Yes) Where?	
With whom?	
Difficulty encountered?	
Are there any activities against flood in your community?	Yes/No
(If Yes) What kind of activities?	
Effective or not against this flood	

Fig. 6.2-3 Flood Survey sheet -Part2-

8. Any Findings on "Cause & Effect" of the flood and damage

Free description

9. Any Other Remarks

Free description

10. Pictures

Picture	*Picture*
Caption	*Caption*

Fig. 6.2-4 Flood Survey sheet –Part3-

(4) **Taking out of collected information**

The survey team takes out the collected information at the site to relevant WRMA office.

(5) **Preparation of the report**

The survey team will organize the survey sheets brought back from the site and prepare the survey report. Basically, in addition to the original information such as "Water level" or "Inundation duration", the analysis about the "Cause & Effect" will be filled in the format on the sheet, and then it will be stored as electronic data after the addition of pictures.

The map of the survey site will be organized by "FMO" belongs to SRM by using the

topographic map. At the office that survey member belongs, the staff of SRO will make hard copies of processed questionnaires and then deliver the documents to survey members and chairman of WRUA.

(6) **Information entry into data sheet**

WRMA staffs make the sheet to be able to inform floods frequency a year or five years, their characteristics and damages. And also WRMA staffs will fill the information continuously.

The data sheet is shown below.

Table 6.2-5 Data sheet for survey record

No.	Date of survey (dd/mm/yy)	Surveyor		Survey Area					Flood Duration			Flood Type (Flash/ River/ Stormwater/ Lake)
		Name ex) Mr. or Ms. XXXX XXXXX	ex) XXX Sub-Regional Office XXX WRUA	County	Sub county	Location	Sub-location	Village	Start	End	Flood duration	
1												
2												
3												
4												
5												
6												
7												
8												
9												

Any Findings on "Cause & Effect" of the flood and damage	Maximum depth (m)	Water level upstream	Approx. affected area (Km2)	Casualties	Infrastructure Damages	damage to crops and livestocks	Total Number of Affected Residents	Any other remarks

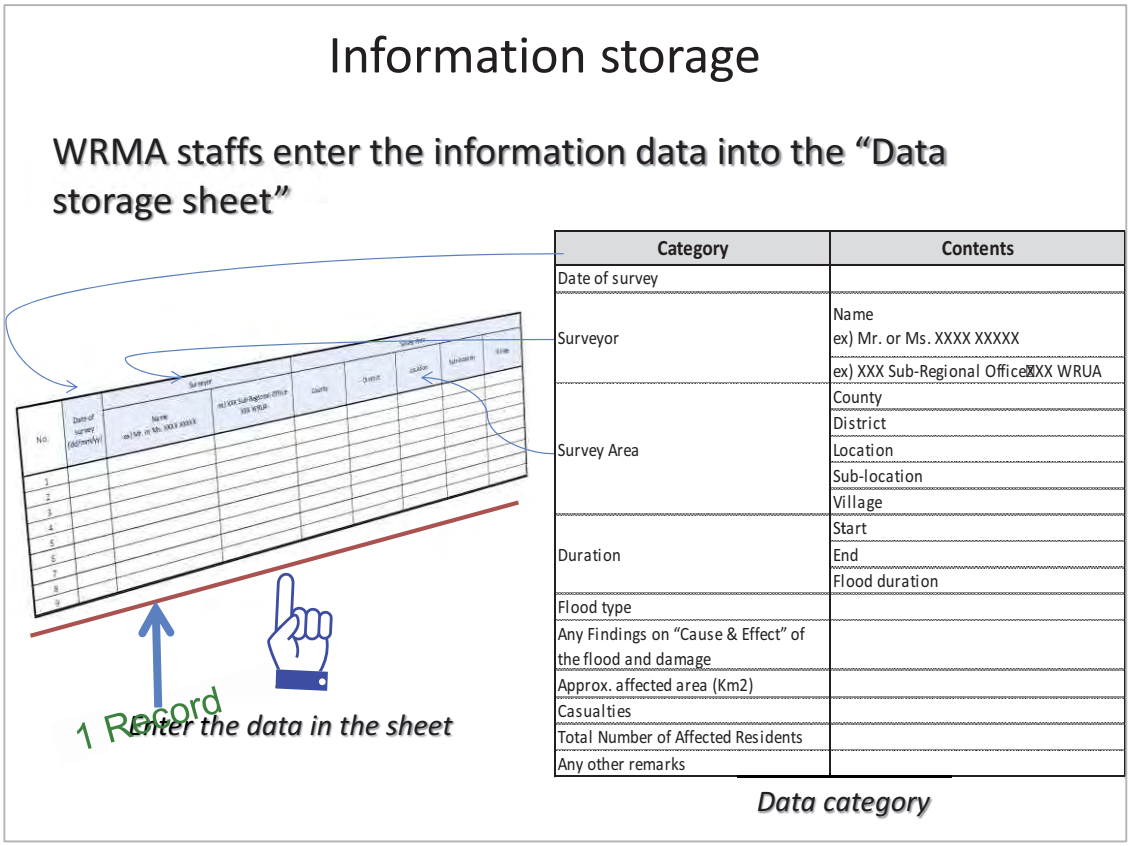
(7) **Data transmission to Head Quarter and FMU**

WRMA FMO exchanges the report to pdf format, and then sends it to RO and FMU of Head Quarter via e-mail

(8) **Data storage**

FMU staffs will check the reports from each area office. Then after the confirmation, FMU staffs hand the data files to ICT department. The ICT officer will store the data files in the reserved sector of WRMA server.

Data storage will be implemented by using the data sheet mentioned above. This data sheet is developed based on the spread sheet. This sheet stores the information by the categories as "Column" almost common with the "flood survey sheet" explained above. And this data sheet will store the information of 1 flood survey sheet in a line "Row" as 1 record. The data storage image is shown below.



Category	Contents
Date of survey	
Surveyor	Name ex) Mr. or Ms. XXXX XXXXX
	ex) XXX Sub-Regional Office XXX WRUA
Survey Area	County
	District
	Location
	Sub-location
	Village
Duration	Start
	End
	Flood duration
Flood type	
Any Findings on "Cause & Effect" of the flood and damage	
Approx. affected area (Km2)	
Casualties	
Total Number of Affected Residents	
Any other remarks	

Fig. 6.2-5 Data storage image

The categories for stored data are "Date", "Surveyor", "Survey area", "Duration", "Flood type", "Any findings of 'Case & Effect'", "Affected Area (Km2)", "Casualties" and "Total number of affected residents" etc. except maps or photos. SRO staffs will collect the information concurrently with survey, then RO staffs will merge, and then finally FMU will integrate and store the information to one sheet.

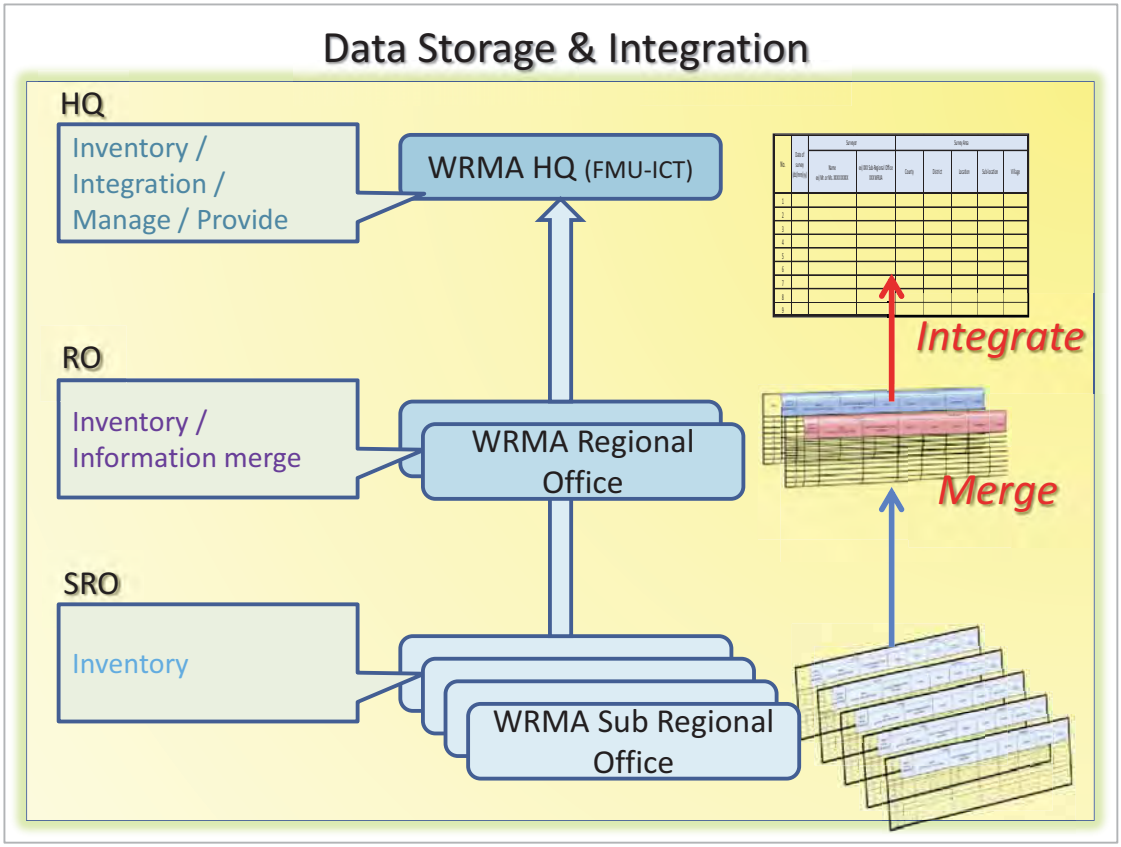


Fig. 6.2-6 Data storage and integration

In this way, if the information from each survey sheet will be integrated and accumulated as records, then the users can utilize this information effectively by summarizing for various purposes. For instance, by using the function of sorting, there are some activation methods like the analysis for the flood situation in particular target area or the extraction of the characteristics of each flood type etc.

(9) **Data uploading to WRMA Website**

ICT department develops the web page for downloading the stored files by using the interface of "WRMA website". The new information will be uploaded to the web page whenever newly-arrived report comes.

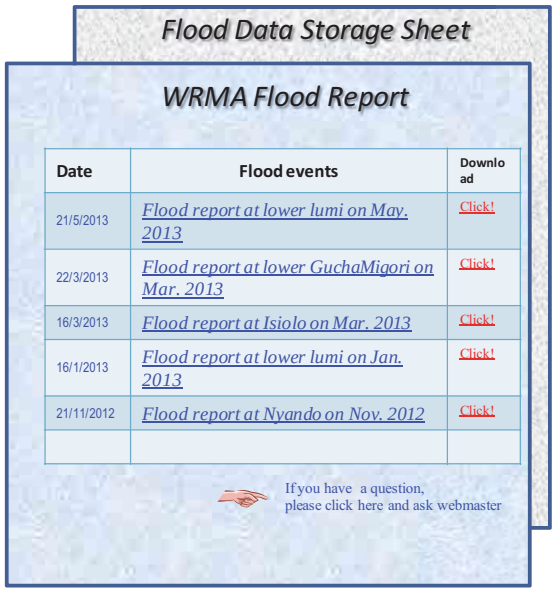
(10) **Data sharing**

WRMA staffs can access the concerned web page and then search and download the target report from the list. Then WRMA staffs can share the information. This page should be accessible only for WRMA staffs for the reason of security.

Currently, at the period of June 2014, WRMA website includes the sub site named "WRMA Intranet" that only WRMA staffs can use. In order to develop actual information downloading site, it will be better to prepare the screen shown below.

Source: WRMA Web site (www.wrma.or.ke)

Fig. 6.2-7 WRMA Intranet



WRMA flood information report download system.

By using the Interface like this, users can obtain and share the report file in pdf format.

It will be available to provide the data stored in spread sheets like "Excel".
In this case, WRMA FMU should manage the information by collecting and integrating the data for spread sheets use.
But, FMU can easily comprehend the flood information.

Fig. 6.2-8 Down loading screen of WRMA flood information report

6.2.4 Implementation Structure -Project Team Structure-

The implementation structure of the "Knowledge Management System" development is shown below.

WRMA DTCM (Deputy Technical Coordination Manager) will take a role of project director. ATCM (Assistant Technical Coordination Manager) belongs to WRMA Head Quarter or RO that manage the pilot area in this project will take a role of implementation promoters. WRMA SRM (Sub Regional Manager) will take a role of Implementation promoter for rural area. WRMA FMO (Flood Management Officer) will take a role of information collectors.

Table 6.2-6 Project team structure

Role	Personnel in charge					
Project director	DTCM HQ					
Implementation promoter	ATCM HQ	ATCM HQ	ATCM HQ	ATCM Athi RO	ATCM Ewaso Nyiro RO	ATCM LVS RO
Implementation promoter for rural area	SRM Loitokitok		SRM Isiolo		SRM Kisii	
Information collecting	FMO Loitokitok		FMO Isiolo		FMO Kisii	

(N.B.) DTCM：Deputy Technical Coordination Manager, ATCM：Assistant Technical Coordination Manager, SRM：Sub Regional Manager, FMO：Flood Management Officer, HQ：Head Quarter, RO：Regional Office

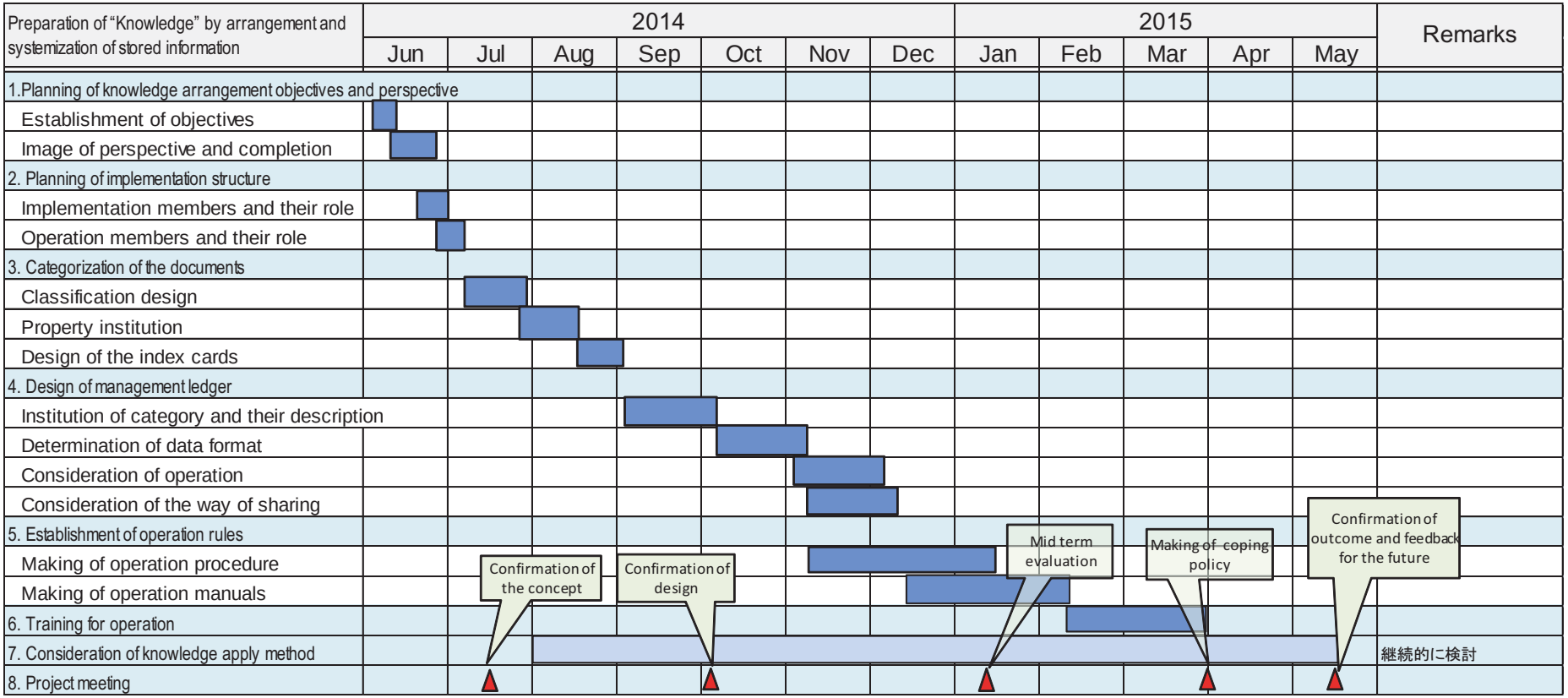
6.2.5 Implementation Schedule

Implementation schedule of "Knowledge Management System" development is shown below.

(1) **Preparation of "Knowledge" by arrangement and systemization of stored information**

In the plan, arrangement of "Knowledge" within a year is the aim of implementation. The objective for implementation is a systematic management of information that WRMA possess, and the development of information systems that can withdraw ideas or lessons learnt by reading or analyzing necessary documents for operation. By setting the check points as July, October, January and March, then the member will discuss about this, and then will review the feedback to the next step after confirming the outcome from the trial.

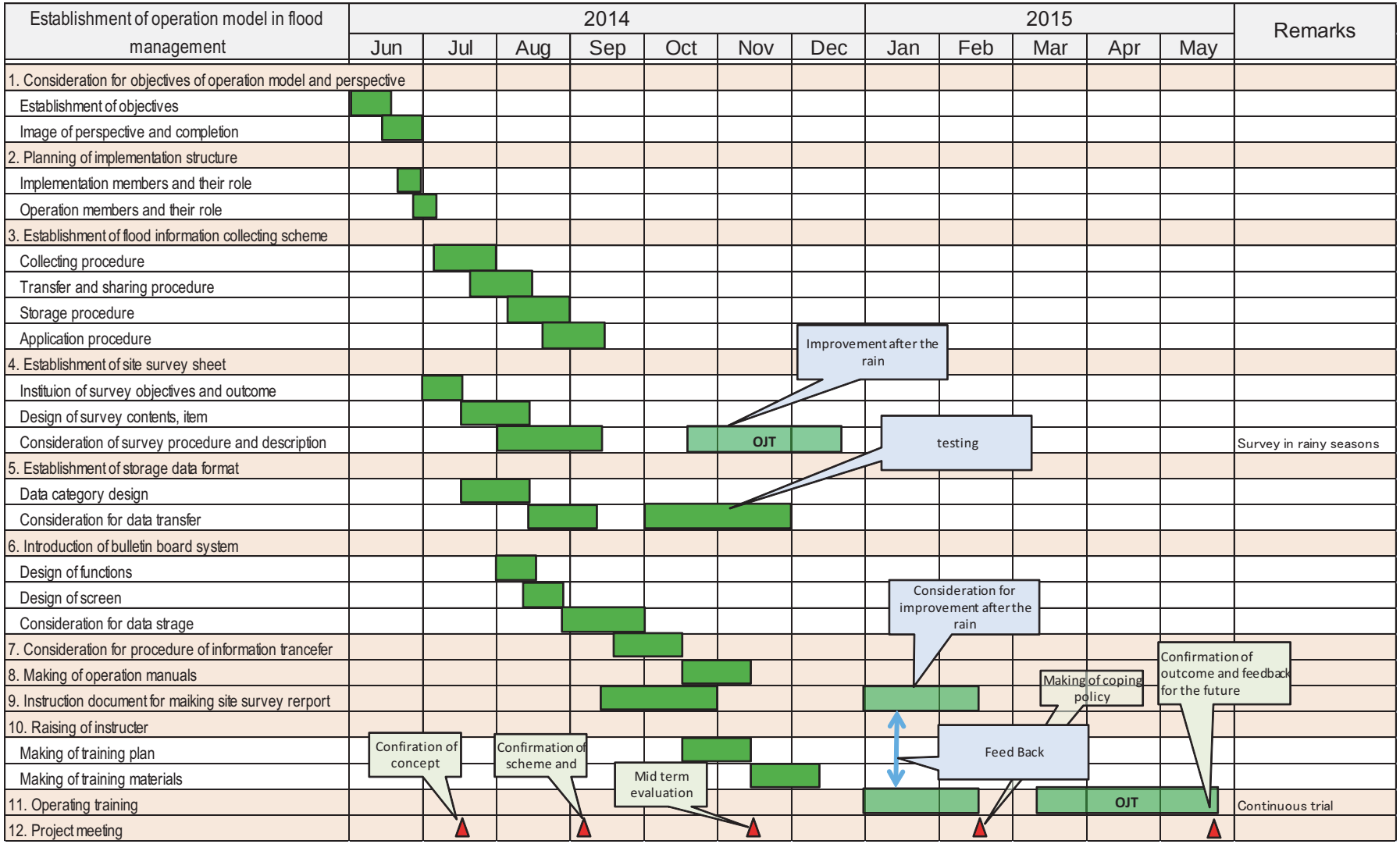
Table 6.2-7 Schedule -preparation of "Knowledge" by arrangement and systemization of stored information-



(2) **Establishment of operation model in flood management**

In the plan, ensconcing the operation model in WRMA organization within a half year by testing in the scheme of OJT (On the Job Training) is the aim of implementation. The objective for implementation is an establishment of the operation model that can share, collect and analysis the information of floods that previously WRMA could not store by implementing the survey to comprehend flood situations. By setting the check points as July, October, January and March, then the member will discuss about this, and then will review the feedback to the next step after confirming the outcome from the trial.

Table 6.2-8 Schedule -Establishment of operation model in flood management-



6.3 Extraction and Sharing of Lessons Learnt from the Activity Experience in Nyando River Basin

The research information of the activities such as the activity records or influences after the floods in Nyando river basin as a preceding case of this project are not stored systematically in WRMA. Therefore the project team extracted the lessons learnt from the activities in Nyando river basin, and then tried to share them from February to March, 2014. In this section, the trial is explained as followings.

6.3.1 Process until the Extraction of Lessons Learnt

The extraction of lessons learnt will be done by collecting the information from the interview to local residents, WRUA and WRMA members that attended the project because it takes long time from the end of the project. The project team focused on the flooding damage that will be easy to remain in people's mind, and then made the brain storming concerning the past damage situation. Then the project team arrange the information and analyzed to extract the lessons learnt. The works until the extraction of lessons learnt was done by leading of Mr. Omuya who is a Kisumu Sub Regional Manager at WRMA LVS Regional Office with the member of the project team. Implementation flowchart is shown below.

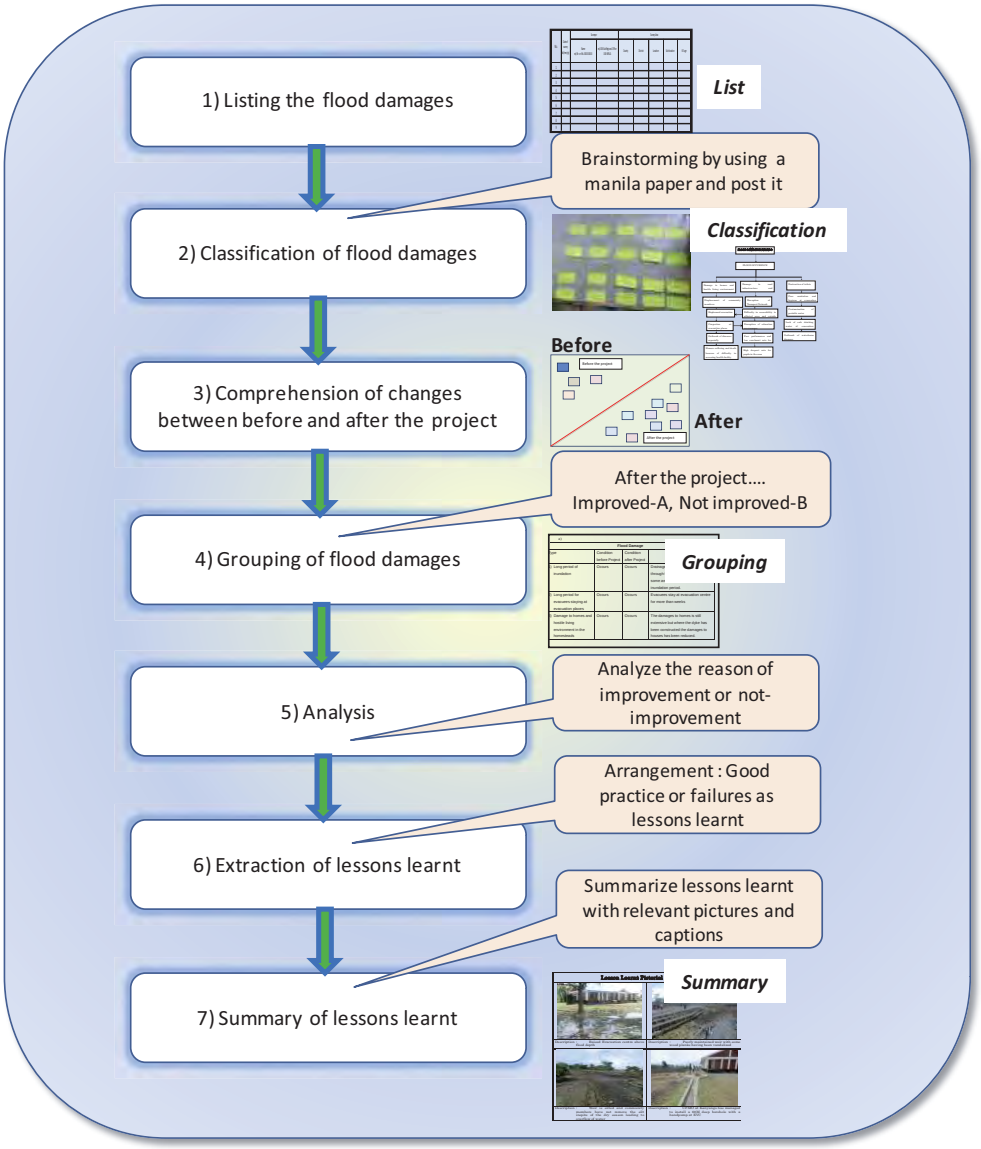


Fig. 6.3-1 Flowchart of extracting lessons learnt

1) Listing up of flood damages
First of all, the working member listed the recent flood damages up specifically, each member wrote down the flood damage situations that remembered on A6 sized paper, and then each member stuck on a big manila paper.

2) Classification of flood damages
Glance over the damages stuck on the manila paper, put the same meanings description into same place, and then classified by putting together as representative damage category.

3) Comprehension of flood damages between before and after of Nyando project
The members focused on the out breaking period of flood damages, and divided the damages to the damages before Nyando project and the damages after the Nyando project.

4) Grouping of flood damages

The members considered the damages whether improved or not after the Nyando project, and then carried out the grouping.

5) Analysis

The members carried out the evaluation analysis of each damage from the view point of influence provided by Nyando project. In the improved cases, the characteristics of improvement are described after the discussion about the reasons based on the influences of Nyando project. Otherwise, each characteristic are described by doing discussion in same manner.

Table 6.3-1 Results of flood damage analysis

Flood Damage			
Type	Condition before Project	Condition after Project	Remarks
1) Long period of inundation	Occurs	Occurs	Drainage has improved in the area through food for work activities but some areas still experience long inundation period.
2) Long period for evacuees staying at evacuation places	Occurs	Occurs	Evacuees stay at evacuation centre for more than weeks
3) Damage to homes and hostile living environment in the homesteads	Occurs	Occurs	The damages to homes is still extensive but where the dyke has been constructed the damages to houses has been reduced.
4) Displacement of community members	Occurs	Occurs	Community members get displaced but after the project in places where dykes were constructed it has reduced
5) Congestion at evacuation places	Occurs	Rarely	Congestion at evacuation places has reduced by construction of evacuation centres.
6) Outbreak of diseases especially waterborne	Occurs	Sporadic	Outbreak of diseases has reduced by virtue of improved sanitation and hygiene at evacuation places.
7) Human suffering and death because of difficulty in accessing health facility	Occurs	Sporadic	Human suffering and death at evacuation places has reduced because of improved accessibility for evacuees and response oriented stakeholders.
8) Damage to road infrastructure and inundation of the roads with flood water	Occurs	Occurs	Damage to road infrastructure still occurs but has reduced due to improved drainage.
9) Disruption of Transport Network	Occurs	Occurs	It still occurs but has reduced in magnitude due to constructed culverts, footbridges and vehicular bridges.
10) Hazardous evacuation	Occurs	Rarely	Community members have been empowered by evacuation drills that have been implemented in the area.
11) Difficulty in accessibility to affected area and outside world	Occurs	Rarely	It has reduced because of improved accessibility for evacuees and response oriented stakeholders.
12) Disruption of education programmes	Occurs	Rarely	It has reduced because of evacuation centres in the area that has enables pupils to use their classrooms
13) Poor performance and low enrolment rate for pupils	Occurs	Rarely	This has since improved with improved enrolment in primary schools
14) High dropout rate for pupils in the area	Occurs	Reduced	Because of reduce interruptions of school activities the dropout rate has reduced.
15) Destruction of toilets	Occurs	Occurs	Destruction of toilets is on the decrease as community members adapt to constructing raised toilets.
16) Poor sanitation and hygiene at evacuation places	Occurs	Reduced	Sanitation and hygiene has improved because of the constructed toilet facilities at evacuation places.
17) Contamination of portable water	Occurs	Occurs	Flood water still contaminates the open shallow well dug in the homes.
18) Lack of safe drinking water at evacuation places	Occurs	Reduced	Drilling of borehole and installation of raised apron and hand pump has enable availability of clean water
19) Damage to farmlands by crops being washed away	Occurs	Occurs	Still occurs because community members have encroached riparian lands
20) Loss of livestock and properties	Occurs	Occurs	Still occurs because community members do not evacuate until the flood water starts flowing into the village.
21) Food insecurity	Occurs	Occurs	This has improved because of the stores at evacuation centre and storage facility where community members can store their food.
22) Lack of food leading to dependence on relief aid	Occurs	Occurs	CFMOs have planted banana trees at evacuation places and they had been trained on preparation of emergency food.

Flood Damage			
Type	Condition before Project	Condition after Project	Remarks
23) Loss of sources of livelihood	Occurs	Occurs	Still occur but at a reduced rate because affected families can still access their farmlands and markets.
24) Lack of capacity to deal with flood	Occurs	Reduced	Has been drastically reduced because of the training on community based flood management.
25) Enhanced human suffering during floods	Occurs	Reduced	It has reduced because of the evacuation drills and basic first aid training.
26) Reduced human resilience against floods	Occurs	Reduced	There has been improvement on the resilience because of the trainings but resilience to floods is still very low.
27) Stagnated economic growth	Occurs	Occurs	Because of low resilience against floods the cyclic stagnation of economic growth is still experienced.
28) Disruption of the social activities like funerals and wedding	Occurs	Occurs	Because of improved accessibility disruption of social activities has reduced.
29) Delay in burial of the dead leading to Inability of the bereaved family to settle burial expenses which leads to Social, emotional and psychological trauma which causes Social problems and vices	Occurs	Occurs	Delay in burial as a result of inundation is still common.
30) Damage to riverbanks leading to Widening of the width of the river which implies increased points of hotspots for floods which leads to extended area that is affected by floods and therefore more or increased number of people affected by floods	Occurs	Occurs	This is still common in the area.
31) Lack of places to evacuate to leading to congestions	Occurs	Reduced	This has reduced drastically as a result of construction of evacuation centres and improvement of evacuation places.
32) Destruction of the flood control structures like dykes	Occurs	Occurs	This has reduced and the dyke constructed in 2007 under pilot project is yet to be breached.
33) Destruction of drainage system	Occurs	Reduced	This has improved as a result of food for work initiatives.
34) Destruction of houses	Occurs	Occurs	This is still common but in areas where dyke has been constructed has been reduced.
35) Cyclic pattern of poverty leading to high rate of poverty	Occurs	Occurs	Poverty is still high in the area

6) Extraction of lessons learnt

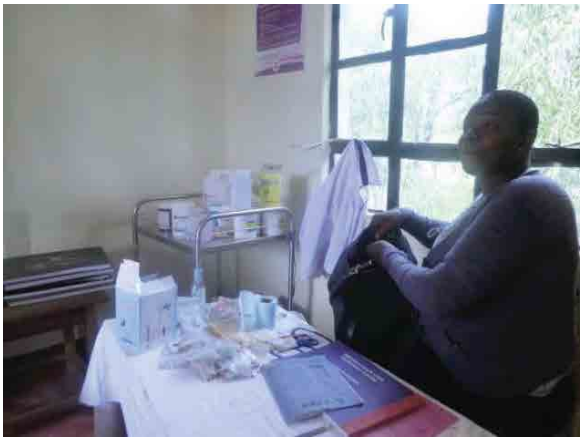
The members implement the works to extract the lessons learnt from the characteristics based on the rearrangement. WRMA has many pictures after the end of Nyando project, and then the members compared the characteristics previously mentioned with these pictures, and also matched the lessons learnt with the pictures.

7) Summarize of lessons learnt

Summary is done by connecting the lessons learnt and representative pictures in order to make them easy to obtain the concrete image.

Table 6.3-2 Results of summarize of lessons learnt

Lesson Learnt Pictorial Description	
	
Description: Raised Evacuation centre above flood depth	Description: Poorly maintained weir with some wood planks having been vandalized
	
Description: Weir is silted and community members have not remove the silt inspite of the dry season leading to overflow of water	Description: CFMO at Kanyango has managed to install a 60M deep borehole with a handpump at EVC
	
Description: Well-maintained water tank that is used for drinking in the village. CFMO charges Kshs. 2/- per 20Lts gallon	Description: Well-maintained EVC that hosted at least 200 flood affected persons in the last flood occurrence

	
Description: Development Partner from the MWI with rods for borehole O&M training for Kanyango CFMO	Description: Clinical Officer Posted at Storage facility that now acts as a health facility in Kowiti village
	
Description: Medical supplies stored at the health facility constructed as Storage facility being currently used as a dispensary	Description: Culvert has increased accesibility to Bwanda school but was damaged by heavy lorry
	
Description: Some Community members have adopted constructing raised toilets in their homes	Description: Culvert that has enhanced accessibility in Bwanda to Nyamthoi farmlands and markets even during flood occurrence

Description: In spite of constructed culvert community members still wade through water so long as river water levels are low

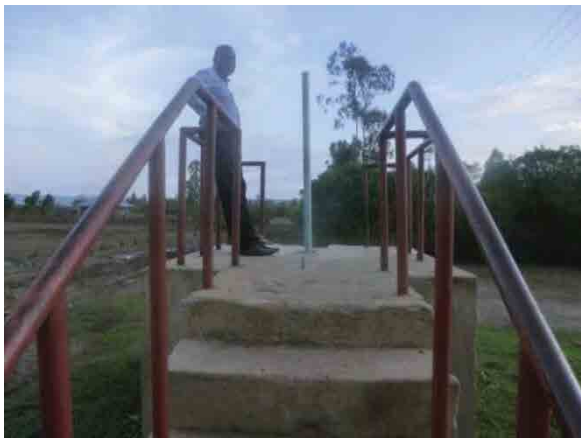
Description: Poorly maintained weir with some wood planks having been vandalized

Description: Community members cross the river via the raised culvert that has enhanced accessibility in Bwanda village

Description: Storage facility at Kanyilum village that community members are using as a health facility. It has 2 Clinical Officer stationed there

Description: Storage facility that acts as a health facility is infested by bees which community members have tried to terminate the bees but in vain

Description: Storage facility that community members are using as a health facility

	
Description: Borehole at Kanyilum village is damaged since Dec. 2013 is yet to be repaired though it had been repaired before but only once	Description: Toilets that the school pupils (girls), teachers and patients use but because the borehole is not repaired washing them demands that pupils
	
Description: Borehole at Kadika village was saline and is currently damaged and even though the CFMO were given spare tools they are yet to repair it	Description: Footbridge has enhanced accessibility in Kadika village. Before the Nyando Project the area was inaccessible during rainy season
	
Description: Borehole at Kojiem village hand pump was removed and kept at the chair's house for fear of vandalism after the bolt that holds the hand-pump to the slab was breached	Description: Breached Borehole installed in Kojiem Village before the NY Project near the borehole drilled during the NY Project has its hand-pump intact

	
Description: The evacuation route signboard kept at members home after vandalism attempt	Description: Evacuation centre signboard at evacuation place
	
Description: Community Flood Hazard map pasted on the big signboard, this kind of signboard was installed in all the twenty four villages	Description: Damage to houses as a result of floods still occurs

6.3.2 Sharing of Lessons Learnt

These results of analysis was shared at the workshop that held in WRMA Head Quarter on 8th April, 2014. And in the future, by applying the "Knowledge Management System", WRMA and the project team confirmed and agreed to facilitate the information and results of analysis sharing. The results of analysis will be included the knowledge system previously mentioned, and will be shared with WRMA Head Quarter as knowledge. These information or lessons learnt will be reflected to the revision of IFMP as the knowledge of "Cause & Effect of floods" after the various analysis. And then the knowledge will be made use of the community based disaster prevention activities conducted by local residents.

6.4 World Bank's Support of Flood Management and Water Resource Management

WRMA (Water Resources Management Authority) has other projects than this project being promoted by the cooperation with other donors.

Among others, WRMA has "Water Security and Climate Resilience Project" supported by World Bank, to which information management control by means of database and other methods as to hydrological information is applied.

Outline of "Knowledge Management System" incorporated in World Bank project and

relevant significant matters are introduced below.

According to WRMA's data of "Project Appraisal Document on a Proposed Credit in the Amount of SDR 103.4 million (equivalent to US$ 150 million) to the Republic of Kenya for a Water Security and Climate Resilience Project", the project fund is US$ 150 million with the project period of 7 years from October 1, 2013.

Contents of the data and a part of basic project information are as follows.

Table 6.4-1 Contents of WRMA's Data

I.STRATEGIC CONTEXT		
	A	Country Context
	B	Sectorial and Institutional Context
	C	Higher Level Objectives to which the Program Contributes
II.PROJECT DEVELOPMENT OBJECTIVES		
	A	PDO (Project Development Objective)
	B	Project Beneficiary
	C	PDO Level Results Indicators
III.PROJECT DESCRIPTION		
	A	Project Components
	B	Project Financing
	C	Program Objective and Phases
	D	Lessons Learned and Reflected in the Project Design
IV.IMPLEMENTATION		
	A	Institutional and Implementation Arrangements
	B	Results Monitoring and Evaluation
	C	Sustainability
V.KEY RISKS AND MITIGATION MEASURES		
	A	Risk Ratings Summary Table
	B	Overall Risk Rating Explanation
VI.APPRAISAL SUMMARY		
	A	Economic and Financial Analysis
	B	Technical
	C	Financial Management
	D	Procurement
	E	Environmental and Social Considerations (including Safeguards)
Annex 1	Results Framework and Monitoring	
Annex 2	Detailed Project Description	
Annex 3	Implementation Arrangements	
Annex 4	Operational Risk Assessment Framework (ORAF)	
Annex 5	Implementation Support Plan	
Annex 6	Investment Framework	
Annex 7	Context for Sub-Component 2.2	
Annex 8	Map of Lower Nzoia Irrigation Scheme	

Source: Project Appraisal Document on a Proposed Credit in the Amount of SDR 103.4 million (US$ 150 million equivalent) to the Republic of Kenya for a Water Security and Climate Resilience Project (June 18, 2013)

Table 6.4-2 Basic Information on the World Bank's Project (extracted)

Basic Information			
Project ID	Lending Instrument	EA Category	Team Leader
P117635	Investment Project Financing	A – Full Assessment	Gustavo Saltiel
Project Implementation Start Date		Project Implementation End Date	
01-Oct-2013		30-Jun-2020	
Expected Effectiveness Date		Expected Closing Date	
01-Oct-2013		01-Oct-2020	
Joint IFC			
No.			
Sector Manager	Sector Director	Country Director	Regional Vice President
Jonathan S. Kamkwalala	Jamal Saghir	Johannes C.M. Zutt	Makhtar Diop
Borrower : The National Treasury			
Responsible Agency : Ministry of Environment, Water and Natural Resources			
Contact	Robinson Gaita	Title	Director of Irrigation, Drainage and Water Storage
Telephone No.	254-20-2716103	Email	rkgaita@gmail.com

Source: Project Appraisal Document on a Proposed Credit in the Amount of SDR 103.4 million (US$ 150 million equivalent) to the Republic of Kenya for a Water Security and Climate Resilience Project (June 18, 2013)

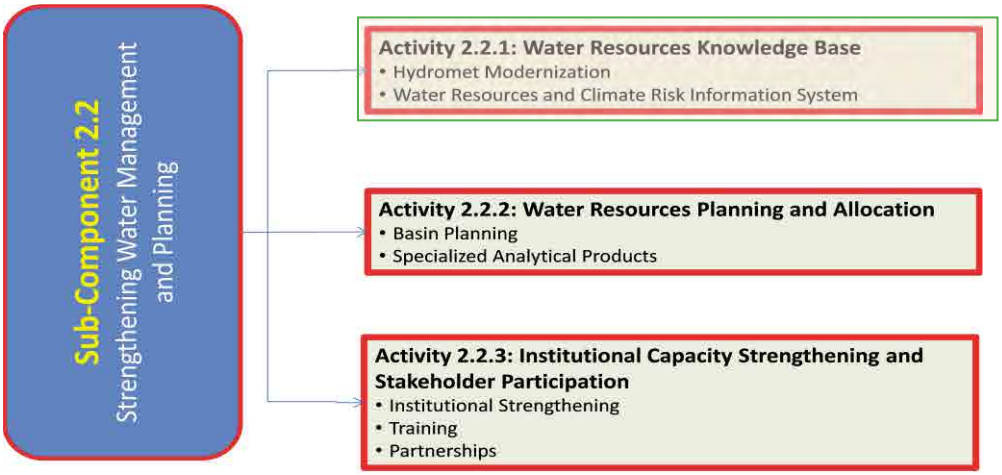
Above-mentioned information shows the project implementation components consist of with sub-components as follows. 3

Table 6.4-3 Composition of Project Implementation Components

Components and Sub-components	Financing				
	IDA	KfW	GoK	Ben	Total
Component 1: Water Resources Development	**76.8**	**20.0**	**6.5**	**1.2**	**104.5**
SC 1.1: Water Sector Investments – Lower Nzoia Irrigation Scheme Phase 1	*26.8*	*20.0*	*6.5*	*1.2*	54.5
SC 1.2: Water Investment Pipeline	*50.0*				50.0
Component 2: Effective Water Sector Institutions	**56.3**				**56.3**
SC 2.1: Support for Water Sector Transition and Reforms	*26.1*				26.1
SC 2.2: Strengthening Water Management and Planning	*30.2*				30.2
Component 3: Support for Project Implementation	**15.2**				**15.2**
Project Preparation Advance	**3.0**				**3.0**
Unallocated	**3.3**				**3.7**
Total	**155.0**	**20.0**	**6.5**	**1.2**	**182.7**

Source: Project Appraisal Document on a Proposed Credit in the Amount of SDR 103.4 Million (US$ 150 million equivalent) to the Republic of Kenya for a Water Security and Climate Resilience Project (June 18, 2013)

Out of the above-mentioned components, the sector relevant to "Knowledge Management System" is "Activity 2.2.1 – Water Resources Knowledge Base" in the "SC 2.2: Strengthening Water Management and Planning".



Source: Project Appraisal Document on a Proposed Credit in the Amount of SDR 103.4 Million (US$ 150 million equivalent) to the Republic of Kenya for a Water Security and Climate Resilience Project (June 18, 2013)

Fig. 6.4-1 Implementation Program of Sub-Component 2.2

This program aims at improving the water resources monitoring network for the purpose of supporting quick judgment of WRMA's water resources policy for the 6 (six) basins.

It is necessary to collaborate and arrange with the domestic relevant governmental organizations for WRMA to judge its policy, for which information share on water resources management among them is indispensable

In order to realize the above-mentioned tasks, the following specific measures are taken in the World Bank's project:

Hydro-met Modernization

Establishment of telemetering system in the monitoring network by refurbishing existing observatories and their new construction at some points so that the monitoring data can be obtained on real time.

Real-time Forecasting and DRM (Drought Risk Management) Decision Support System

Strengthening the forecasting capacity to enhance warning capacity and to give timely announcement for the purpose of improving the announcement condition of the hydrological information and advice

Water Resources and Climate Risk Information Systems (WCIS)

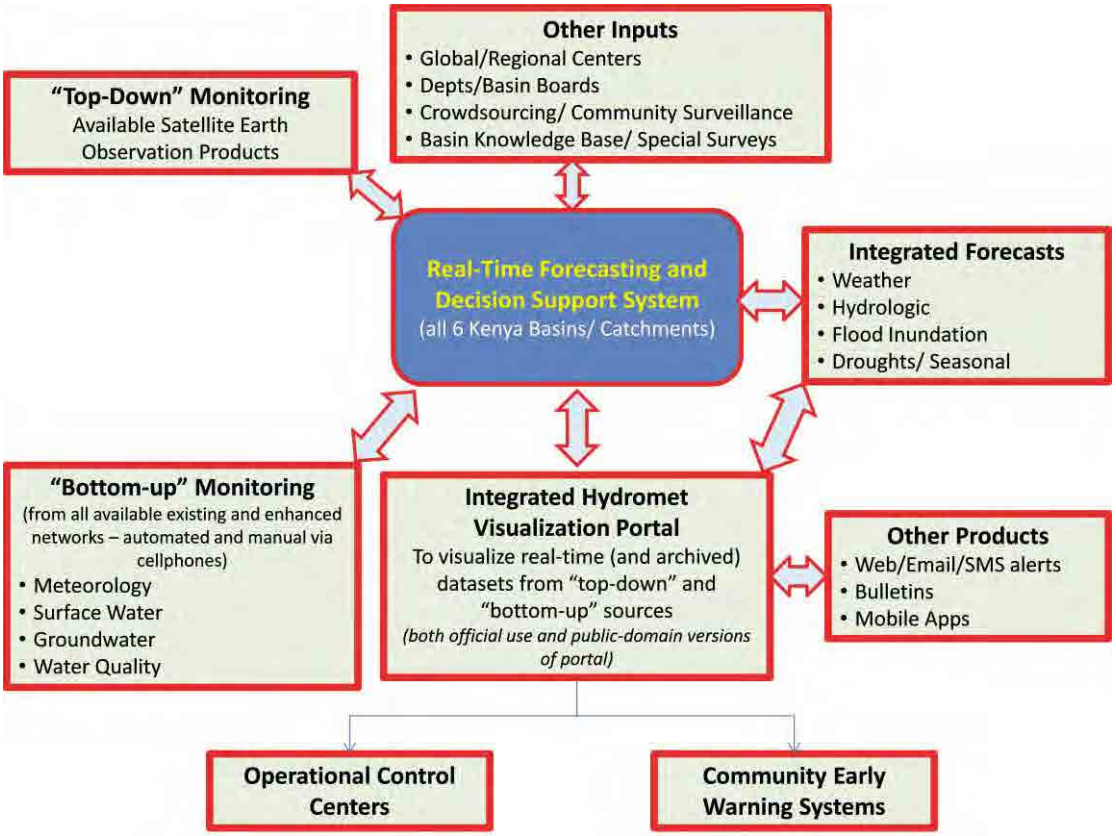
Establishment of water resources knowledge base among the governmental Organizations concerned by utilizing such information technology system as GIS (Geographic Information System) and DSS (Decision Support System).

Through the acquisition of those information systems, information-access method is to be arranged by intellective operation of map and portal site and so on

Following shows the image of linked data and function for proceeding with the above-mentioned measures in accordance with Activity 2.2.1.

"Real-Time Forecasting and Decision Support System" is circled by "Other Inputs", "Integrated Forecasts", "Other Products", "Integrated Hydro-met Visualization Portal", "Bottom-up Monitoring" and "Top-down Monitoring" in terms of respective function and interface.

Further, "Integrated Forecasts" deliver informative data as well as factors for the decision-making-support toward "Community Early Warning Systems" and "Operational Control Centers"

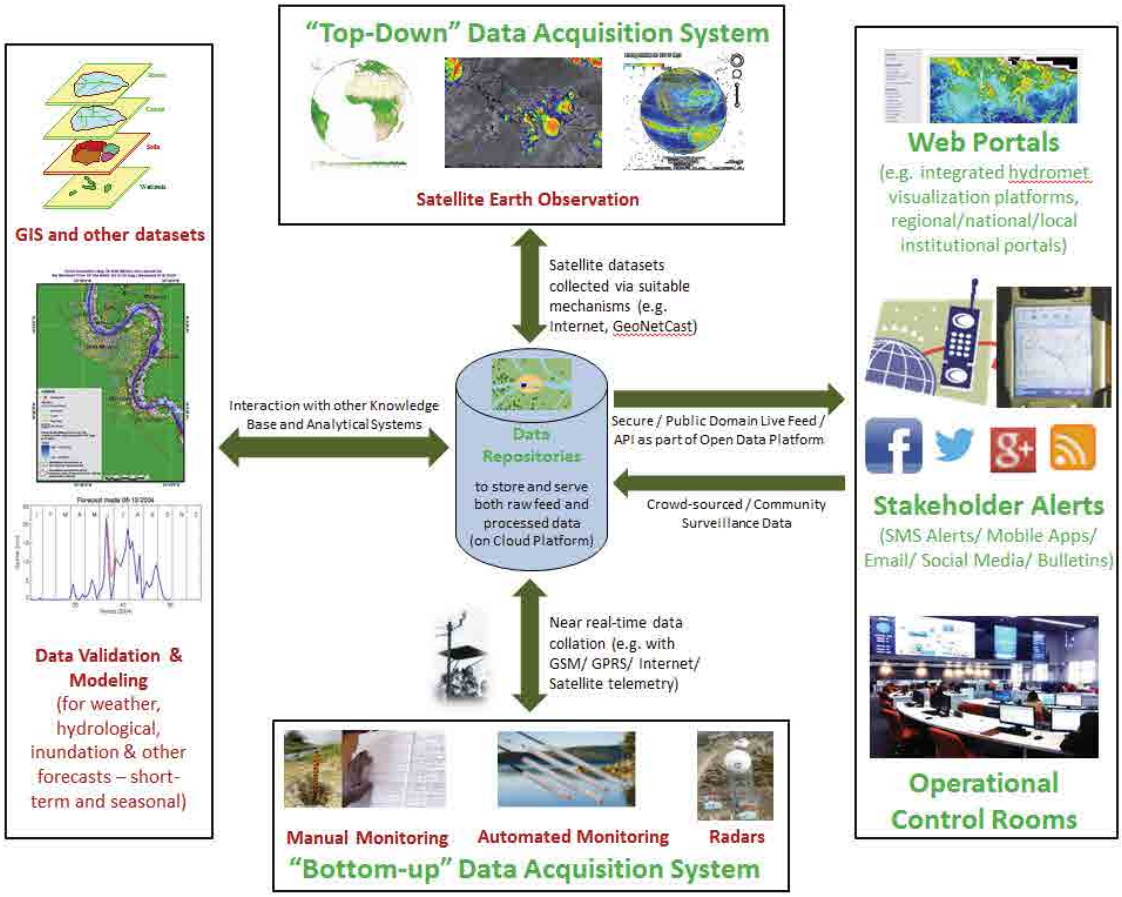


Source : Project Appraisal Document on a Proposed Credit in the Amount of SDR 103.4 Million (US$ 150 million equivalent) to the Republic of Kenya for a Water Security and Climate Resilience Project (June 18, 2013)

Fig. 6.4-2 Image of Linked Data and Function Derived from Activity 2.2.1

When reflecting above-mentioned Image to "Knowledge Management System" of this Project, "Community Surveillance" and "Basin Knowledge Bases" in the "Other Inputs" can be identical. "Flood Inundation" in the "Integrated Forecasts" can be unified through "Integrated Hydro-met Visualization Portal".

Based on the above Image, following shows relation between informative data and picture images.



Source: Standard Request for Proposals – Kenya Water Security and Climate Resilience Project : Implementation Support Consultancy for Sub-Component2.2 : Water Resources Planning and Implementation Support (March 2014)

Fig. 6.4-3 Relation between Informative Data and Picture Image

6.5 Recommendations

In order to implement the flood management works in WRMA, WRMA staff should comprehend the flood situations that will alter every year, and should take appropriate measures against the situations. The accurate analysis of flood "Cause & Effect" and consideration of efficient countermeasures will make the establishment of flood management plan against the current flood situation true. That is to say, to make the flows from flood information collection, arrangement, analysis, extraction of lessons learnt to the knowledge sharing to be inclusive into the routine operation, will be thought as the method for securing the institutionalization of "Knowledge management system".

Based on the description above, consideration related to the institutionalization of "Knowledge management system", 4 key points shown below can be pointed out.

- Routinize
- Recognition of necessity
- Recognition of advantage to use
- Providing incentive

The measures to be taken are categorized and the result is shown below by each key point.

Table 6.5-1 Key points and measures

Key point	Measures to be taken	Remarks
Routinize	Including "Knowledge management system" in the process of WRMA flood management operation and make it essential operation model. Establish the training course to understand the usage and ability of "Knowledge management system"	Making it closer matters Identified as the operation model
Recognition of necessity	Understanding the flood survey, analysis and information sharing for establishment of IFMP by using "Knowledge management system". 1. "Knowledge management system" is essential to revise and store the lessons learnt to train WRUAs	Proceed information sharing and storage, then make it necessary matters.
Recognition of advantage to use	Using "Knowledge management system" is making advantage to decision making of policy and budget. Information sharing provides the enhancement of motivation and knowledge to flood management.	Add values to flood management operation by WRMA
Providing incentive	Provide incentive by praising the best practice.	Implementation of PDCA cycle and obtaining the sustainability

In order to promote the institutionalization of "Knowledge Management System", "Knowledge Management System" should be raised up to be an essential tool for works as the description in the section of "Remarks" in the table mentioned above. And it is important that the value of "Knowledge Management System" will be high. For making it true, WRMA staff should implement site surveys and information collection positively, and make the stock of knowledge to be full. WRMA also should establish the meetings or workshops to present the outcome, and aims to enhance the value of the activity.

Chapter 7 Coordination with Other Donors

7.1 Coordination and Cooperation with GIZ

GIZ is conducting assistance to enhance the SCMP formulation by WRUA and one of the project target area is Lake Victoria South Catchment Area (LVSCA). The Project also determined Lower Gucha Migori Sub Catchment which is in LVSCA as a project target area. Therefore, GIZ and the Project Team coordinated and cooperated to formulate a SCMP and a flood management plan which will be a part of SCMP.

Following activities were conducted as coordination and cooperation.

- Exchange visit to Nyando River Basin and Lower Gucha Migori Sub Catchment
- Information sharing
- Trainer for the first stage training of the Project
- Attendance to the JCC and the workshop of the Project

7.2 Coordination and Cooperation with World Bank

World Bank has two projects which are related to flood management namely WKCDD&FMP and KWSCRP. Therefore, in order seek possibility of coordination and cooperation, the Project Team had met a Senior Water Resources Specialist of World Bank in charge of Kenya but not periodically.

7.3 Coordination and Cooperation with KRCS

From July 2012, based on the advice from the JICA Project Consultation Team, the Project Team determined the possibility of cooperation with KRCS for the implementation of pilot projects in particular communities. KRCS has a large number of volunteers in the whole country and work with them. The way of working with those volunteers is useful for sustainable community building. Especially the skills to involve communities to activities and training method to communities are strong points of them.

Finally, non-structural measures of community based flood management activities including disaster education in school, livelihood improvement and information dissemination part of Flood Early Warning System were contracted from JICA Kenya Office to KRCS and conducted by KRCS.

PART III

PROJECT ACTIVITIES FOR OUTPUT 2

PART III PROJECT ACTIVITIES FOR OUTPUT 2

TABLE OF CONTENTS

Chapter 1 Determination of pilot sub-catchments

Project Team evaluated candidates of the project target areas which were proposed by WRMA. In the result of discussion with WRMA at the first JCC meeting, Isiolo sub-catchment, Lower Lumi sub-catchment and Lower Gucha Migori sub-catchment were selected as project target areas (Pilot sub-catchments).

1.1 Organization of boundary area of water sector in Kenya

Firstly in this chapter boundary of water sector in Kenya was organized. WRMA and WRUA administrative areas and river basin, catchment areas are organized follows.

- Catchment Area: Catchment Area is defined by Water Act 2002 as follows.

> *In accordance with the national water resources management strategy, the Authority may by notice published in the Gazette designate a defined area from which rainwater flows into a watercourse to be a catchment area for the purposes of this Act.*

- Region: Administrative area of WRMA Regional Office which covers as same as Catchment Area
- Sub-Region: Administrative area of WRMA Sub-Regional Office
- River Basin: A river basin is an area of land drained by a river and its tributaries.
- Sub-Catchment: A sub-catchment is in charge of WRUA.

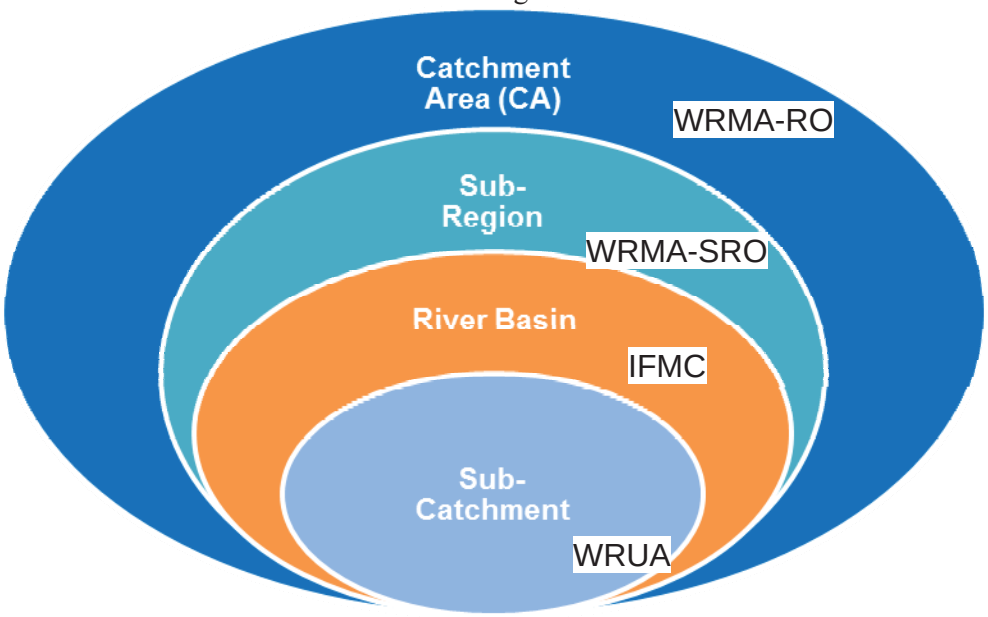
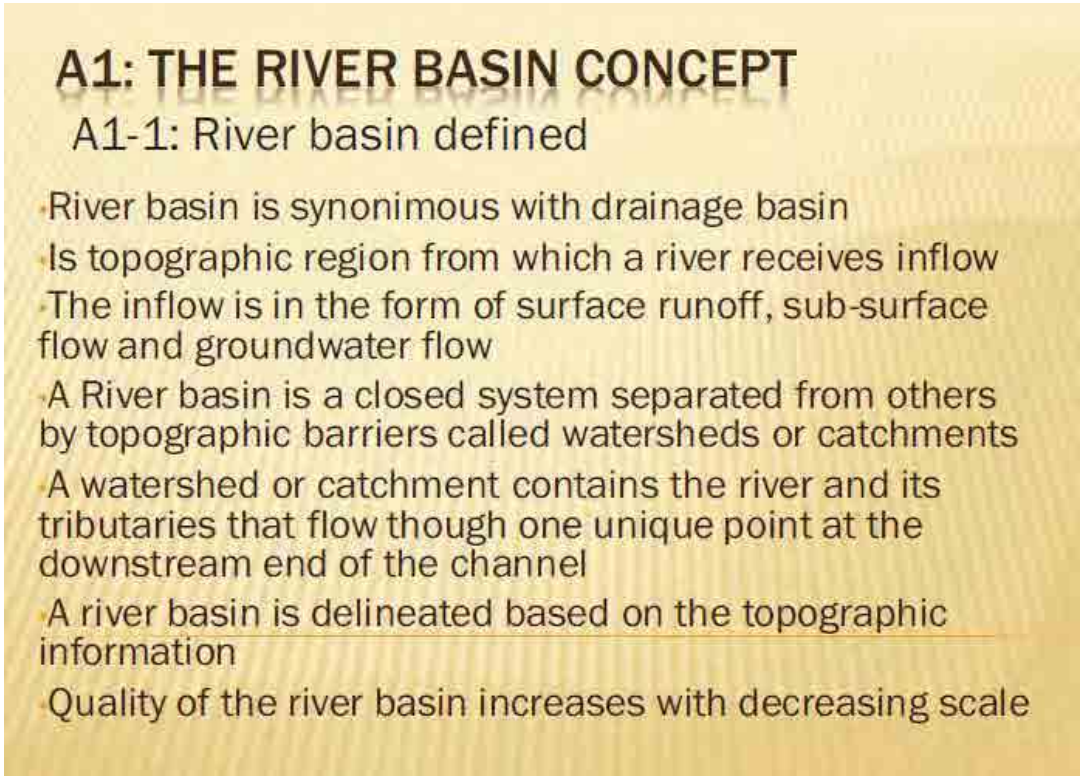


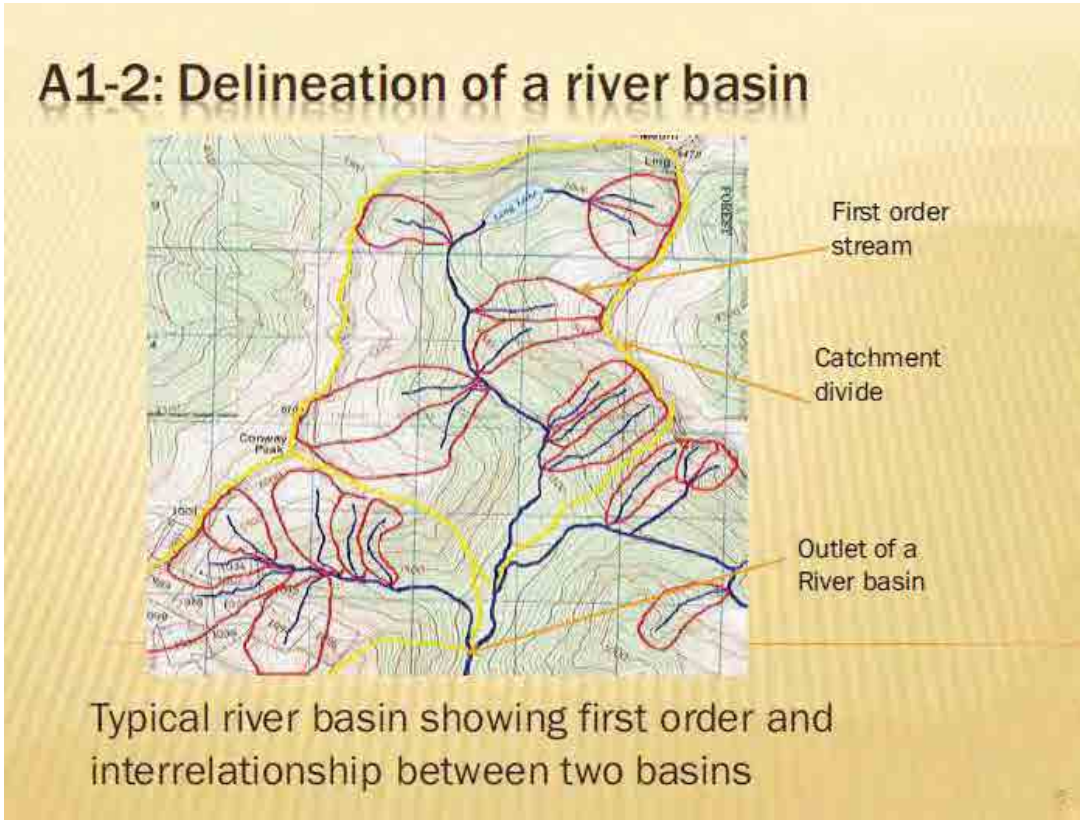
Fig. 1.1-1 Boundary of WRMA and WRUA administrative area and River basin and Catchment Area

River basin is not same as the concept as “Catchment Area”, “Sub-Region” and “Sub-Catchment”. And concept of river basin is not popular and used in WRMA, therefore Project team proposed the concept of river basin on various occasions. For example, text of the WRMA technical training for food management shows in follows.



Source: WRMA Technical Training Text for Flood Management (Second edition), the presentation is prepared by Professor Japheth Onyando

Fig. 1.1-2 River basin concept



Source: WRMA Technical Training Text for Flood Management (Second edition), the presentation is prepared by Professor Japheth Onyando

Fig. 1.1-3 Delineation of a river basin

1.2 Project target areas

In the Selection of project target area, Project Team targeted to select two sub-catchments as project target areas from the list of candidates of the project target areas (Pilot Sub-catchments) proposed by WRMA. The shortlisted candidates of the project target areas (Pilot Sub-catchments) are as shown in the following table.

Table 1.2-1 Candidates of project target areas (Pilot Sub-Catchments)

	Catchment Area (Regional Office)	Sub-Region/ Sub-Regional Office*	Sub-Catchment
1	Ewaso Ng'iro North CA (Nanyuki)	Middle Ewaso Ng'iro Sub-Region (Isiolo)	Isiolo Sub-Catchment
2	Athi CA (Machakos)	Nolturesh-Lumi Sub-Region (Loitokitok)	Lower Lumi Sub-Catchment
3	Lake Victoria South CA (Kisumu)	Southern Shoreline- Gucha Migori Sub-Region (Kisii)	Lower Gucha Migori Sub-Catchment
4	Tana CA (Embu)	Garrisa	

Project Team evaluated the list of candidates objectively using the following selection perimeters: flood damage records; importance of sub-catchment; and the easy accessibility of the areas from WRMA sub-regional office to the site of Sub-catchment.

Selection criteria for Project target area

1) The area is prone to flooding
2) Water Resources Users Association (WRUA), which is a community based water resource management organization, is established in the area.
3) The area is safe enough to conduct activities as a JICA's project

First, Garrissa was eliminated because of safety concerns reason. Project Team therefore set priority criteria and the result of prioritization was as follows: Lower Lumi, Ewaso Ngi'ro North (upper part of Archer's Post) and Lower Gucha Migori. Evaluation result of the candidate project target areas is show in following table.

Table 1.2-2 Evaluation result of the candidates of project target areas

	Province	Nyanza	Coast	Eastern
	County	Migori	Taita-Taveta	Isiolo
	District	Nyatike	Bomni, Jipe	Samburu
	WRMA Regional Office	Victoria South	Athi	Ewaso Ngi'ro North
	Targeted Catchments	Gucha, Migori	Lumi	Isiolo
		Riana, Ongoche	Soua, Ruvu	Ewaso Ngi'ro
	Targeted Sub Regional Office	Southern Shoreline - Gucha Migori	Nolturesh-Lumi	Middle Ewaso Ngi'ro North
	Targeted Sub Catchments	Gucha, Migori (Lower Gucha-Migori)	Lumi (Lower Lumi)	Ewaso Ngi'ro North (Upper part of Archer's Post)
Score	Security	**3**	**3**	**3**
	Access in Rainy Season	**1**	**1**	**3**
	Distance from JICA expert office	**1**	**3**	**3**
	Flood Duration	**2**	**3**	**1**
	Affected People by Floods	**3**	**3**	**1**
	Population Density	**1**	**2**	**3**
	Total	**11**	**15**	**14**
Overall Judgments		**III**	**I**	**II**

However, WRMA made a request that project target areas should be three sub-catchments and also they pointed out that not only high priority sub-catchments should have structural measures implemented, but also low priority sub-catchments should be supported with some pilot activity. And Ewaso Ngi'ro North was changed to Isiolo sub-catchment because the former coverage area was too wide and there were issues of safety concerns compared to the latter.

In the result of discussion with WRMA at the first JCC meeting, Isiolo sub-catchment, Lower Lumi sub-catchment and Lower Gucha Migori sub-catchment were selected as project target areas (Pilot sub-catchments).

The Project covers Nairobi, where WRMA Headquarters are located and three pilot Sub-Catchments. Three pilot sub-catchments are as follows.

Table 1.2-3 Pilot project Target areas (Pilot Sub-Catchments)

	Catchment Area (Regional Office)	Sub-Region/ Sub-Regional Office*	River Basin	Sub-Catchment	Type of activities
1	Ewaso Ng'iro North CA (Nanyuki)	Middle Ewaso Ng'iro Sub-Region (Isiolo)	Isiolo	Isiolo Sub-Catchment	Type 1
2	Athi CA (Machakos)	Nolturesh-Lumi Sub-Region (Loitokitok)	Lumi	Lower Lumi Sub-Catchment	Type 2
3	Lake Victoria South CA (Kisumu)	Southern Shoreline-Gucha Migori Sub-Region (Kisii)	Gucha Migori	Lower Gucha Migori Sub-Catchment	Type 2

*Sub- Region/ Sub-Regional Office name in parentheses shows old one

Location of selected project targeted areas is shown in figure 1.2-2.

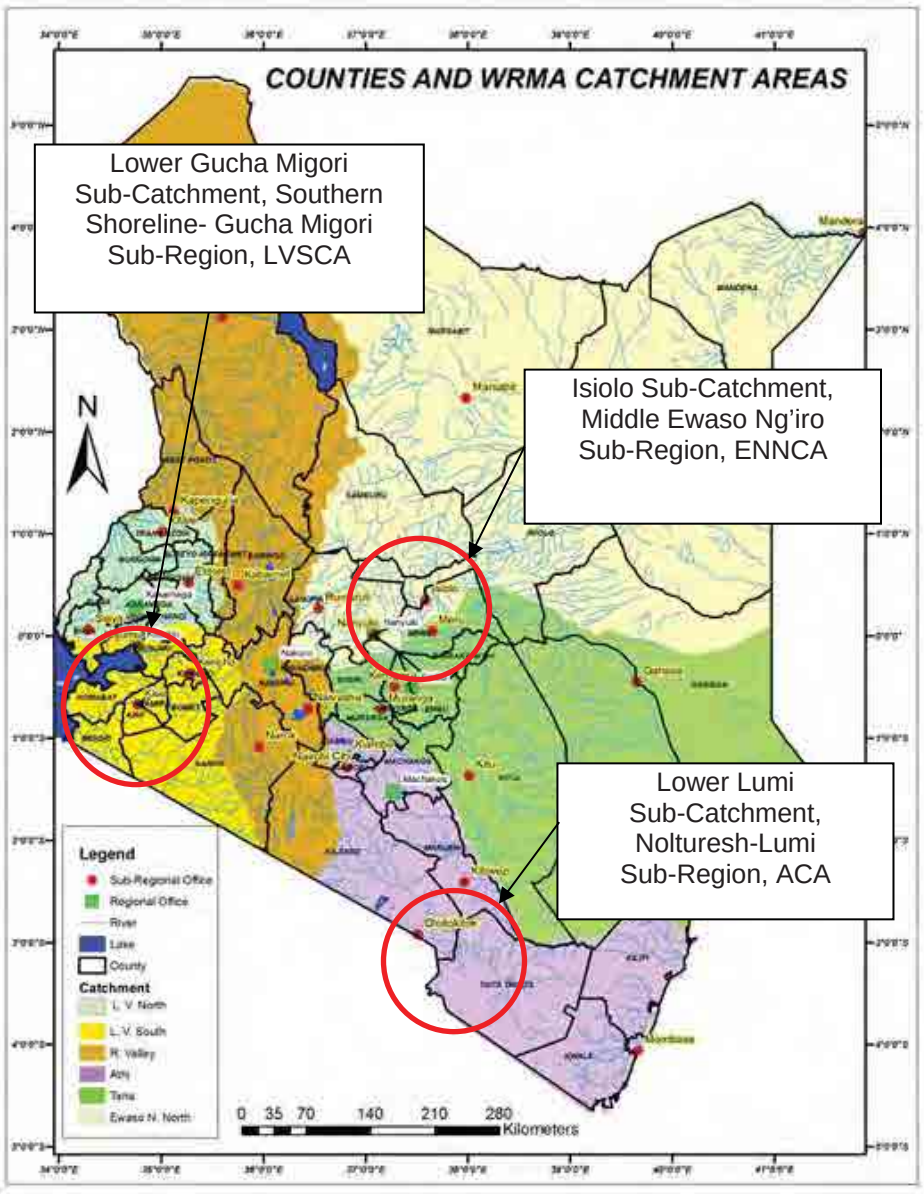


Fig. 1.2-1 Location of the Project Target Areas

These areas are categorized into two types according to the activities conducted as described below.

1.2.1 Common activities in type 1 and 2

- To provide advice and suggestion on preparation of CMS to include flood management plan prepared by WRMA
- Implementation of Baseline Survey
- To prepare draft Flood Management Plan to be integrated into SCMP
- To support institutionalization of knowledge management system for accumulated at WRMA regional and sub-regional levels
- To formulate Implementation Plan of community based flood management activities.

1.2.2 Activities in type 1

- To facilitate expansion of structural and non-structural measures experienced in Nyando Project within the same region;
- To prepare case studies on structural and non-structural measures conducted in the Integrated Flood Management Project in Nyando River Basin; and
- To support fund raising and formulating proposals to access WSTF to implement pilot activities including structural and non-structural measures in the pilot areas.

1.2.3 Activities in type 2

- To support the implementation of community based flood management activities including financial assistance; and
- To monitor and evaluate the community based flood management activities

Chapter 2 Analysing the current situations of communities (Baseline survey)

Capacity assessment of communities on flood management and flood risk analysis including community based flood hazard mapping were implemented in the pilot sub-catchments through the baseline survey and the additional site survey. These activities were reported as follows.

2.1 Outline of the baseline survey

Baseline survey had been implemented by a subcontracted local consultant since September 2011 to November 2011. Main purposes of the baseline survey were as follows:

- To assess the capacity of communities on flood management and get the baseline date;
- To figure out flood characteristics in order to draft integrated flood management plan;
- To collect base information in order to determine pilot areas;

Baseline survey report consists of four parts as follows:

Part 1: describes hydrometeorology information and past flood records at national level in Kenya.

Part 2: describes policy and institutional framework at national level in Kenya.

Part 3: describes results of capacity assessment of community on flood management at the three pilot sub-catchments, such as flood maps and results of questionnaire to community.

Part 4: describes the summary of the survey.

The baseline survey information was regarded as insufficient for the purposes of determining pilot project areas and for necessary requisite input to develop draft integrated flood management plan. Therefore, the Project Team carried out additional site surveys alongside WRMA.

2.2 Capacity assessment of communities on flood management

Capacity assessment of communities on flood management was implemented using questionnaire in the selected sub-catchments. The questionnaire are shown in below.

Questionnaire

1. Does flooding occur in your community?
   1 Yes
   2 No
   3 d/k

2. If yes how many times in a year?
   1 Once
   2 Twice
   3 Thrice
   4 more times

3. What are the causes of floods in your community
   1Heavy rains in the area
   2 Heavy rain from other areas
   3 Flat areas
   4 Continuous rain fall
   5 River banks bursts
   6 Others (specify)

4. What are the causes of drought in your community?_____

5. In case of flood what risk would you incur?
   1 House washed away
   2 Displacement
   3 Loss of property
   4 Loss of crops
   5 Loss of livestock
   6 Attack by diseases
   7 Injuries and trauma
   8 Loss of life
   9 Other
   _____

6. Can you quantify the loss in terms money? Kshs_____

7. In case of drought, what risks do you face?
   1. Loss of life
   2. Loss of livestock
   3. Loss of Crops
   4. Others (specify)

8. Are there any flood early warnings?
   1. Yes
   2. No

9. If yes by who
   1. Government
   2. CBO/NGO
   3. MET Office
   4. Church
   5. Others bank bursts
   6. Neighbours, friends, relatives
   7. Others_____

10. How many times are you warned?
    1. None
    2. Once
    3. Twice
    4. Thrice
    5. more times

11. Do you recall any flooding event in the recent past in your community?
    1. Yes
    2. No

12. If yes how do you rate it
    1. High
    2. Average
    3. Low

13. Are there any flood protection plans in your community?
    1. Yes
    2. No

14. If Yes, in what form?
    1. Water canals
    2. Dykes
    3. Retaining walls
    4. Dams for water storage
    5. Raised buildings
    6. Other.

15. Who developed them?
    1. Community
    2. NGO/CBO
    3. GOVT
    4. Church
    5. Other.

16. If in Q15 you chose 1. Community, what kind of flood protection plans exists?
    1. Developing escape means e.g. boats
    2. Evacuation centres
    3. Moral and Physical support
    4. Others (specify)

17. If in Q15 you chose 2. CBO/NGO, what kind of protection plans exists?
    1. Developing awareness
    2. Building of dams
    3. Constructing dykes / garbions
    4. Removal of sediments
    5. Others

18. If in Q15, the answer was 3. GOVT, what kind of protection plans?
    1. Building of dykes
    2. Construction of retaining walls
    3. Developing evaluation centres
    4. Others (specify).

Fig. 2.2-1 Questionnaire sheet (1) for Capacity Assessment of Community for flood management

1. As an individual, during flooding in your homestead, what was the first action you took?
   1. Stay in the house
   2. Climb on trees, Roof
   3. Escape to hilly areas
   4. Escape to evacuation areas
   5. Others

2. What evacuation Centres/Areas exist in your community.
   1. GOVT building
   2. Church
   3. Schools
   4. Hilly areas
   5. Others

3. What basic necessities are you provided in the evacuation centres?
   1. Food
   2. Water
   3. Medicine
   4. Fuel
   5. Clothing
   6. Other.

4. During your household construction works, are measures of Flood Prevention considered
   1. Yes
   2. No
   3. Don't Know

5. If Yes, which ones
   1. Water channels
   2. Retaining walls
   3. Ponds
   4. Raised building foundations
   5. High ground site selection
   6. Other

6. During government civil construction works, are measures of Flood Prevention considered
   1. Yes
   2. No
   3. Don't Know

7. If Yes, which ones
   1. Water channels
   2. Retaining walls
   3. Dams
   4. Bridges
   5. Raised building foundations
   6. High ground site selection
   7. Other_____
   _____

8. Have you ever attended a flood management capacity development and training programmes?
   1. Yes 2. No

9. If Yes, How many times?
   1 Once
   2 Twice
   3 Thrice
   4 More

10. Who organized them?
   1 GOVT institutions
   2. NGO/CBO
   3. Church
   4. Others (specify)

11. What was the main lesson learnt in the training programmes?

12. Have you found those lessons relevant to your handling of floods?

   1 Yes 2. No 3. Don't Know

Fig. 2.2-2 Questionnaire sheet (2) for Capacity Assessment of Community for flood management

2.3 Flood risk analysis

Flood risk analysis including community based flood hazard mapping was implemented during the baseline survey and also during the additional site survey by the Project Team and WRMA.

2.3.1 Flood hazard map

At the commencement of the Project, there was no flood hazard map that had been prepared that could show flood depth and inundation area on a topographic map.

Therefore, the Project Team implemented site survey with WRMA ROs and SROs staffs and WRUAs members as a part of capacity development of WRMA and WRUA on flood management. The site areas that were visited were the pilot sub-catchments and related river basins (Lumi River Basin, Gucha Migori River Basin and Isiolo River Basin).

Summary of the flood hazard mapping activities are shown in the followings.

(1) Community based flood hazard map

While developing the capacity of WRMA staffs on community based flood hazard map, the past experience accrued from the JICA project in the Nyando river basin was utilized in planning and preparing the required materials for this activity.

Process of the community based flood hazard map activity is shown below:

Table 2.3-1 Process of the community based flood hazard map

1	Capacity development of flood hazard mapping to WRMA staffs by the Project team.	
2	WRMA staff explained how to draw community based flood hazard map to WRUA.	
3	WRUA members draw community based flood hazard map.	
4	A completed Community based flood hazard map.	

Leaflet of community based flood hazard mapping, which was distributed to WRUA, and herein below is the sample of the leaflets.

Definitions of terminologies

Vulnerability: the degree of fragility of a (natural or socio-economic) community or a (natural socioeconomic) system towards natural hazards. It is a set of conditions and processes resulting from physical, social, economical and environmental factors, which increase the susceptibility of the impact and the consequences of natural hazards.

Vulnerability is determined by the potential of a natural hazard, the resulting risk and the potential to react to and/or to withstand it, i.e. its adaptability, adaptive capacity and/or coping capacity.

Hazard: A potential event that could cause loss of life or damage to property or environment

Risks: The scientific approach defines the risk as the probability and extent of damage due to a particular flood. Conventionally the risk is expressed by the notation ***Risk = Flooding x Vulnerability*** .

Flood related risk refers to the probability of harmful consequences, or expected losses resulting from interactions between natural hazards and vulnerable conditions.

Disaster: The serious disruption of the functioning of society causing widespread human, material or environmental losses which exceed the ability of the affected communities to cope using their resources. Disasters occur when negative effects of the hazards are not well managed.

Flood: a temporary covering by water of land normally not covered by water. This shall include floods from rivers, mountain torrents, Mediterranean ephemeral water courses, and floods from the sea in coastal areas, and may exclude floods from sewerage systems.

Flood risk: the combination of the probability of a flood event and of the potential adverse consequences to human health, the environment and economic activity associated with a flood event.

Flood plain maps indicate the geographical areas, which could be covered by a flood according to one or several probabilities: floods with a very low probability or extreme events scenarios; floods with a medium probability floods with a high probability.

Flood hazard maps are detailed flood plain maps complemented with: type of flood, the flood extent; water depths or water level, flow velocity or the relevant water flow direction. In the community flood hazard mapping process, the community members along with the executing agencies and the concerned governmental officials, demarcate flood hazardous areas, evacuation centres and evacuation routes.

Objective s of flood hazard maps:

i) Understand the characteristics of flood in the community;
ii) Understand the weaknesses to floods in the community;
iii) Increase awareness of personal flood mitigation measures; and
iv) Assist the establishment and strengthening of community organisations for flood disaster mitigation.

N/B: It is desirable that community flood hazard maps should be shown on the community board for dissemination of proper evacuation routes and places dangerous to the community.

Flood risk map: indicate potential adverse consequences associated with floods under several probabilities, expressed in terms of: the indicative number of inhabitants potentially affected; type of economic activity of the area potentially affected; installation which might cause accidental pollution in case of flooding.

Damage: the amount of destruction or damage, either in health, financial, environmental functional and/or other terms as a consequence of an occurred hazard.

Fig. 2.3-1 Leaflet of community based flood hazard mapping (1)

Developing Community Flood Hazard Map

Preparatory Work
1. Arrangement of Place
2. Arrangement of Map and Stationary
3. Formulation of Program

Implementation
1. Introduction
2. Explanation of the Steps in drawing Hazard Map;
3. Identification of the person who will lead in drawing the community flood hazard map;
4. Implementation of Step 1: Analysis of the current condition
   (a) Draw the boundary of the area;
   (b) Identification of the major link roads within the area;
   (c) Drawing of current natural conditions in the communities (residential area, agricultural land, grass land, forest, river, hilly area etc.);
   (d) Drawing of community transport and communication infrastructure (road and culverts , footpaths, drainage, bridges, dykes, fields etc,); and
   (e) Drawing of other community infrastructures (office, school, hospital, church, evacuation facility, kiosk, storage etc.)
5. Implementation of Step 2: Analysis of community vulnerability
   (a) Drawing source and direction of the flooding water into the affected area;
   (b) Drawing past flooded areas and duration of inundation;
   (c) Indicating on the map the places of past serious accident and damages during flood period
   (d) Indicating on the map evacuation route, evacuation place, resource activity, communication etc
6. Formulation of countermeasures

Discussion on community based necessary actions such as resource, evacuation route, evacuation center management, communication etc.

Table: Graphic images for the steps involved in drawing community flood hazard map


Arrangement of material


Explanation of the steps in drawing hazard map


Identifying a person to lead in drawing the map


Drawing the boundaries of the area


Drawing the link roads, culverts, rivers, streams, bridges etc


example of community drawn flood hazard map

Fig. 2.3-2 Leaflet of community based flood hazard mapping (2)

In this leaflet, the concept of flood damage, purpose of mapping and utilization of the map, process of mapping is clearly explained. During the mapping process, community members discuss issues of floods and it is possible to be used or learning and triggering thinking of flood management.

Examples of community based flood hazard map that was drawn by WRUA at the three Pilot Project sub-catchments are as shown below.

Photo 2.3-1 Community based flood hazard map by Lower Lumi WRUA

Photo. 2.3-2 Community based flood hazard map by Lower Gucha Migori WRUA

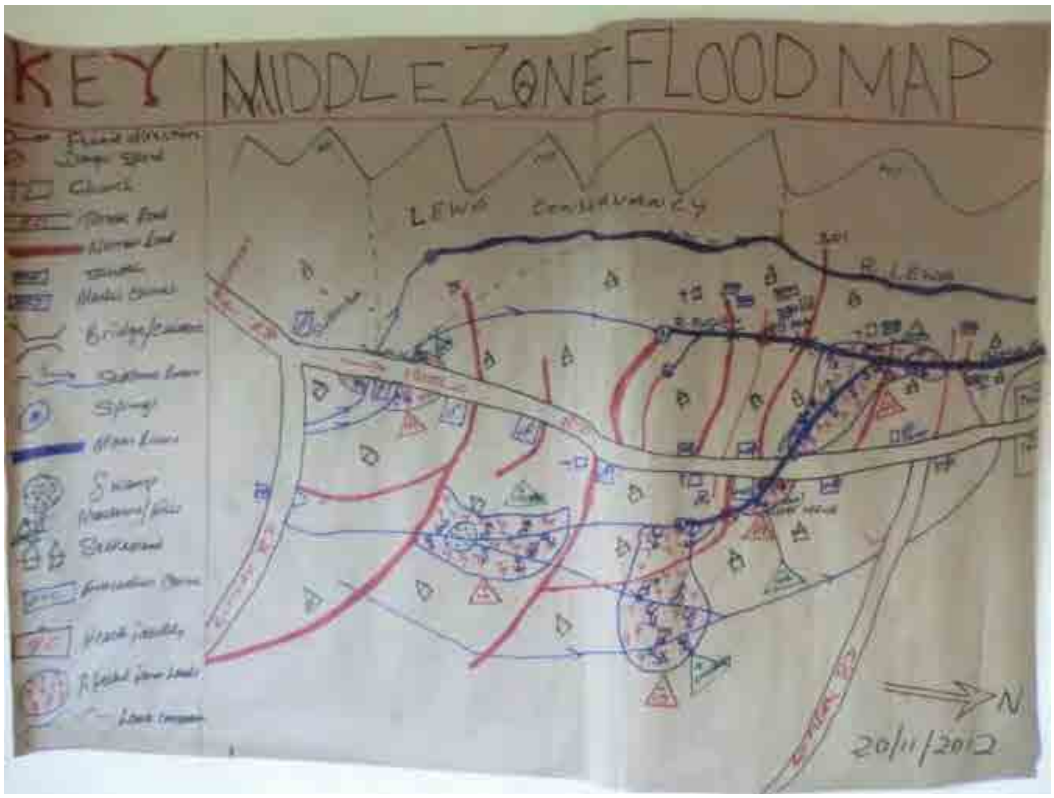


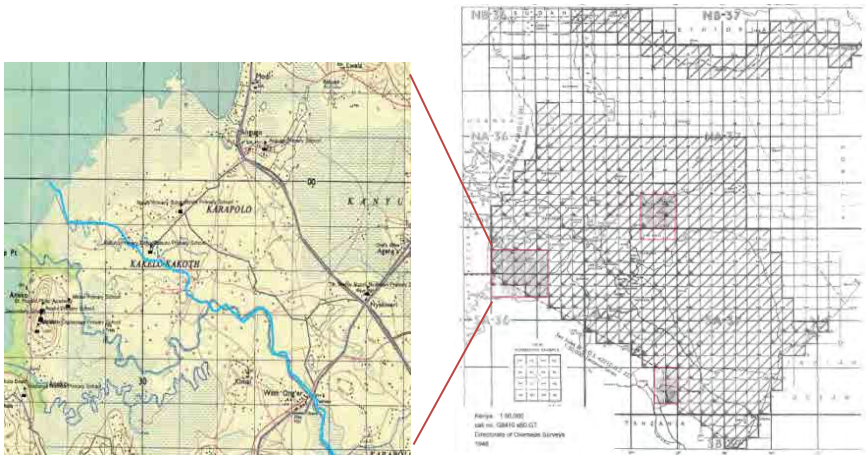
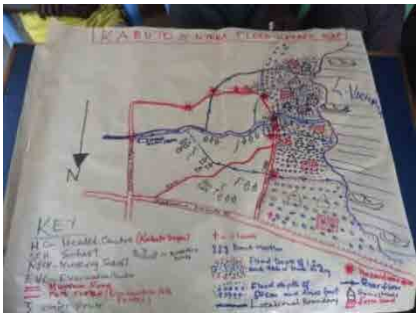
Photo. 2.3-3 Community based flood hazard map by Isiolo WRUA

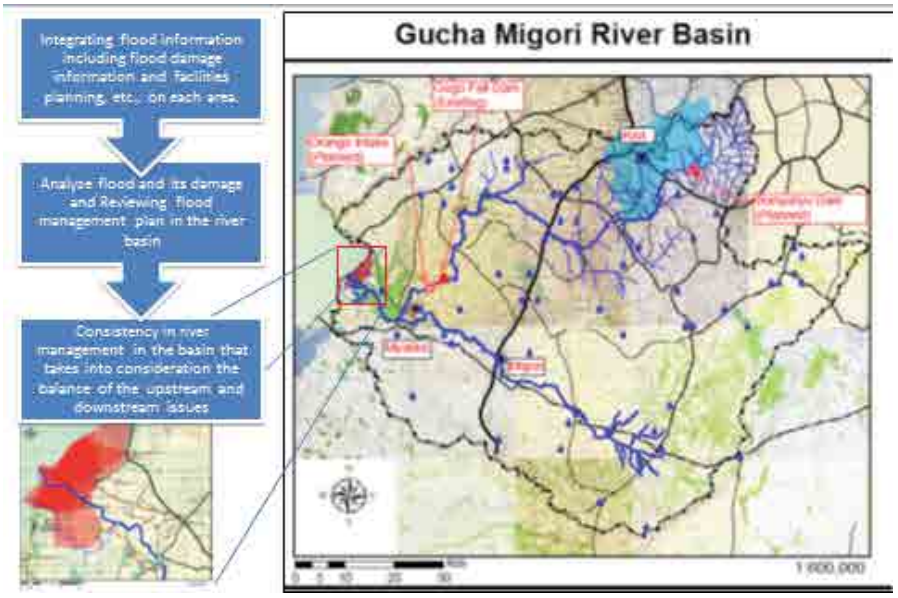
Detailed explanations of these activities are shown in Appendix 3-1.

(2) Flood hazard map at the river basin level

At the commencement of the Project, WRMA did not have any developed flood hazard maps that covers a river basin. The Project Team therefore explained the concept of flood hazard map to WRMA and thereafter implemented site surveys with WRMA-RO, SRO officer and WRUA members. The Project Team thereafter developed flood hazard map that covers the river basin using the community based flood hazard map drawn by community and the results of the site surveys.

Table 2.3-2 process for river basin flood hazard map

1	Collecting topo map To Collect topographic map of target river basin.	
2	Collecting flood damage data To collect flood damage information from existing flood disaster reports and past flood records and maps in the target river basin.	 
3	Interview survey Carry out interview survey with the community members.	  Carry out interview survey with the community members residing in flood prone areas and they should respond to the various questions that asked that will explained the flood history, flood depth, flood inundation period, flood coverage area etc. and also collect GPS data.
4	Site survey To visit and collect GPS data of hydrological and meteorological station, major infrastructure and evacuation center at target river basin level.	 

5	Drawing of flood disaster map at inundation area To transfer the collected data and results of the survey to the topographic map (Using GIS).	
6	Integrating flood information for that river basin To collect flood disaster maps in target river basin and integrate the maps. To analyze flood, its damage and review flood management plan and water resources management plan at the river basin level.	

2.3.2 Review of flood records

Based on results of the baseline survey and additional site survey, flood characteristics of pilot sub-catchments were analyzed. The flood characteristic of each pilot sub-catchment is as shown below:

(1) Flood characteristics analysis at the middle zone of Isiolo river basin

1) Summary of flood characteristics

Isiolo River originates from Mt. Kenya forest and passes through several counties, namely Meru Central, Imenti North, and Isiolo before it joins Ewaso Ng'iro River, covering a distance of 95km and average basin width of 3 km. It covers an area of about 165km^2. The slope of the river profile ranges between 14% and 4% with the steeper slopes existing near Mt. Kenya.

Isiolo Town is heavily affected by flood which mainly affects the socio-economic strata of the town. Isiolo Town is earmarked as a focused developing area in the Vision 2030. Therefore, Isiolo Town is considered high-priority area that needs flood protection. Flood

characteristics in Isiolo are therefore identified as follows:

1) Overflow from Merire River, which is the tributary of Isiolo River. Flood water flows down into Isiolo town centre,

2) Lack of storm drainage capacity in the whole of Isiolo Town

3) Lack of the coordination of town development vis-à-vis controlling of flood. For example construction of the airport and the new road changed river flow of Moji Ya Chumvi River, which now flows into Isiolo Town.

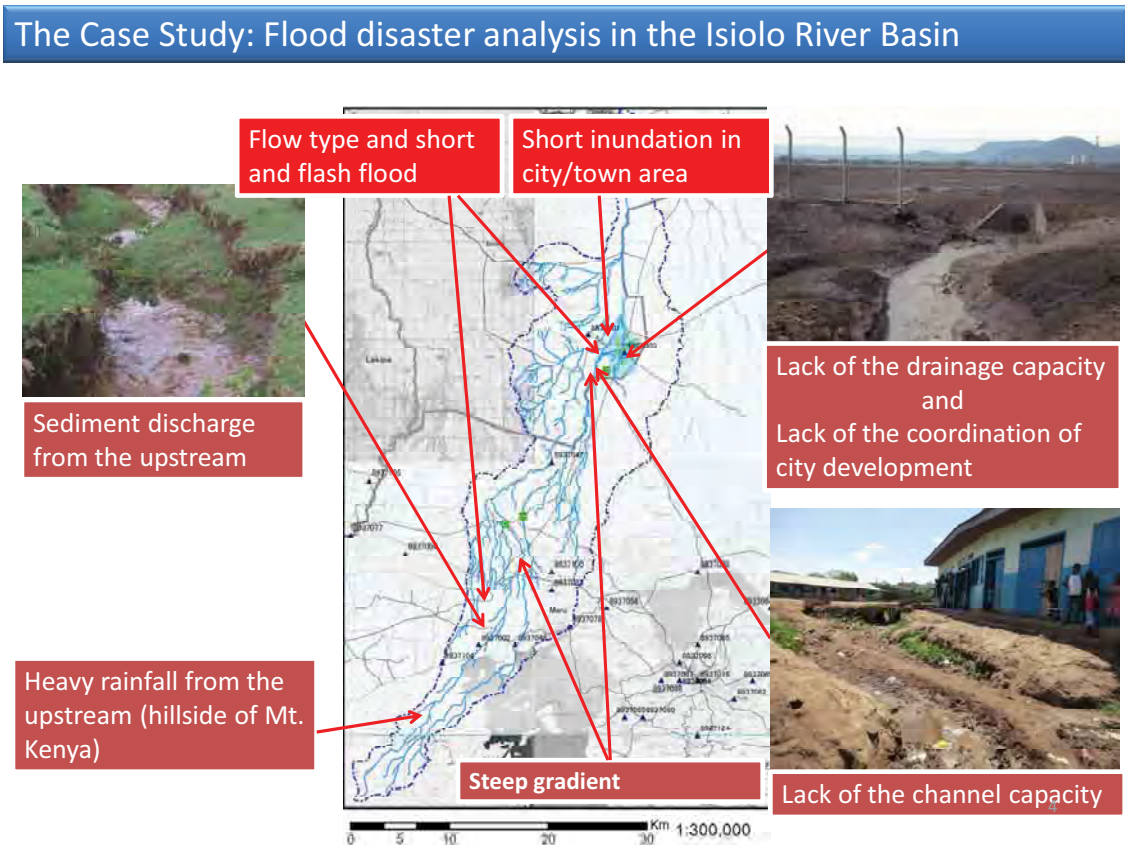


Fig. 2.3-3 Isiolo River Basin

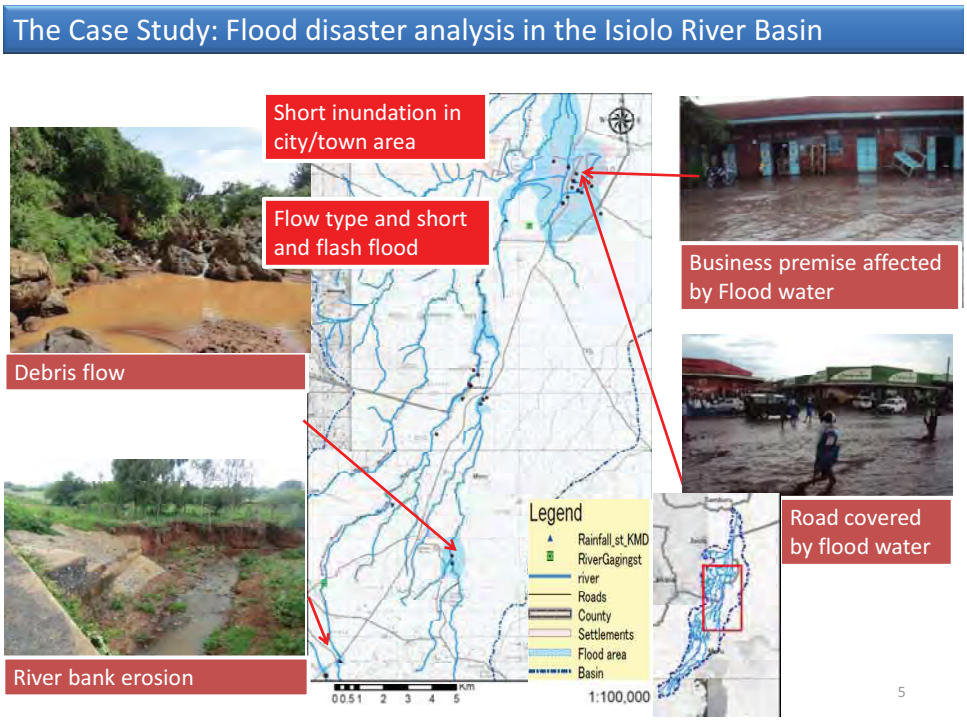
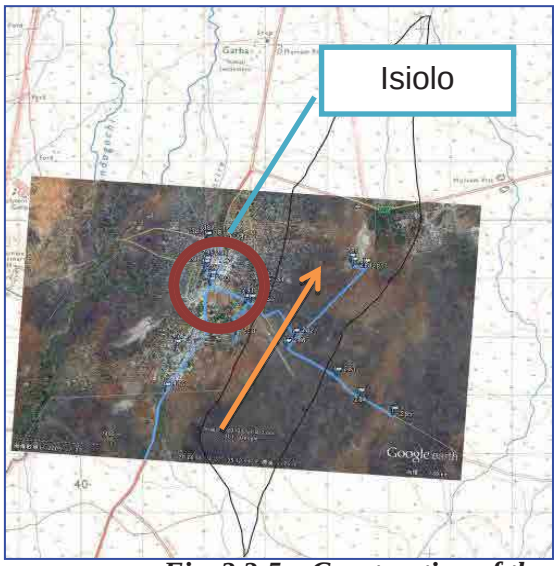


Fig. 2.3-4 Flood Prone Area of the Middle Zone of Isiolo River Basin

Before construction



After construction

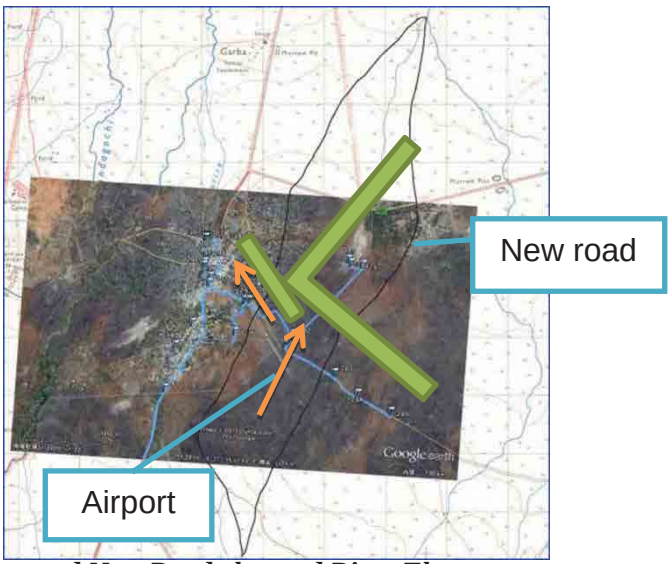


Fig. 2.3-5 Construction of the Airport and New Road changed River Flow of Moji Ya Chumvi River into Isiolo Town

2) Records of Flood Damages

Table 2.3-3 shows that floods occurrence in recent times in the Isiolo River Basin has been annually. Floods have major adverse effects on agricultural products, livestock, houses, infrastructures such as road, electric cable and etc., lives and properties, bountiful surface soil runoff, sediment deposition in farming land, stockpiled food, pollution of water resources, health problems such as waterborne diseases, increasing of conflicts on water resources, poor nutrition which is caused by damage of stockpiled food and etc.

Table 2.3-3 Recent Flood Damages

Month/ Year	Place	Outline of flood damage
Sep. 25, 2012	Urban area of Isiolo Town, Kiwanjani Sub location	The flood is caused by minimum of a 20-minute heavy rain with high wind. Flash flood occurred and inundated to a depth of below-knee at urban area of Isiolo town and it is detrimental to public transportation and economic activities. However, its adverse effect is limited to about one hour. Residential area of Kiwanjani Sub-location which is located near the airport and in a high altitude, most of damages were number of houses that collapsed due to high wind.
2011	Urban area of Isiolo Town	Long-term disruption of agricultural activities due to inability to farm as a result of inundation of the farmlands, occlusion of culverts, destroyed IWACO's water intake facility and washing away of number of houses
Oct. 2006	Kulamawe, Bullapesa, Bulla Arera, Juakali, Kambiodha, Kambibulle, Kampigabra and kabiwacho villages	Embankment of the Isiolo river was broken and numbers of affected people were approximately 500, number of recorded human deaths was 8. People who were affected by flood were forced to evacuate and stay at the Isiolo Catholic Church.
2005		Number of deaths: 10

Source: Data is created by JICA Project Team based on interview with WRMA and Isiolo WRUA

3) Flood Condition Inquiring From Relevant Communities

JICA Project team conducted interviews with the local communities in the Isiolo River Basin that were affected by flood damage. The figure 2.3-6 is a location map that shows the local communities where the interview was conducted. Table 2.3-4 shows the results of interviews on flood damages that were conducted on the local communities.

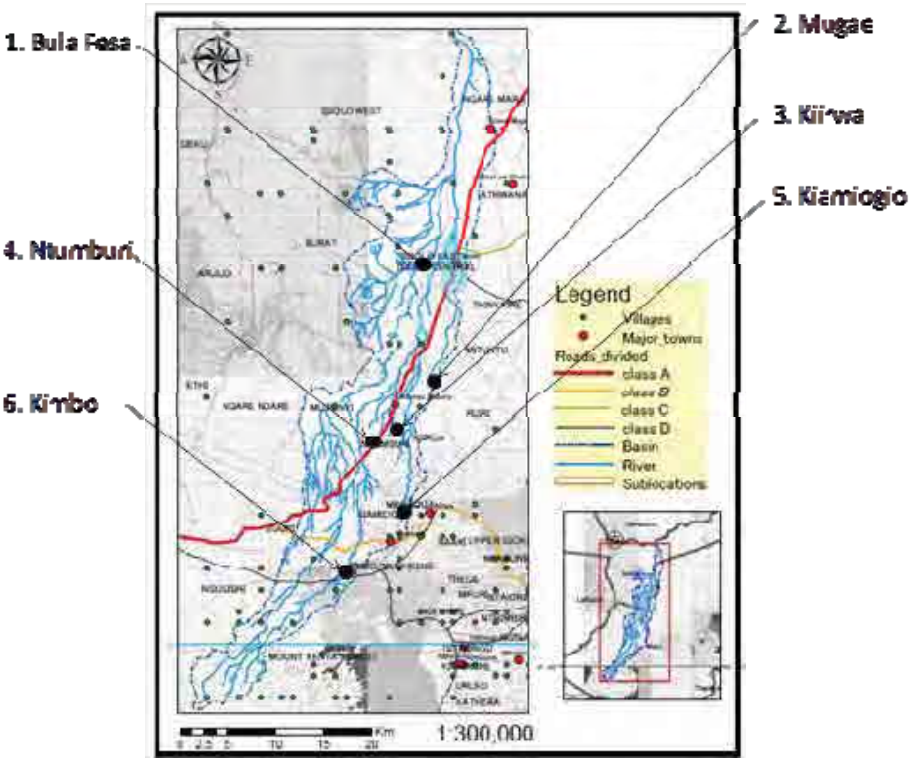


Fig. 2.3-6 Map of Isiolo River Basin and Location of Communities

Table 2.3-4 Communities in Isiolo River Basin and Each flood situation

No	Community	Population	Flood depth	Flood duration	Frequency
1	Bula Pesa	22, 722	Between 50 cm to 1.5 m	2-3 Hours	Erratic, but mostly expected between Oct.- Dec. every year
2	Mugae	1,217	Approximately 50 cm	2-3 Hours	Erratic
3	Kiirwa	4,196	Between 50 cm to 1.5 m	2-3 Hours	Erratic
4	Ntumburi	2,847	Between 50 cm to 1.5 m	2-3 Hours	Erratic
5	Kiamiogio	3,181	Approximately 50 cm	2-3 Hours	Erratic
6	Kimbo	4,149	Approximately 50 cm	2-3 Hours	Erratic

The Project Team's inquiring site survey on damage situations and flood type in each of the community are shown below.

(1) Bula Pesa

- Human settlements are affected when Merire river over flows (Inundation in urban area).
- Houses are damaged by the debris flowing on the flooding river (Outflow from rivers).
- Roads are badly eroded making accessibility to social amenities like schools and hospitals inaccessible (Inundation in urban area).
- In some cases there are losses of human life as a result of flooding of Merire river (Inundation in urban area).

(2) Mugae

- Debris flow damaging river structures like water intakes, and bridges (Debris flow).
- There is erosion carrying away arable top soil leaving the farmlands infertile hence decreased agricultural production (Bank erosion).

(3) Kiirwa

- Sediments overflow into farmlands burying crops (Debris flow).
- Access roads are eroded by flood water making accessibility to market for agricultural products difficult (Bank erosion).

(4) Ntumburi

- River bank erosion reducing the size of farmlands, hence less agricultural produces (Bank erosion).
- Crops are washed away by flood waters (Outflow from rivers).
- Makeshift bridges are washed away when the river overflows making accessibility to social amenities difficult. (Outflow from rivers).

(5) Kiamiogio

- Sediments are deposited on farmlands submerging the crops (Debris flow).
- Makeshift bridges are washed away making accessibility to the market for farm products difficult (Outflow from rivers).

(6) Kimbo

- Erosion on farmlands carry away top fertile soil leaving farmlands infertile (Bank erosion).
- Debris flow blocks access roads to market for farm products (Debris flow).

(2) Flood characteristics analysis at the Lower Lumi river basin

1) Summary of flood characteristics

Lumi River is a trans-boundary river that originates from Mt. Kilimanjaro and borders to Tanzania to the west, Tsavo West National Park to the east and Upper Lumi sub-catchment in the north. The large sediment discharge from the upstream and sediment deposition on the riverbed at the downstream lead to insufficient flow capacity of river channel. In particular, the condition of Lower Lumi River at the downstream area, where Lumi River flows into Lake Jipe, is described as high-bedded river. This is the most flood-affected area. The drainage canals running along in the right bank of Lumi River also lack flow capacity, and almost ceased to function. In addition part of the dykes at downstream of Lower Lumi River is broken. Under this condition, flood of Lower Lumi River continues for long period and affecting wide area.

Flood of Lower Lumi River basin is not only caused by overflows from the main stream of Lumi River. There are also flash floods occurring in various wadis in the left bank of Lower Lumi river basin.

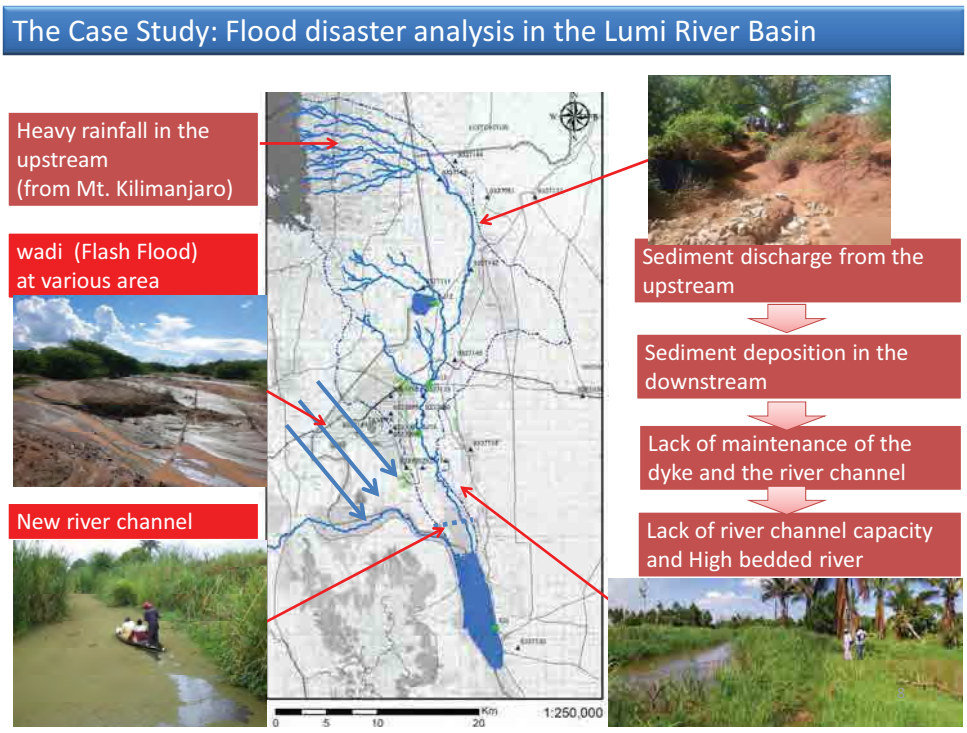


Fig. 2.3-7 Lumi River Basin

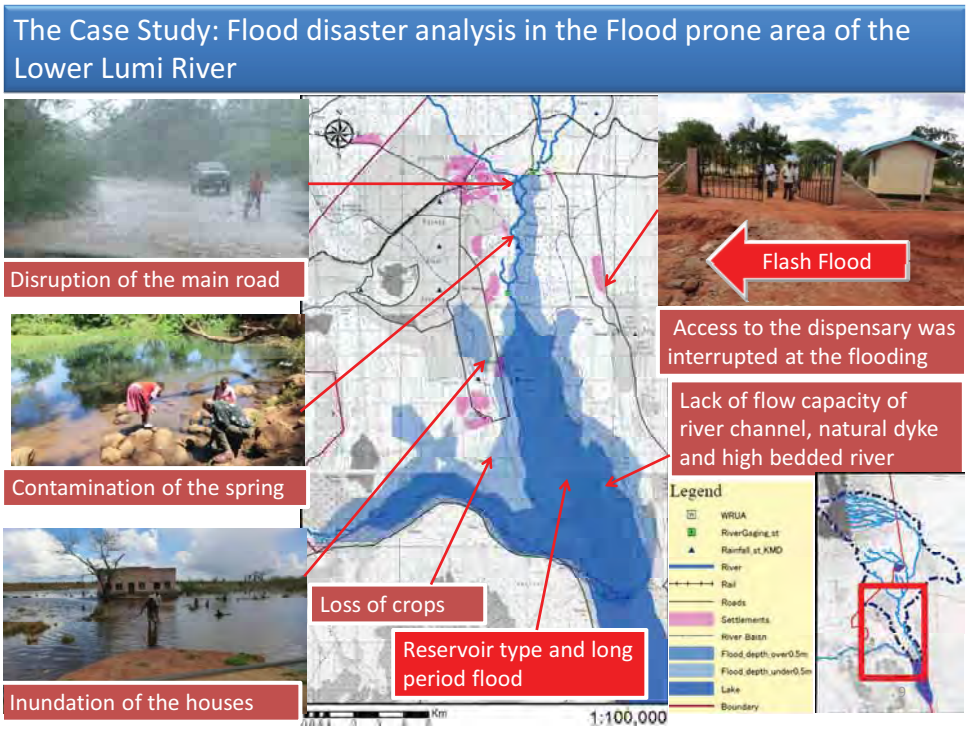


Fig. 2.3-8 Flood Prone Area of Lower Lumi River Basin

2) Records of Flood Damages

Records of flood damages in the Lumi River Basin are shown in figure 2.3-9. Especially, near mouth area of the river such as Kimorigo sub-location, Kimala Mata sub-location and Kitobo sub-location suffered heavy damages from flood from the Lumi River. The longitudinal slope of the Lumi River is steep in the mountainous area of Mt. Kilimanjaro within the borders of the United Republic of Tanzania. When the river flows into the territory of the Republic of Kenya, the stream has gentle gradient. The section from the Lake Jipe to Taveta Town is about 1/1000 to 1/500 and the velocity in the section is low so that flood water is extended for a long period of time at the lower basin.

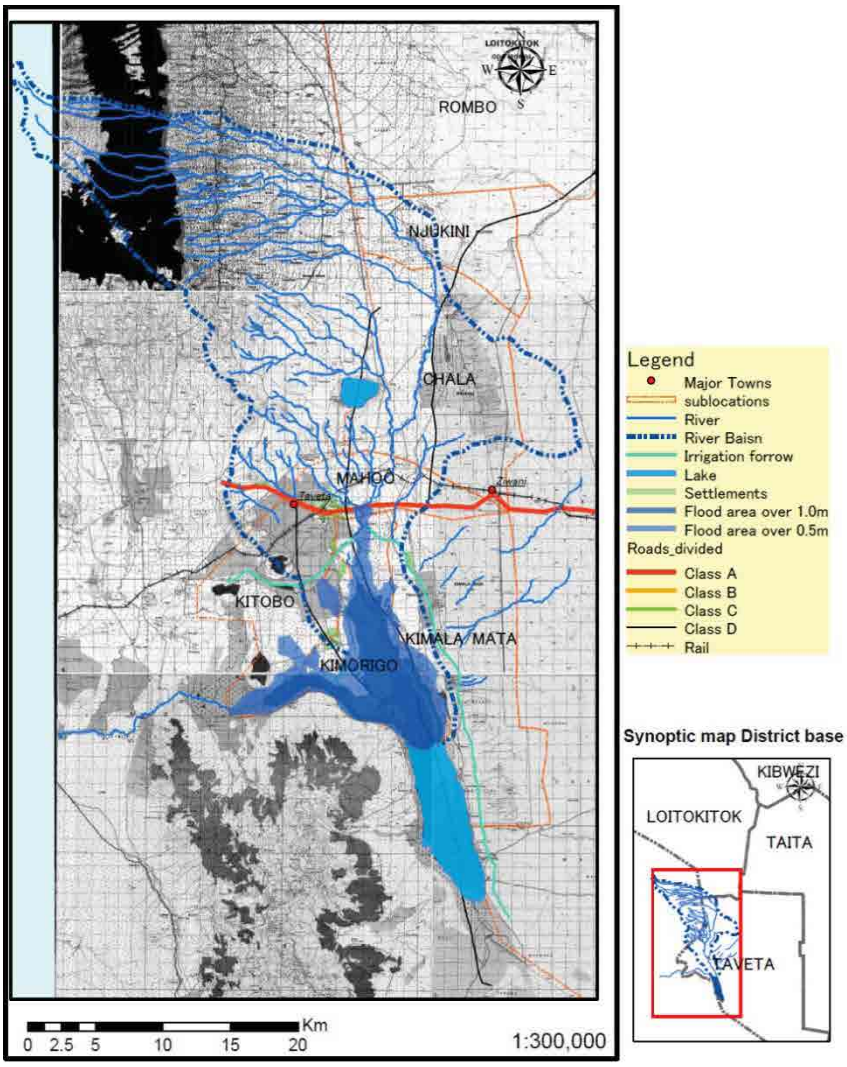


Fig. 2.3-9 Records of Flood Damage in the Lumi River Basin

In the Lower Lumi River Basin suffers damage from flood frequently and it has major adverse effects on agricultural products, infrastructures, houses, lives and properties, land use, local economy and etc. Moreover floods have caused delay development. Since flood damage is critically important because of the problems it poses to the people who live in the Lower Lumi River Basin, they have prioritized issues of flood management in the Sub-Catchment Management Plan (SCMP).

According to information that is provided by WRMA, numeric character data of floods which was occurred in an ordinary year and 2009 in the Lower Lumi River Basin is shown in the table 2.3-5. The information indicates that approximately 80km^2 was inundated in 2009 and that was four times larger in the area affected and the number of victims and duration of the evacuation was two times larger and longer than an ordinary year.

Table 2.3-5 Overview of Flood in the Lower Lumi River Basin (Ordinary year and 2009)

	The flooding situation in an ordinary year	The flooding situation In an extreme year (2009)
Flood area	22.5 km^2	79.8 km^2
Depth of water	0.3 m	0.9 m
No of evacuee	700	1600
Evacuation duration	1 month	2 month
No of floods in a year	1	2

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

Overview of recent flood damages in the Lower Lumi River Basin is shown table 1.5-6. As described above, estimated flood damage in 2009 is approximately Kenya shillings thirty million (Kshs. 30,000,000/-) and it is larger than an ordinary year. On the other hand, number of people who were affected by flood in 2009 is shown to be lower than an ordinary year. Therefore there is a possibility that WRMA was unable to collect and understand the actual data and information of flood damage in the basin.

Table 2.3-6 Overview of Annual Flood Damage in the Lumi River Basin

Year	No of People affected	No of People dead	Estimated Damages cost (Kshs)
2012	464	0	5,530,000
2011	105	1	1,350,000
2010	110	0	1,700,000
2009	29	4	30,300,000
TOTAL	708	5	38,880,000

Source: ACTION PLAN ON THE DEVELOPMENT AND IMPLEMENTATION OF A FLOOD MANAGEMENT PLAN FOR LUMI RIVER Training Program: Capacity Development for Flood Risk Management with IFAS (A) July 9th to August 8th 2012

Table 2.3-7 shows estimated flood damage cost and inundated area that affected agriculture sector in the Lumi River Basin from the year of 2001 to 2011. Irrigation facilities of Kitobo suffered a great deal of damage on cost and area of farming land.

Table 2.3-7 Agricultural Estimated Damage in the Lumi River Basin (2001-2011)

	Name of Irrigation scheme	Area (HA)	Damage Cost
1	Kasokoni	5.3	430,000
2	Block C	12	235,000
3	Ngutini	4.9	780,000
4	Marondo	1.8	3,000,000
5	Msengoni	6.2	230,000
6	Kamleza	6.1	1,200,000
7	Kitobo	21	13,900,000
8	Rekeke/Lumi (Grogan canal)	8.9	2,100,000
9	Kimondia	8.1	730,000
10	Kimala	3.5	650,000
	Total		23,255,000

Source: District Irrigation Office - Taveta

3) Flood Condition Inquiring From Relevant Communities

The principal points having flood damages in the Lumi river basin are Kimorigo, Kiwalwa, Eldoro, Riata Marabani, Rekeke, Kimala, Ndilidau, Njoro, Bahati, Mata-Jipe and Kitobo etc. The results of inquiring during site surveys on the communities concerning the flooding situations in these points are shown in the following table.

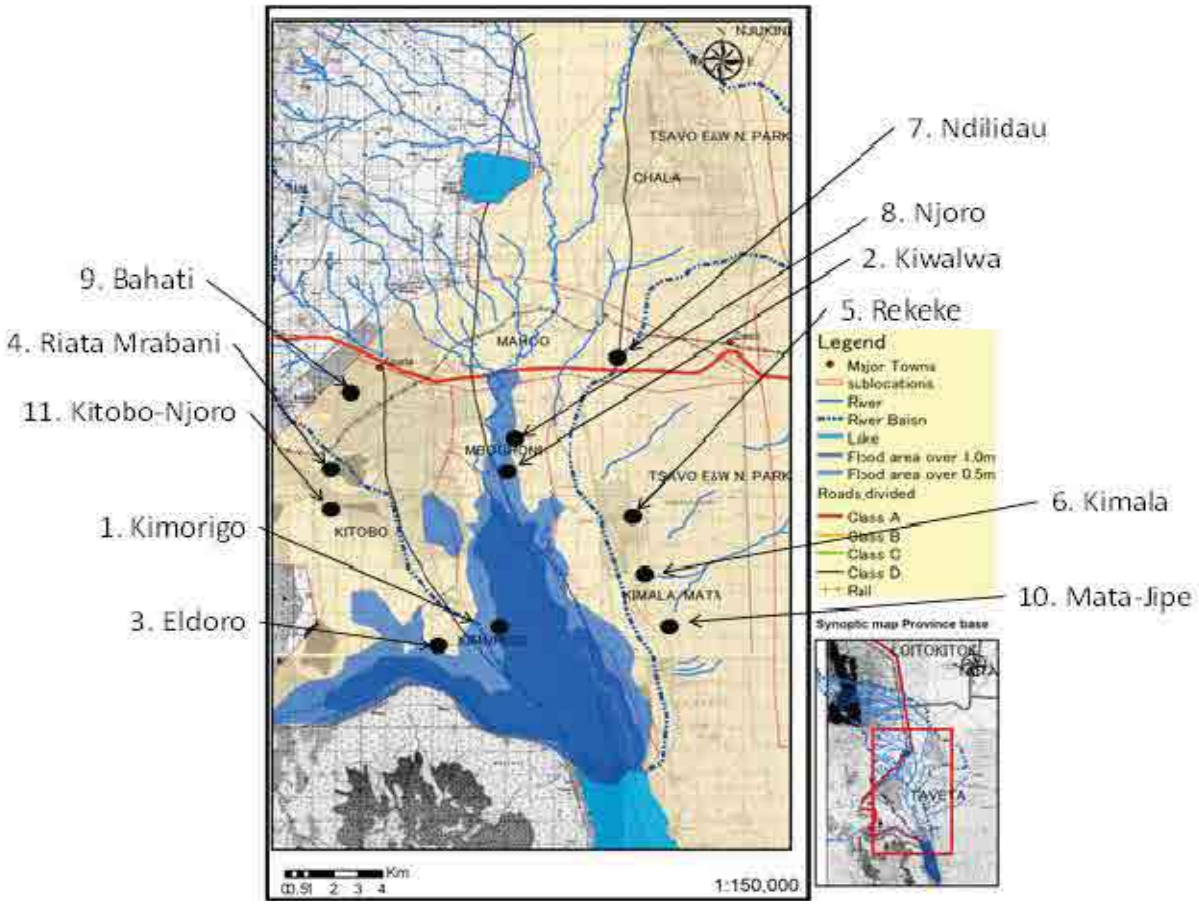


Fig. 2.3-10 Location Map of Principal Community in Downstream Area

Table 2.3-8 Communities in Lumi River Basin and Each flood situation

No	Community	Water depth (cm)	Duration Time	Frequency	Direct Affected Population by Flood	Population	Direct Affected Population by Flood /Population
1	Kimorigo	120	2 months	2 times in a year	1939	1,939	1.00
2	Kiwalwa	40	3 week	2 times in a year	4500	7,082	0.64
3	Elodro	120	2 months	2 times in a year	300	4,323	0.07
4	Riata-mrabani	60	8 hours	2 times in a year	200	2,203	0.09
5	Rekeke	60	5-6 hours	2 times in a year	200	1300	0.15
6	Kimala	60	5 hours	2 times in a year	950	1,608	0.59
7	Ndilau	60	8 hours	2 times in a year	500	954	0.52
8	Njoro	45	2 hours	2 times in a year	1000	2,400	0.42
9	Bahati	40	3 hours	2 times in a year	800	1,550	0.52
10	Mata-Jipe	60	6 hours	2 times in a year	3000	4,549	0.66
11	Kitobo-Njoro	60	8 hours	2 times in a year	500	3,801	0.13

Source: JICA project team survey by inquiring to communities

Widespread and long term inundation around the river mouth area caused by outflow from the Lumi River or dyke break bring the severe damages to especially "Kimorigo" or "Eldoro" communities located in inundation area western side of the Lumi River, and there occurred the flood inundation of 120cm in depth and lasted 2 months duration.
According to the figure described above, "Rekeke" or "Kimala" communities are located around the downstream tributaries and small streams towards Lake Jipe directly and they are absolutely different with the phenomenon of flooding around the Lumi River.
It can be speculated that the flow velocity is high because the duration of inundation is comparatively short approximated for just several hours.
In addition, although the depth is 60cm around, the danger posed by inundation caused by erosion or corrosion is high because of high energy of flow as a result of high velocity. This leads to difficulty in evacuation even when the water depth is shallow.
Also, the following features can be highlighted at the inundation points:

- Although the population of Kimorigo community is smaller than Kiwala or Eldoro, the number of affected people ratio in community population is very high.

- The number of affected people of Kiwala or Mata-Jipe is numerous because their population is large.

According to this, the damage situations and flood type in each community by Project Team's inquiring site survey on the communities are shown below:

(1) Kimorigo

- Water depth is 120cm; duration is 2 month when floods occur.
  (Inundation caused by overflow and dyke break from the Lumi River).

- Flow from river water and from upstream even when there is no rainfall in Kimorigo area
  (Inundation caused by overflow and dyke break from the Lumi River).

- Waters and sediments flow into the houses
  (Inundation caused by overflow and dyke break from the Lumi River).

- Small livestock such as goats, sheep, chicken and rabbits swept away
  (Inundation caused by overflow and dyke break from the Lumi River).

- The murram roads are inundated with flood water cutting off the villages from travelling.
  (Inundation caused by overflow and dyke break from the Lumi River).

- The farms are flooded sweeping away the food crops
  (Inundation caused by overflow and dyke break from the Lumi River).

- During very heavy flows Abori Primary School is closed
  (Inundation caused by overflow and dyke break from the Lumi River).

- Some mud houses are swept away
  (Inundation caused by overflow and dyke break from the Lumi River).

- Some of the farmlands have been turned into permanent swamps
  (Inundation caused by overflow and dyke break from the Lumi River).

(2) Kiwalwa

- Flood waters flows into the farmlands and sweeps the crops away
  (Inundation caused by overflow and dyke break from the Lumi River).

- Sediment flows into the houses and deposited inside
  (Inundation caused by overflow and dyke break from the Lumi River).

- Access roads are affected by the flood water interfering with transportation of produce to the market (Inundation caused by overflow and dyke break from the Lumi River).

- Pollution of spring water
  (Inundation caused by overflow and dyke break from the Lumi River).

(3) Elodro

- Some of the farmlands have been turned into permanent swamps
  (Inundation caused by overflow and dyke break from the Lumi River).

- During periods of very heavy flooding school work is interfered with at Eldoro Primary School (Inundation caused by overflow and dyke break from the Lumi River).

- The flood waters sweep away the food crops
  (Inundation caused by overflow and dyke break from the Lumi River).

(4) Riata-mrabani

- Flooding from the slopes of Mt. Kilimanjaro (Flash flood).

- Destruction of infrastructure like roads and the railway (Flash flood).

- Flood water gets into the houses with sediments (Flash flood).

- Very serious gulley erosion leading to loss of farmlands (Flash flood).

(5) Rekeke

- Flood waters from Tsavo West (Flash flood).

- Destruction of infrastructure such as the bridge on the road (Flash flood).

- Death of one villager in 2009 (Flash flood).

- Destruction of houses in Rekeke (Flash flood).

- Sediment flow inside the houses (Flash flood).

- Small livestock such as goats, sheep, chicken and rabbits swept away (Flash flood).

- Very serious erosion that increases the sizes of the gulleys and reduces the size of the residents farmlands at the same time (Flash flood).

(6) Kimala

- Flood waters mainly from the Tsavo West National Park (Flash flood).

- Leads to destruction of infrastructure like bridges (Flash flood).

- Houses are inundated with flood water. (Flash flood).

- Loss of lands by gully erosion. (Flash flood).

(7) Ndilau

- Flash flooding from the side of Tsavo West National Parks (Flash flood).
- Heavy soil erosion has led to the formation of very big gulleys hence loss of farmlands (Soil and sediment run off).
- It has caused the destruction of the road to Voi and Lake Jipe (Soil and sediment run off).
- The flood flows also cause the destruction of houses (Flash flood).
- Destruction of farmland and the sweeping away of crops (Flash flood).
- 1 person was killed while trying to cross the big gulleys during the flood (Flash flood).

(8) Njoro

- Flood waters cause the pollution of the springs (Inundation caused by overflow and dyke break from the Lumi River).
- Sweeping away the crops in the farmlands (Inundation caused by overflow and dyke break from the Lumi River).
- Destruction of the house (Inundation caused by overflow and dyke break from the Lumi River).

(9) Bahati

- Flash flooding from the side of Tsavo National Park (Flash flood).
- Destruction of the houses (Flash flood).
- Sweeping away of the livestock (Flash flood).

(10) Mata-jipe

- Flash flooding from the side of Tsavo West National Park (Flash flood).
- Destruction of houses (Flash flood).
- Sweeping away of Livestock and other domestic animals (Flash flood).
- Sweeping away of the crops in the farms (Flash flood).
- Serious gulley erosion leading to the loss of farmland (Flash flood).

(11) Kitobo-Njoro

- Flash flooding from the mountain on the upper side but then the flood water settle near the Kitobo spring (Flash flood).
- Leads to the pollution of the spring waters (Flash flood).
- Land surrounding the Kitobo springs made unsuitable for agriculture (Flash flood).

- Serious gulley erosion leading to the loss of farmlands (Flash flood).

4) Existing Structures along the River

There are flood control and water use facilities in the Lumi River Basin such as Canal-A, Canal-B, Canal-C and Grogan-Canal.

As shown in following figures, Canal-A (approx. 12km), Canal-B and Canal-C (approx. 17km) flow parallel on the western side of the Lower Lumi River and these three canal merge into one at the north side of the Lake Jipe and then the canal connects the Ruvu River which flow from the Lake Jipe. These canals were constructed in 1930's during the colonial period and they have functions of drainage and irrigation.

According to the report of NWCPC, embankments (Height: 1.5m, Length: 10km) along the Canal-C were built in 1973. In conjunction with construction of embankments, two irrigation canals were dredged. However, due to sediment discharge and inappropriate maintenance of the channels, capacity of flow has been reduced and part of embankment got collapsed when flood had occurred. Since then canals doesn't fulfill a function. Especially flood in 1987 and 1997, farmers destroyed dykes in order to intake agricultural water for farmland between the Lumi River and dyke and currently part of embankment is dysfunctional.

Part of embankment of Canal-C (approx. 700m) is broken at this moment, flooding water in the Lower Lumi River can't run through the Canal-C and spread across area of the Canal-B and the Canal-A. We infer that these canals which can't fulfill a function may have caused frequent flood damage in the western low-lying area of the Lower Lumi River Basin.

On the other hand, part of the Grogan Canal was renovated at the initiative of WRMA in 2012, it is function effectively on irrigation purpose and WRUA is maintaining the canal and its facilities properly. Hence, MWI, WRMA, DC, WRUA and etc. become their primary focus on projects of renovation on the Canal-A, Canal-B and Canal-C and mitigation of flood damages,

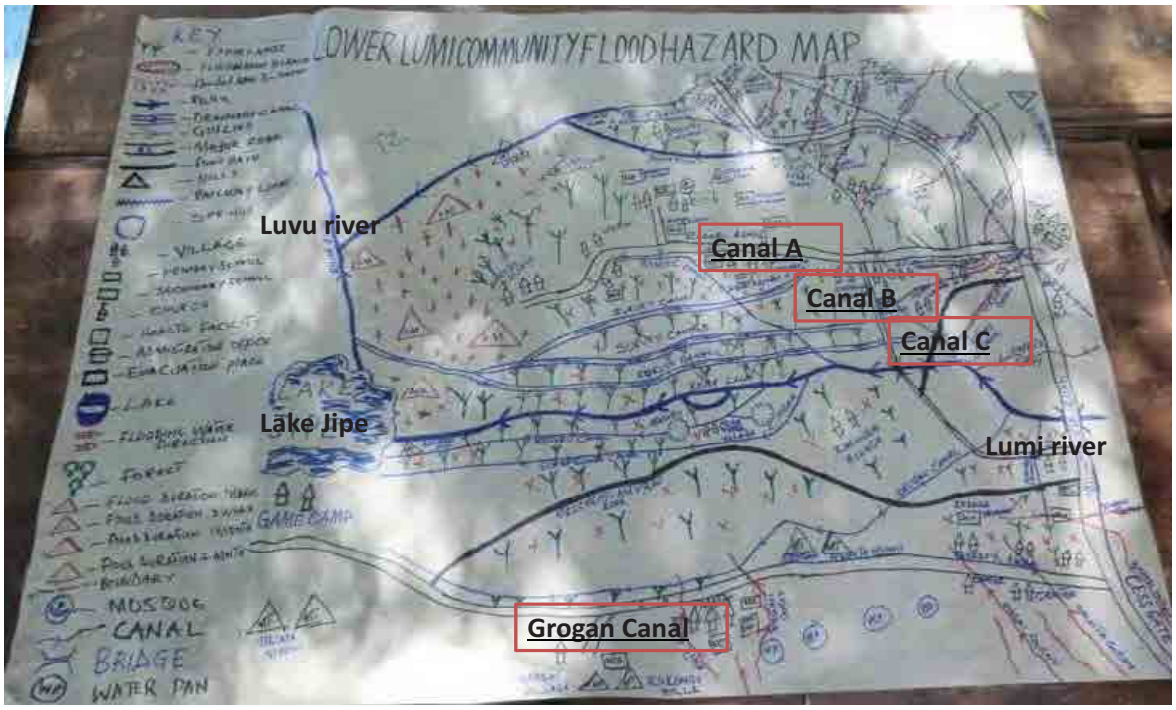


Fig. 2.3-11 Location of Canals

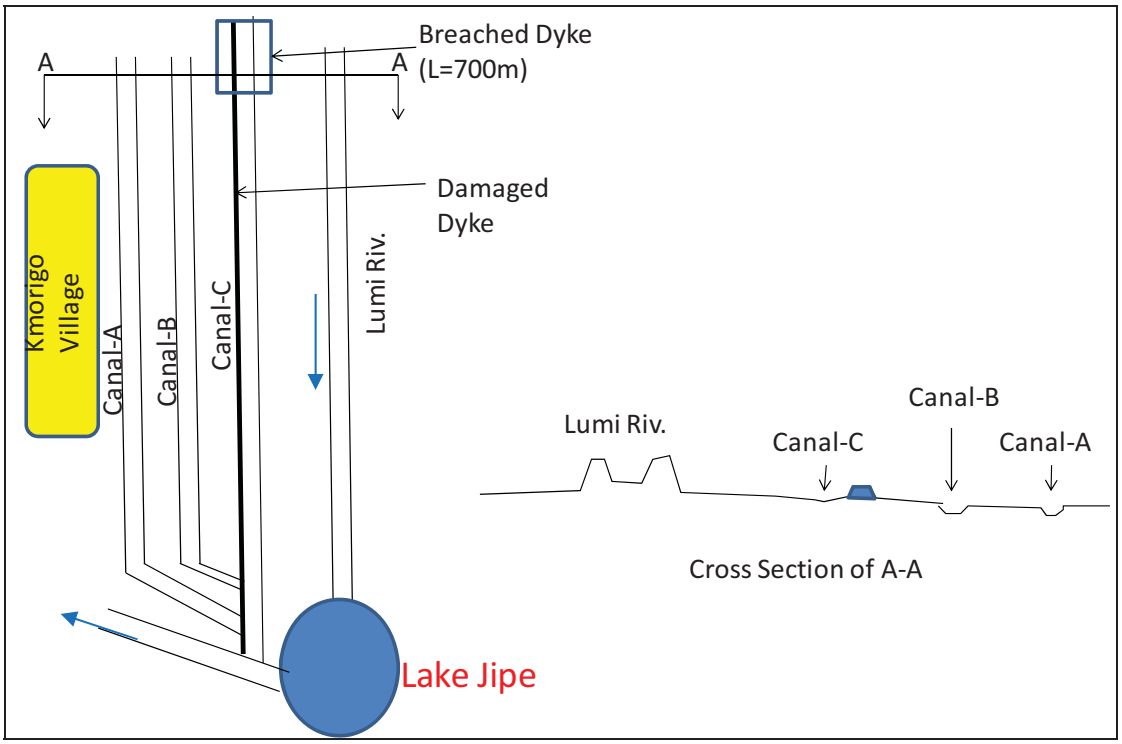


Fig. 2.3-12 Cross-section Diagram of the Lumi River and Canals

Photo 2.3.1 Embankment of the Canal-C

Photo 2.3.2 Broken point of the embankment Canal-C

Photo 2.3.3 Canal-A around Kimorigo village

Photo 2.3.4 A point of artificially-destroyed embankment
(take agricultural water from Lumi R. of the left side on the photo and supply to the right side)

(3) Flood characteristics analysis at the Lower Gucha Migori river basin

1) Summary of flood characteristics

Gucha Migori River consists of two permanent rivers, Gucha and Migori Rivers and the two rivers join to become one big river that drains into Lake Victoria. Land features of Lower Gucha Migori area is defined by the sloped land in the upstream and low lying area in the downstream. Main flood prone areas are near the river month as the river drains into Lake Victoria in the Lower Gucha Migori river basin. Flood comes in gradually rising inundation, which reaches to 1-1.2 meters in depth. The causes of long-lasting inundation are the overflow from mainstream of the river and absence of proper drainage. Inundation stays more than one month.

One of flood characteristics at the Lower Gucha Migori river basin is the river course changing its course at the river month. The major change of the course was observed between 1999 and 2003 and is shown in the figure 2.3-14 below. Change of the channel course is still continuing, advances at the time of large scale flood, and riverbank erosion is prevalent.

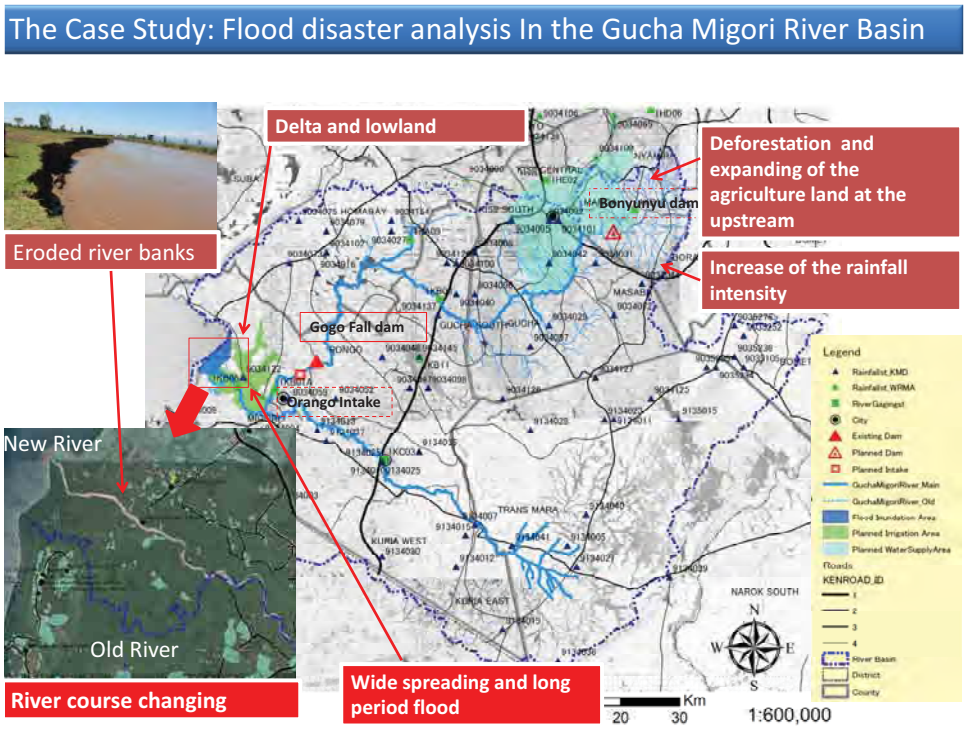


Fig. 2.3-13 Gucha Migori River Basin

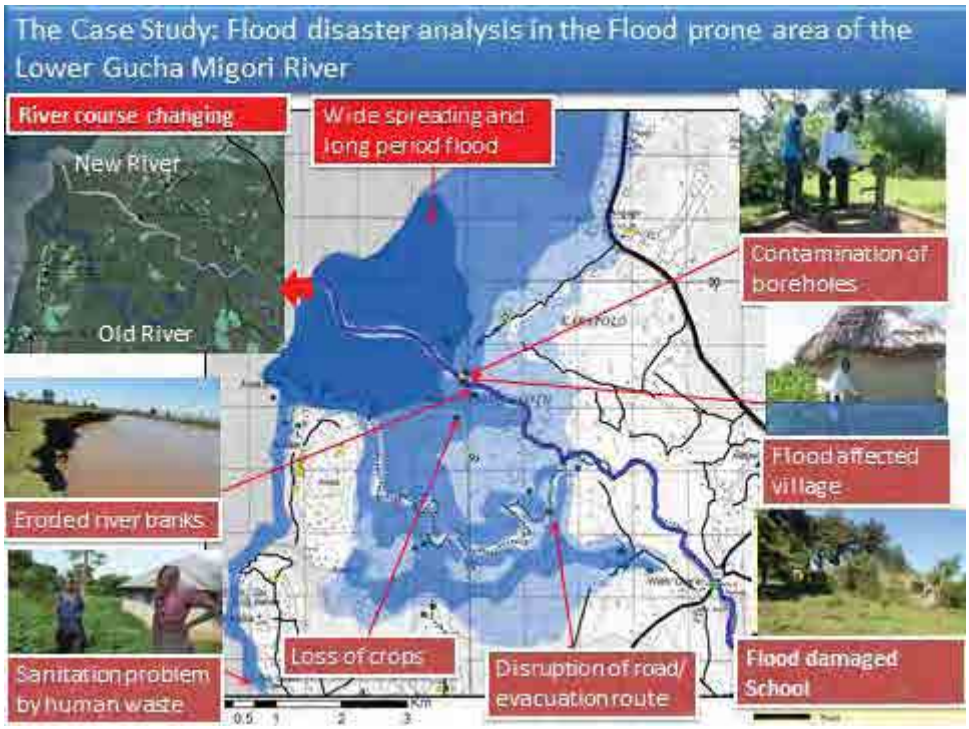


Fig. 2.3-14 Flood Prone Area of the Lower Gucha Migori River Basin

Chapter 3 Preparing River basin Integrated Flood Management Plan (IFMP)

The Project Team and WRMA drafted "Integrated Flood Management Plans (IFMPs)" for the three pilot river basins. The drafted IFMPs were based on the analyses of basin characteristics and flood characteristics obtained by "Baseline survey" and the additional site surveys and described flood management activities that stakeholders such as District, County, WRUA and NGO considered necessary, through the discussions held in IFMCs.

And the Project Team and WRMA considered the implementation scheme of flood management by incorporating the IFMP into the existing plans that have activity funds or legal effects such as SCMPs, CMSs or County Development Plans.

3.1 Understanding the state of the existing SCMPs

3.1.1 Flood management of the existing SCMPs

The Project Team collected SCMPS from the three WRUAs in the pilot Project areas to understand the state of the existing SCMPs at the pilot WRUAs.

Each of the SCMPs basically is structured as in the table of contents shown on the right side of this column. The degree of importance given to each chapter and the volume of narratives are variable among SCMPs. The existing SCMPs are mainly about the water-resource management, and flood-related descriptions are seen in the water resource problems.

Table of contents of SCMP

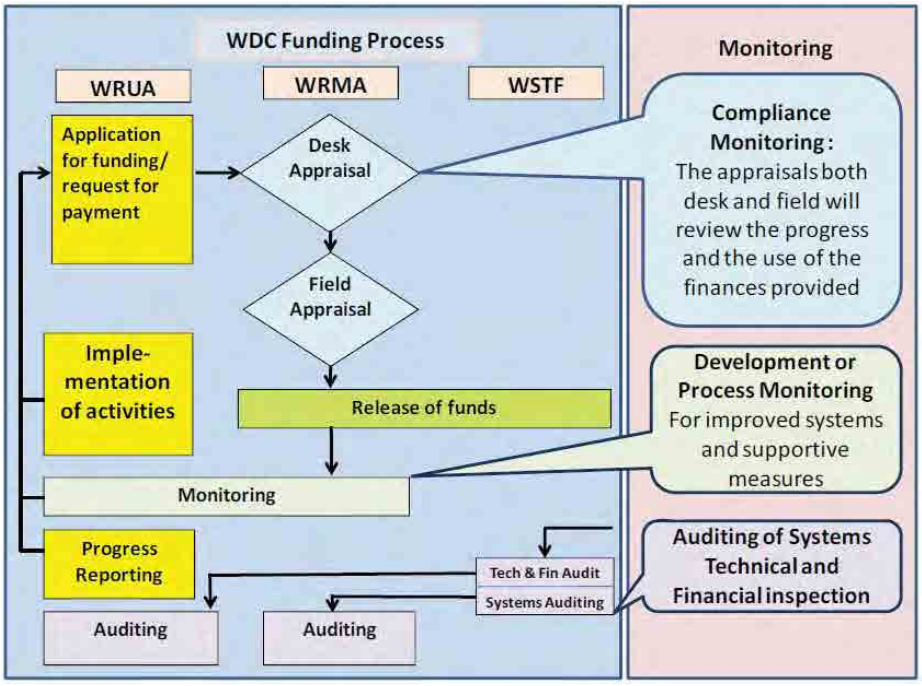
The descriptions about the flood in SCMPs of three pilot WRUAs are shown in the table 3.1-1. It shows that the floods are considered as a problem in chapter 3 of water resource problems in the sub-catchment, but countermeasures to the floods are mentioned only in the chapter 10 of infrastructure development and integrated measures combined with structural and non-structural measures are not considered.

Table 3.1-1 Flood-related Descriptions in SCMPs

LOGUMI WRUA	Lower Lumi WRUA	Isiolo WRUA
♦ In Chapter 10 Infrastructure Development, a sub-section, 10.1.3 Flood Mitigation, is set up. Flood damages and flood mitigation measures are described, such as construction of drainage channels and water way, afforestation and use of boats to support community in evacuation. Also, lack of evacuation centres and danger in evacuation routes are also pointed out. In addition, countermeasures such as preparedness activity, response activity and reconstruction activity are proposed. ♦ In Chapter 3 Water Resources Problems in the Sub-catchment, nine main water related disasters are identified in sub-section 3.1. Also, sub-section 3.3 mentions several issues, such as limitation of WRMA's capacity, lack of flood control facilities, inadequate data, lack of understanding to WRMA's activities, lack of efforts to approach to other funds, etc..	♦ Water related disasters are described in Chapter 1 sub-section 1.1, as shown below. - Flooding, - Degradation of hills, - Encroachment & siltation of springs, - Soil erosion, - Excess water drainage to Kitobo springs source from Njoro Kubwa springs, - Siltation of water pans, - Poor water quality (Njoro Masaini &Kitobo areas), - Unplanned blockage of river Lumi, - Poor drainage of irrigation canals, - Poor relationships among canal committees ♦ The description about the flood countermeasures in Chapter 10 Infrastructure Development are as shown below. Target: To increase water storage facilities to control floods Output: Storage capacity increased and water security improved floods controlled Activity: Flood Mitigation Sub-Activity: Conduct a study, Construct Dykes, Construct 2 storage dams (50,000m^3), Construct check dams	♦ Main water resource problems described in Chapter 3 are contamination of water and water shortage in the dry season. However flood is not lined up as one of main problems in the area. ♦ The description about the flood in Chapter 10 Infrastructure Development includes loss of properties and damages to infrastructure such as road, power distribution and water supply facilities. As one of countermeasures, construction of new dam is proposed; its budget Ksh 15,000,000 and 5 year implementation schedule. ♦ Establishing a river flow monitoring network and information sharing systems amongst all water users are proposed in Chapter 12.

3.1.2 WDC application of each SCMP

WRUA Development Cycle (WDC) is a framework to fund water resource management activities through the WRUAs. The funding is based on WDC contract among WSTF, WRUA and WRMA and the funding is guaranteed by WSTF. After the first funding and WRUA passes the audit, they can advance to the next level of funding. As WRUA advances in the level of funding there are more stringent scrutiny of WRUA's activities and funding.



Source: WDC ver. 2 (April 2014)

Fig. 3.1-1 WDC fundng process

The result of the interview with WRMA-HQ staff in charge of Community Development wherein WDC falls under is summarized as follows:

WSTF funding provided by WSTF is classified in 5 levels. Maximum funding for 1st level is Ksh 1,000,000 and used in such activities as capacity development of WRUA and support for SCMP preparation. For 2nd level, funding is increased to Ksh 2,000,000, mostly used for site investigation or small construction works. For 3rd level, WSTF funding increases to Ksh 5,000,000. For 4th level the amount is increased Ksh 10,000,000. And 5th level the amount is at Ksh 50,000,000. However, majority of WRUAs are at 1st or 2nd levels and they have remained there so far. There are few WRUAs that have advanced to 3rd level.

A process of funding application takes long time. Reasons identified for this were; at the initial stage, fulfilment of conditions to form a WRUA (area smaller than 100 sq-km, without overlapping with neighbouring WRUA), lack of required information such as member list, map that shows the area, bank account etc. If there is no lack of information in the application, funding for 1st and 2nd levels are not difficult to acquire. The situations of WDC application in SCMPs of three WRUAs in pilot sub-catchments are shown below.

Table 3.1-2 Progress of WDC Application of 3 WRUAs (Information gathered from WRMA HQ Staff)

	Lower Gucha Migori WRUA	Isiolo WRUA	Lower Lumi WRUA
Revision of SCMP	First edition (5-year plan) is published May 2012. It is already approved by WRMA-HQ.	First edition (3-year plan) is published March 2009.	First edition (3-year plan) is published December 2009.
Description of "Flood" in the SCMP	Yes	No	Yes
Next revision	2017 (tentative)	2012 (tentative)	2012 (tentative)
	* The time of validity is provided in each SCMP. However, if application for WDC is on process, WRUA cannot revise their SCMP until all project and procedures are finalized.		
WDC Level	Level 2	Level 3	Level 2
WDC application	Level 1: completed Application: 13/1/2010 Approval: 21/4/2010 Finalization: 21/10/2010 Level 2: (in the process) Application: 4/6/2012 Approval: WRMA HQ approved and send to WSTF on 6/11/2012	Level 1: completed Level 2: completed Level 3: The application has been approved (projects are 4,994,600sh). Applied projects are afforestation.	Level 1: completed Level 2: The application has been approved. The project by WSTF fund under progress -dredging of canals -spring protection
Tentative schedule of finalization of WDC application on present level	Half -1 year	November 2013, at earliest	No information
Flood management activities in present WDC application	No	No	Yes (dredging of canals)

3.2 Developing the integrated flood management plan

3.2.1 Defining the Integrated Flood Management Plan

Three documents are discussed herein i.e. "Sub-catchment Management Plan (SCMP)", "Flood Management Plan to be incorporated into SCMP", and "River Basin Integrate Flood Management Plan (RBIFMP)". The three documents address who is the main actor, and what the role each actor plays in each of the document.

SCMP is a document prepared by WRUA, and the main actor carrying out activities therein, including those activities derived from Integrated Flood Management Plan, is the WRUA. Therefore, SCMP should address issues of Mutual Support and Self-help type activities that are in the Integrated Flood Management Plan. Those activities or projects classified as "Public Assistance" should be the responsibility of government authority in charge of flood management, which in this case is WRMA. It is desirable that the river basin flood management plan be formulated by WRMA and SCMP prepared by WRUA be properly and

well-coordinated.

A possible relationship between RBIFMP and Flood Management Plan in SCMP is illustrated in the table 3.2-1 below.

Table 3.2-1 Flood Management Plan to be incorporated into SCMP

Approach / Level	Public Assistance	Mutual Support	Self-help
WRUA level	Flood Management Plan not to be incorporated into SCMP	Flood Management Plan to be incorporated into SCMP (WRUAs make the plan under WRMA's guidance)	
River Basin level	River Basin Integrated Flood Management Plan (RBIFMP) (WRMA should make the plan)		

The Project Team therefore supported the formulation of not only flood management plan that should be integrated into SCMP that is developed by WRUA in consultation with relevant parties including the counties, but also a draft model of "RBIFMP" which WRMA can develop in the future as WRMA implements flood management.

The Project Team conducted river basin-wide survey, beyond the boundary of the pilot WRUA, in order to collect basin-wide information. The Project Team also presented a long list of flood countermeasures that included not only self-help and mutual support types, but also public assistance type. Therefore the Integrated Flood Management Plan described below is not just "Flood Management Plan to be incorporated into SCMP" but a draft RBIFMP.

3.2.2 Developing the draft flood management plan

A RBIFMP is a document to be prepared by WRMA for each river basin. WRMA should assist WRUA to list projects that the WRUA can implement and thus such projects should be reflected on the WRUA's SCMP. In addition, WRMA provides the technical assistance for WRUA to implement the countermeasures against flood.
In case of the projects that WRUA cannot play a leading role, WRMA shall coordinate with relevant stakeholders to promote the projects.

As for the Integrated Flood Management Plans for Isiolo and Lumi river basins, WRMA and the Project Team formulated the draft Integrated Flood Management Plans, while coordinating with relevant counties and WRUAs.

Integrated Flood Management Plan will be developed by WRMA in the future. Therefore, the Integrated Flood Management Plan for Gucha Migori river basin was developed mainly WRMA, with minimum support from the Project Team.

3.2.3 Process of the developing the draft Integrated Flood Management Plan

A draft Flood Management Plan consists of following chapters;

1. Definition and position of river basin flood management plan
2. Outline of the river basin
3. Analysis of flood characteristics
4. Selecting Process of flood countermeasures
5. Project implementation plan for flood countermeasures
6. Recommendation

The content of each chapter of IFMP are shown below.

(IFMPs for Isiolo, Lumi and Gucha Migori River basins are shown in Appendix 3-2, 3-3 and 3-4.)

a) Definition and position of river basin flood management plan

In chapter 1, definition and position of river basin flood management plan and the role and responsibility of WRMA, and the roles of other members of the IFMC are described.

b) Outline of the river basin

In chapter 2, the outline of the river basin is described in three themes. First part, "natural condition", describes topography, soil, vegetation, land use, hydrology and meteorology. Second part, "socio economic condition", describes administration, population, and industry. Third part, "development plan", describes Vision2030, District Development Plans and Catchment Management Strategy (CMS).

c) Analysis of flood characteristics

In chapter 3, the records of flood damage in the basin are highlighted, thereafter analysis of flood characteristics on the basis of the natural conditions and socio economic conditions, wherein they had been discussed in the previous chapter.

The next topic that is to be addressed is the flood damage and their causes are related systematically using "Problem Tree" technique. And countermeasures considered effective to each of flood damages are examined using "Objective Tree" technique. Through this process, a long list of the countermeasures is prepared. Finally, priorities of the countermeasures are listed for consideration in a long list and thereafter a short list of proposed countermeasures is prepared.

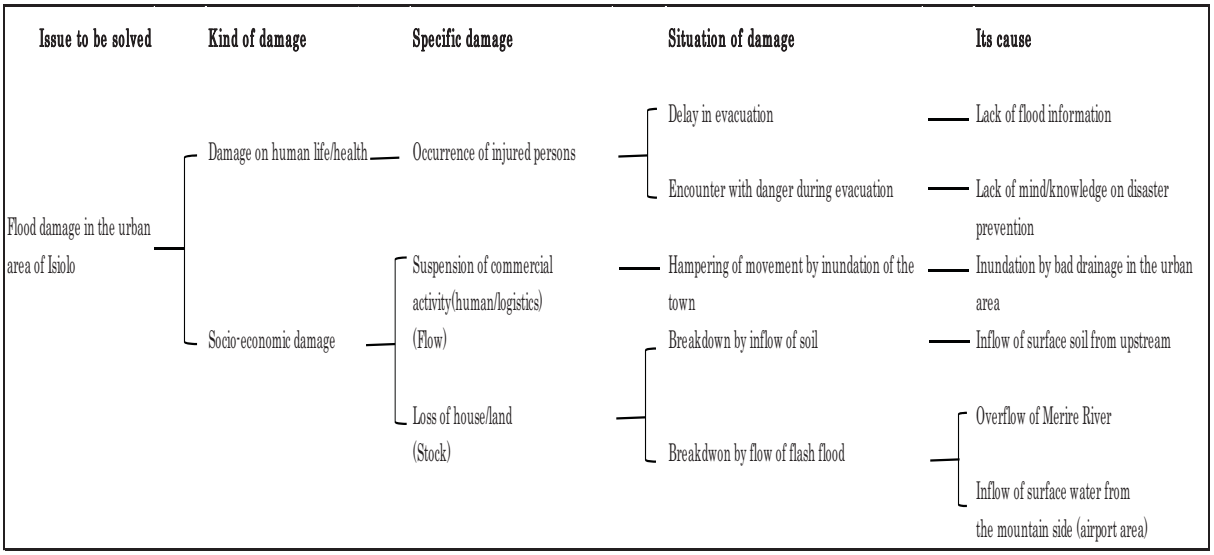


Fig. 3.2-1 Analysis on Problem Tree

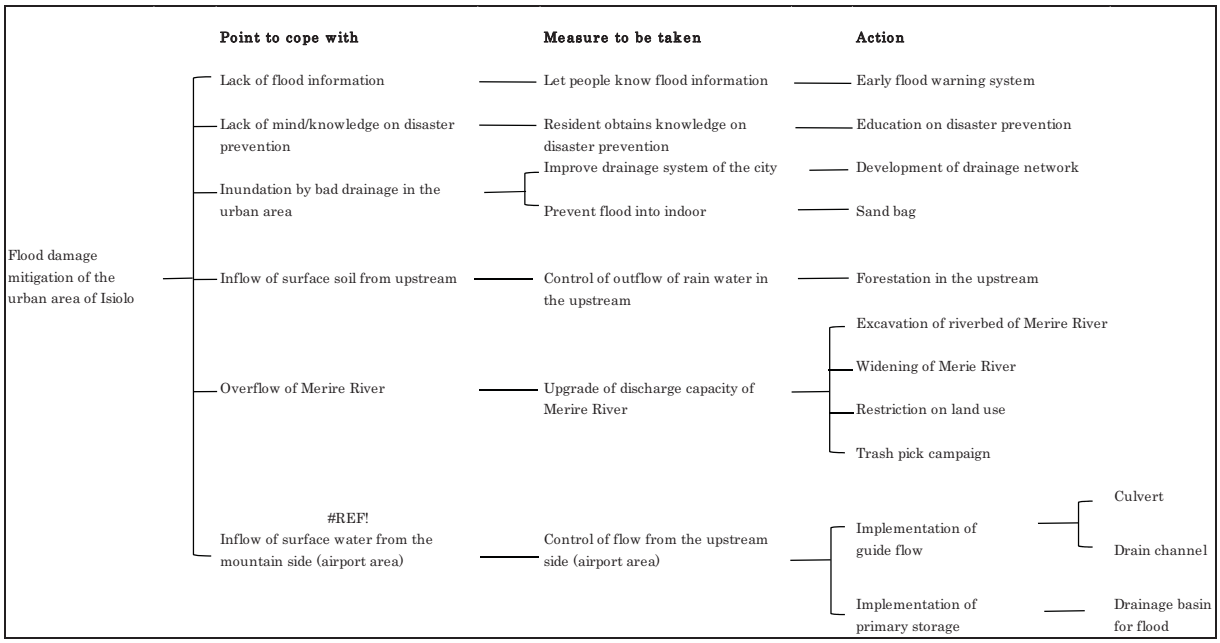


Fig. 3.2-2 Analysis on Objective Tree

d) Selecting Process of pilot projects

In chapter 4, criteria are set up to evaluate the flood countermeasures from various perspectives using similar method to DAC's evaluation criteria (Relevance, Effectiveness, Efficiency, Impact, and Sustainability).

In addition, there is need for EIA, to determine possible negative impacts on the environment and also community contribution are considered.

Table 3.2-2 Sample Evaluation matrix

No.		**I-U2**		
Target Area		**Upstream of Isiolo River**		
Countermeasure (Project)		**Bank Protection**		
Outline		It is a structure to prevent riverbank erosion.		
Image				
Evaluation items				
Evaluation by Five Criteria	**Relevance**	Population and number of houses are few at upstream. However, damage to farmland and plantation is extensive. There is a main highway near by upstream of Isiolo River. Prevention for road erosion is necessary. Stakeholder has strong request.	A	3
	Effectiveness	It also functions as protection of highway. In addition, it contributes to reduce flood damage to physical distribution and human movement. However, the effect of one construction is limited.	B	2
	Efficiency	Both cost and effectiveness are medium scale.	B	2
	Impact	If it is simple design, application in other area is not difficult.	B	2
	Sustainability	Continuous maintenance is inevitable. However, if it is simple design, maintenance is not difficult.	B	2
Evaluation by Five Criteria・Total			11	
Main Actor of the Project		Ministry of Water and Irrigation / Ministry of Special Program /WRMA/WRUA		
Public assistance (Government Level) Mutual support (Community Level) Self-help (Personal Level)		Public Assistance		
Comment		Each process such as planning, design, and construction need long term. However, residents by the river have strong request, because damage from sedimentation from upstream also affects downstream.		

e) Project implementation plan of flood counter measure

In chapter 5, through the examinations in the previous chapter, types of flood events to be tackled in the basin are prioritized, and the draft implementation schedule of

flood countermeasures is proposed. Example of the implementation schedule is shown in Table 3.2-3 for Isiolo river basin and Table 3.2-4 for Lumi river basin.

Table 3.2-3 Draft implementation schedule of flood countermeasures in Isiolo river basin

	Countermeasures	Required Preparation	Main Actor	Support Actor			WRMA's role	WRUA's role	1st year	2nd year	3rd year	4th year	5th year	6th year or later
				NGO	Administrative Authority	Techinical Authority								
Structural Measure	Development of Drainage Canal at Airport Area	Study/Survey/Discussion	County/District/WRUA		KeRRA	MWI, WRMA	coordination with related ministries	planning/ construction/ maintenance	Study and Discussion					
	Development of Drainage Network in Whole Urban Area of Isiolo Town	Study/Survey/Discussion	County/District		Ministry of Planning	MWI, WRMA	coordination with related ministries	maintenance			Study and Discussion			
	Culvert under road at airport area	Study/Survey/Discussion	KeRRA		County/District	MWI, WRMA	coordination with related ministries	maintenance	Study and Discussion					
	Retarding Basin/Pond at airport area	Study/Survey/Discussion	Airport Authority		County/District	MWI, WRMA	coordination with related ministries		Study and Discussion					
	Bank Protection (affected area to the transportation and farmlands)		WRUA		WRMA/ County/ District, Ministry of Road/ KeNHA	MWI, WRMA	approval of construction, coordination with related ministries, techinical advice	planning/construction/ maintenance						
	Improvement of Merire River (widening, etc)	Study/Survey/Discussion	NWCPC		County/District	MWI, WRMA	coordination with related ministries	maintenance			Survey and Discussion			
	Dam/Check Dam in the upstream of Merire River	Study/Survey/Discussion	WRUA/NWCPC		County/District	MWI, WRMA	coordination with related ministries	planning/ construction/ maintenance			Survey and Discussion			
Non-structural Measure	Flood Hazard Map		WRUA		County/District	MWI, WRMA	coordination with related ministries/techinical advice	cooperation/participation/enlightenment activity						
	Contingency Plan	Study and Discussion	County/ District	KRCS/World Vision	Min. of Special Programmes	MWI, WRMA	coordination with related ministries/techinical advice	cooperation/participation/enlightenment activity	Study and Discussion					
	Communication and collaboration between up/down stream	Already started in the committee	WRUA		MWI, WRMA	MWI, WRMA	coordination with related ministries/techinical advice	cooperation/participation/enlightenment activity						
	Flood Evacuation Programme	Study and Discussion	WRUA		County/District	MWI, WRMA	coordination with related ministries/techinical advice	cooperation/participation/enlightenment activity	Study and Discussion					
	Education on Disaster Prevention		Schools, WRUA	KRCS/ PTA	Ministry of Education/ County/District	MWI, WRMA	coordination with related ministries/techinical advice	cooperation/participation/enlightenment activity						
	Trash picker Campaign		WRUA		County/District	MWI, WRMA	coordination with related ministries	cooperation/participation/enlightenment activity						
	Flood Early Warning System	Study and Discussion	WRUA/County/District	KRCS	KMD/Ministry of Special Programs	MWI, WRMA	techinical advice	planning/formulation/operation/maintenance	Study					
	Sandbag		WRUA		County/District	MWI, WRMA	coordination with related ministries	cooperation/participation/enlightenment activity						
	Reconstruction and Recovery including Funds		County/ District	KRCS	Min. of Special Programmes	MWI, WRMA	coordination with related ministries	cooperation/participation/enlightenment activity						
	Forestation Activity		WRUA	KRCS	Kenya Forest Service	MWI, WRMA	coordination with related ministries	cooperation/participation/enlightenment activity						
	Restriction on land use		WRMA MOL		MOL	MWI, WRMA	coordination with related ministries	cooperation/participation/enlightenment activity						

Table 3.2-4 Draft implementation schedule of flood countermeasures in Lumi river basin

Draft Implementation Schedule of Flood Countermeasures in Lumi River Basin

	Countermeasures	Required Preparation	Main Actor	Support Actor			WRMA's role	WRUA's role	1st year	2nd year	3rd year	4th year	5th year	6th year or later
				NGO	Administrative Authority	Techinical Authority								
Structural Measure	Environmental Improvement of Evacuation Camp		WRUA	KRCS	County/District/Ministry of Education	MWI, WRMA	techinical advice	planning/construction/operation/maintenance						
	Raised-up Toilet		WRUA/Community/Individual		County/District/Ministry of Public Health	MWI, WRMA	techinical advice	planning/construction/enlightenment activity						
	Repair of existing embankment	Study/Survey/Discussion	NWCPC or County		County/District	MWI, WRMA	coordination with related ministries	planning/maintenance	Study/Survey/Discussion					
	Development of Community Road	Study/Survey/Discussion	WRUA		County/District/Ministry of Road/KeRRA	KeRRA, MWI, WRMA	techinical advice	planning/construction/maintenance		Study/Survey/Discussio				
	Channel Improvement of Lumi River	Study/Survey/Discussion	NWCPC or County		County/District	MWI, WRMA	coordination with related ministries	planning/maintenance				Study/Survey/Discussion		
	Dredging of Lake Jipe	Study/Survey/Discussion	NWCPC or County		County/District	MWI, WRMA	coordination with related ministries	planning/maintenance				Study/Survey/Discussio		
	Bank Protection	Study/Survey/Discussion	WRUA		County/District, MWI, WRMA	MWI, WRMA	techinical advice	planning/construction/maintenance				Study/Survey/Discussio		
Non-structural Measure	Education on Disaster Prevention		Schools, WRUA	KRCS	Ministry of Education/County/District	MWI, WRMA	coordination with related ministries	cooperation/participation/enlightenment activity						
	Community based Early Warning System against Flash Flood		WRUA	KRCS	KMD/Ministry of Special Programs	MWI, WRMA	techinical advice	planning/establishment/operation/mainenance	Formulation					
	Early Warning System for downstream (IFAS/GFAS)		WRUA/Community	KRCS	KMD/Ministry of Special Programs	MWI, WRMA	coordination with related ministries	cooperation/participation/enlightenment activity	Consideration					
	Forestation Activity		Youth group/Residents	KRCS	Kenya Forest Service	MWI, WRMA	coordination with related ministries	cooperation/participation/enlightenment activity						

f) Recommendation

In chapter 6, remarks, recommendations and other narrative information for the Integrated Flood Management Plan (IFMP) to be successful are described.

3.3 Flood management plan to be incorporated into Sub Catchment Management Plan (SCMP)

IFMP, which is drafted by IFMC, does not have any legal status and therefore it does not have fund allocated to it. Therefore, the IFMP should be incorporated into the plan that have legal status and therefore the plan can attract funding in order to ensure the effectiveness of flood management activities as described in the IFMP.

In conjunction with the support for development of IFMP and establishment of IFMC described above, the Project Team also examined the possibility of utilization of an existing funding scheme of SCMP, etc. that can be use funds by the WSTF in order to ensure effectiveness of the IFMP.

3.3.1 Organizing existing plans to be in tandem with IFMP

Flood management activities in IFMP can be classified into three approaches "Public Assistance", "Mutual Support" and "Self-help".

There are plans that the IFMP can be coordinated to fit in i.e. the CMS, national and/or sectoral development plan, County Development Plan, and SCMP.

These plans can be classified into three as "Public Assistance", "Mutual Support" and "Self-help" based on implementation activities level of each plan. Table 3.3-1 is a summary that shows how the IFMP can be related with other plans.

Table 3.3-1 Relation with flood management activities of IFMP and each plan (CMS, County Development Plan and SCMP)

Approach / Each plan	Public Assistance	Mutual Support	Self-help
CMS by WRMA-RO	✓	✓	-
County Development Plan by County	✓	✓	-
SCMP by WRUA	-	✓	✓

Implementing activities indicated in regional/sectoral development plan, County Development Plan and CMS are mainly classified into "Public Assistance". Implementing activities indicated in SCMP are mainly classified into "Mutual Support" and "Self-help". These plans have legal framework and therefore are able to attract funding.

3.3.2 Collateral of other plans for effectiveness of IFMP

(1) CMS

At the end of this Project, Project Team proposed the following salient issues to WRMA, the revision of CMS, which was approved by WRMA as follows:

- to be incorporated in concept of Integrated Flood and Drought Management

- to develop a IFMP at the river basin level as an object

And also, to promote the developed IFMP and ensure flood management projects and activities are expected horizontally.

(2) Regional/sectoral development plan by the National Government

As for the regional/sectoral development plan prepared by the National Government, Regional Development Authorities (RDAs) under Directorate of Regional Development Authorities (DoRDAs) in the MEWNR, which is former Ministry of Regional Development Authorities (MoRDAs), prepare Regional Development Plans. In these plans large scale infrastructure projects such as large scale dam development projects and river channel improvement projects are included. On the other hand, as for the sectoral development plan, National Irrigation Board (NIB) conducts irrigation development projects. In some of these projects dam and river dyke projects are included. In order to coordinate between IFMP and these regional/sectoral development plans, RDAs and NIB is invited to IFMC.

(3) WDC Manual / SCMP

Community based activities by WRUA are based on the developed SCMP. WDC manual is the guideline that is used to develop SCMP.

The revision of WDC manual was implemented by WRMA, and the Project Team supported the revision by drafting the draft “Flood Management Module” as additional module for the revised WDC manual. Description ("to set a chapter of flood management in the case of SCMP development and update") is specified in revised WDC manual. It is therefore now easy to incorporate flood management activities (Mutual Support and Self-help) of IFMP into the SCMP as mentioned above.

And each of WRUA in the 3rd IFMC meeting in the pilot river basins stated their willingness for the contents of IFMP to be incorporated into SCMP during the revision of their SCMPs.

(4) County Development Plan

The flood management activities in the IFMP, regarding to the large-scale projects such as those classified as Public Assistance and Mutual Support, can be planned and implemented by the County government of the respective region of the river basin. Therefore there is need for cooperation with all stakeholders in the river basin in order to implement the flood management activities efficiently and effectively.

Project Team efforts towards cooperation of WRMA and County government were through the IFMC and pilot activities. As a result, it was agreed that it is necessary for flood management activities in the IFMP to be consistent with activities planned by the County government as per deliberations by participants during the 3rd IFMC meeting at the each pilot river basins.

3.3.3 Revision of the IFMP

IFMP that has been developed through this Project have a lifespan of five years wherein the flood management objectives can be met. It is therefore necessary to be updated appropriately in response to large-scale flood damage and changes in the natural conditions and

socio-economic conditions of the region.

Therefore, the followings were agreed upon by the participants of the IFMC:

- ✓ to operate at IFMC of each river basin, which will be held every year,
- ✓ to consider a review of the appropriate IFMP,
- ✓ to confirms the implementation status of the entire progress of plan,
- ✓ to confirm application status to the WSTF, and
- ✓ to monitor flood management activities funded by the WST.

Chapter 4 Establishing and operating Integrated Flood Management Committee (IFMC)

4.1 Establishment of Integrated Flood Management Committee

It was agreed to establish the Integrated Flood Management Committee (IFMC) in the respective river basins namely Isiolo river, Lumi river and Gucha Migori river having been selected as the pilot project sites at the meeting of Working Group held on November 30, 2012 under the attendance of the personnel in charge of flood management of WRMA headquarters, its regional offices and sub-regional offices through the discussions about the committee's role and work proceedings in the river basins.

The Project Team and WRMA prepared "Concept Note" for establishing the IFMC, and then based on it the "Constitution" was drafted that entailed the background of establishment, operating purpose of the committee etc. The IFMC constitution was explained to the committee members and thereafter a mutual agreement was reached.

Constitution of IFMC is as shown in Appendix 3-5 hereto. The Project Team proposed to WRMA to define the status of IFMC in official documents such as CMS (Catchment Management Strategy).

4.1.1 Purpose of IFMC

The purposes of establishment of IFMC are as follows:

(1) Preparation of flood management plan which plays an important role in the composition of the Sub-Catchment Management Plan through discussions among the persons in charge of the basin control concerned for the purpose of mitigating damages by flooding in the basin.

(2) Selection of priority projects out of the flood management plan utilizing WSTF (Water Service Trust Fund).

(3) Monitoring and confirmation of the progress of the whole flood management plan, application progress to WSTF, progress of the projects applied to WSTF and so on.

(4) Holding of the solution conference on the issues hindering the progress of the flood management plan.

(5) Supervision of the implementation circumstances of the flood management plan and necessary opinion exchange among the persons concerned.

4.1.2 Composition Personnel of the IFMC

IFMC is composed of the personnel of WRMA Regional Manager, WRUA, Ministry of Environment, Water and Natural Resources: MEWNR, Ministry of Interior and Coordination, concerned national government institutions, representatives of County Governments, KRCS, NGOs dealing in water related issues and jurisdictions in charge of control of the river basin concerned.

4.1.3 Operational Substance of the IFMC

The Project Team and WRMA drafted tentative draft "Concept Note" and "Constitution and thereafter the relevant stakeholders related to the flood management gathered and discussed and reached consensus and thereafter prepared the "Concept Note" and "Constitution" in order to establish the committee where the proceedings of flood management, adjustment of the interests and role allocation were discussed.

Those agenda were debated in the committee meetings. The annual IFMC meetings schedule was discussed at the 3rd committee meeting, where the necessity of revision of the flood management plan according to the damages suffered from the most recent flooding were to be studied for purposes of updating and reviewing the IFMP. The subsequent operational elements and the frequency of the IFMC meetings were agreed upon.

Composition of the stakeholders was updated according to the new constitution that was operationalized in 2013 and had reformed the administrative unit management organization.

Based on discussions in IFMC and studies by WRMA, establishment objectives and operational guidelines of IFMC including its meeting frequency will be updated as required.

4.1.4 IFMC Meetings hitherto held

IFMC meetings have been held to date as follows

Table 4.1-1 Holding status of IFMC Meeting

Name of meeting	Date of meeting
Isiolo River Basin 1st Meeting	23 January, 2013
Lumi River Basin 1st Meeting	22 February, 2013
Isiolo River Basin 2nd Meeting	14 August, 2013
Lumi River Basin 2nd Meeting	16 August, 2013
Gucha Migori Basin 1st Meeting	18 December, 2013
Gucha Migori Basin 2nd Meeting	27 February, 2014
Gucha Migori Basin 3rd Meeting	10 April, 2014
Lumi River Basin 3rd Meeting	14 April, 2014
Isiolo River Basin 3rd Meeting	21 May, 2014
Gucha Migori Basin 4th Meeting	24 July, 2014

4.2 Establishment and Meeting Session of IFMC for Isiolo River Basin

4.2.1 The 1st IFMC Meeting for Isiolo River Basin

The Project Team discussed with WRMA/ FMU (Flood Management Unit of WRMA) about the Concept Note for IFMC during the weekly meetings. Thereafter the Project Team sought consensus of the Concept Note with respective WRMA regional offices and sub-regional offices at Isiolo River Basin and Lumi River Basin and on preparation of the meeting agenda, participants and venue for the 1st IFMC meeting.

In parallel with the said meeting and preparatory work, the Project Team proposed possible scheme to be discussed as issues of respective basins based on the past site survey and discussions with WRMA regional office and sub-regional office.

Pursuant to the above-mentioned proceedings, the 1st IFMC meeting was held on January 23, 2013 for Isiolo River Basin to discuss current flooding circumstances and measures therefore to the stakeholders concerned.

The Project Team proposed the handling scheme of structural and non-structural measures classifying it into 2 categories of operation & maintenance to be proceeded, i.e. [1] in short, middle and long term [2] by administrative organization only, co-work by the community and administrative organization, by the community itself, in a matrix form.

As to the candidates of the Pilot Project to be supported by the Project Team, the Project Team explained specific implementation contents so that they would be agreed by WRMA, County or District and so on at the next IFMC meeting.

Appendix 3-6 shows the Minutes of the 1st IFMC meeting for Isiolo river basin.

4.2.2 The 2nd IFMC Meeting for Isiolo River Basin

(1) Integrated Flood Management Plan

The Project Team proposed the draft Integrated Flood Management Plan (IFMP) at the 2nd IFMC meeting for Isiolo river basin held on August 14, 2013. WRMA, secretariat of the committee, explained its outline and mutual agreement was reached among the participants.

The attendants confirmed to promote the IFMP in 5 years for the time being and to revise it at the annual IFMC meeting as required.

(2) Pilot Project (Structural Measures)

"Measures for Bank Erosion" was approved as the priority pilot project for Isiolo River Basin. It was pointed out that the structural measures project by WDC (WRUA Development Cycle) should be applied to WSTF (Water Service Trust Fund) for approval and that since the project would be implemented as a technical cooperation activity WRUA was asked for positive involvement in this project. Community members' participation in the project is requisite under the WSTF, which was also approved by the attendants. Appendix 3-7 shows the Minutes of the 2nd IFMC meeting for Isiolo river basin.

4.2.3 The 3rd IFMC Meeting for Isiolo River Basin

(1) Finalization of Integrated Flood Management Plan (IFMP)

WRMA explained the outline of IFMP at the 3rd IFMC meeting on May 21, 2014. Then, WRMA showed the framework for finalizing the Plan, and the following points among others for finalization were approved by the attendants.

- Updating of the stakeholders due to reform of relevant administrative organizations
- Incorporation of opinions of those stakeholders in the Plan
- Consideration of advanced schedule of Merire river improvement
- Application to the parliament of the County
- Partial correction of "main actor" described in IFMP

(2) Implementation Report of the Pilot Project

Completion of the pilot project (riverbank protection, Flood Early Warning System: FEWS)

implemented in the Isiolo river basin, was reported. Opinions on the importance for the beneficiaries to comprehend the benefits of the riverbank protection were raised for the future project. Opinions concerning botanical matter were examined and it was agreed that botanical matter should be studied more. Regarding the FEWS, it was experienced and reported that when there was heavy rain near the Nkando primary school where FEWS was installed Isiolo town would experience floods in about one hour later. Opinion was raised that in future KRCS (Kenya Red Cross Society) should be considered to be added to the list of information recipients.

(3) Future Proceeding of IFMC

WRMA proposed annual committee meeting though some of stakeholders raised opinion that would few members would participate in such frequency of meetings. It was therefore agreed upon that quarterly meeting would be held and that WRMA would host 2 times and the County government for 2 times this was after the participants debated on the rainy season factor and resource factor. Although Isiolo County government members attended the IFMC meeting but notably Meru County government members were absent. It was therefore decided that 4 persons from each County should be invited for the next meeting in December. Appendix 3-8 shows the Minutes of the 3rd IFMC meeting for Isiolo river basin.

4.3 Establishment and Meeting Session for Lumi River Basin

4.3.1 The 1st IFMC Meeting for Lumi river Basin

The Project Team discussed with WRMA / FMU (Flood Management Unit of WRMA) about the Concept Note for IFMC in the weekly meeting, then after the consensus had been reached it was also discussed with WRMA regional office and sub-regional. WRMA SRO, prepared the meeting agenda, participants and venue for the 1st IFMC meeting.

In parallel with the said meeting and preparatory work, the Project Team proposed possible scheme to be taken for the issues at respective basins based on the past site survey and discussions with WRMA regional office and sub-regional office.

Pursuant to the above-mentioned proceedings, the 1st IFMC meeting was held on February 22, 2013 for Lumi River Basin to discuss current flooding circumstances and measures therefor to the stakeholders concerned. The Project Team proposed the handling scheme of structural and non-structural measures classifying it into 2 categories of operation & maintenance to be proceeded, i.e. [1] in short, middle and long term [2] by administrative organization only, co-work by the community and administrative organization, by the community itself, in a matrix form. As to the candidates of the Pilot Project to be supported by the Project Team, the Project Team explained specific implementation contents so that they would be agreed by WRMA, County or District and so on at the next IFMC meeting.

Appendix 3-9 shows the Minutes of the 1st IFMC meeting for Lumi river basin.

4.3.2 The 2nd IFMC Meeting for Lumi River Basin

(1) Integrated Flood Management Plan

The Project Team proposed the draft Integrated Flood Management Plan (IFMP) at the 2nd IFMC meeting for Lumi river basin held on August 16, 2013. WRMA, secretariat of the committee, explained its outline and the participants agreed to it. The attendants agreed to promote the Plan in 5 years for the time being and to revise it at the annual IFMC meeting as

required.

(2) Pilot Project

Confirmation was obtained from the attendants that "environmental improvement of evacuation camp" was the top priority at this basin, and it was agreed to implement it as the pilot project. It was pointed out that the structural measures project by WDC (WRUA Development Cycle) should be applied to WSTF (Water Service Trust Fund) for approval and that since the project would be implemented as a technical cooperation activity WRUA was asked to positively be involved in this project. Community participation in the project is a requisite requirement under the WSTF. The lead role of WRUA in the project was approved by the participants.

Appendix 3-10 shows the Minutes of the 2nd IFMC meeting for Lumi river basin.

4.3.3 The 3rd IFMC Meeting for Lumi River Basin

(1) Finalization of Integrated Flood Management Plan (IFMP)

WRMA explained the outline of IFMP for Lumi river basin at the 3rd IFMC meeting on April 14, 2014. Then, WRMA showed the framework for finalizing the Plan, and the following points among others for finalization were approved by the attendants:

- Interrelation among WRMA, County Government, IFMC and WRUA is to be defined in IFMP (Integrated Flood Management Plan).
- Some flood measures described in IFMP had been implemented in the County, which should be confirmed.
- IFMP should be revised in due consideration of the measures that would be desirable to be implemented, measures that would be able to be implemented and activities that would be possible to be done.
- Consideration of application of co-funds instead of one fund

(2) Implementation Report of the Pilot Project

It was reported that the pilot projects such as environmental improvement of evacuation camp including evacuation hall, raised evacuation road, raised toilet and Flood Early Warning System (FEWS) had been almost completed.

It was reported that DO-NOU (sand bag) method was applied to the raised evacuation road, and technical transfer thereof was made to the WRUA and school community personnel at the training held at Kiambu. Community's elaborate contribution to the project in cooperation with WRUA and school personnel was introduced as to the banking structure filling for raised evacuation road. As to the FEWS, some river water level gauge and rain gauges were provided in the Lumi river basin including the upstream area of Lumi River, and the Community began to operate them. Further utilization of those devices is expected.

(3) Establishment of CFMO (Community-based Flood Management Organization)

Activities of CFMO under LOGUMI WRUA were introduced, and the establishment of the same for Lower Lumi WRUA was debated. Generally the stakeholders living in the Lumi river basin showed keen interest in this scheme and attitude to proceed with its establishment. Lower Lumi WRUA decided to be proactive by contacting LOGUMI WRUA.

(4) Future Proceeding of IFMC

WRMA proposed that IFMC meetings would be held annually and were no objection from the stakeholders. It was agreed that IFMC would be held after long rainy season and the participants pointed out that the trend of rain in Lumi river basin was twice a year.

Appendix 3-11 shows the Minutes of the 3rd IFMC meeting for Lumi river basin.

4.4 Establishment and Meeting Session of IFMC for Gucha Migori River Basin

4.4.1 The 1st IFMC Meeting for Gucha Migori River Basin

The 1st Meeting was held on December 18, 2013 at the Gucha Migori river basin with attendants of about 50 persons from WRMA, WRUA, representative of County Government, District Commissioner, NEMA (National Environmental Management Authority), KRCS (Kenya Red Cross Society) and so on.

This basin has larger catchment area than those in Isiolo and Lumi, having 9 WRUAs in the basin area and 5 Counties. Thus, all the stakeholders residing in the basin were invited and it was agreed to share the issues and prepare the flood management plan.

Guidelines to holding the meeting were as follows:

- Cultivation of common recognition of flooding circumstances among the areas concerned
- Recognition of necessity of the flood management plan per basin units
- Announce from WRMA for preparation of the flood management plan (Request for WRMA)
- As the next step, screening of priority areas, mutual understanding for realization of the plan by means of self and cooperative proceeding in those areas, introduction of activities thereafter

Process of preparing the Integrated Flood Management Plan was planned and implemented by the vanguard of the WRMA's regional office personnel as a part of capacity development of WRMA personnel. Appendix 3-12 shows the agenda, explanatory documents and minutes of meeting, of the 1st IFMC Meeting for Gucha Migori River Basin.

4.4.2 The 2nd IFMC Meeting for Gucha Migori River Basin

(1) Integrated Flood Management Plan (IFMP)

WRMA introduced "Cause & Effect" system of flood as the fundamental substance of the Integrated Flood Management Plan (IFMP) at the 2nd IFMC meeting on February 27, 2014, by which group-discussion was made about the "Cause & Effect" referring to the experienced flood to enhance the understanding of the actual conditions, characteristics and road map to prepare the Plan.

Integrated Flood Management Plan was to be made out as 5-year plan for the time being with review of Cause & Effect every year. Necessary revisions were to be made at the annual IFMC meeting.

(2) Pilot Project

Pilot projects (FEWS, Educational Program on Flood Management) under implementation in

the Gucha Migori basin were explained. Regarding FEWS, explanation of river water level gauges and rain gauges currently provided in the Gucha Migori basin and future provision plan, were made. As to the educational program of flood management, its promotion to the community members and enhancement of their participation therein, were explained.

Appendix 3-13 shows the agenda, explanatory documents and minutes of meeting for the 2nd IFMC meeting for Gucha Migori river basin.

4.4.3 The 3rd IFMC Meeting for Gucha Migori River Basin

(1) Integrated Flood Management Plan (IFMP)

WRMA explained the IFMP as to preparation process, contents, project plan, suggestions and "Cause & Effect of Flood" as well as WRMA's roles for flood management. WRMA then showed finalization policy of IFMP with the following remarks, to which the attendants agreed.

- Flood damages in the current IFMP would largely cover the downstream and not the whole basin areas.
- Those countermeasures in the IFMP are divided into short-term, mid-term and long-term for both structural and non-structural. The short-term and mid-term structural measures mainly targets addressing flood damage in the downstream with check-dams proposed in the upstream and downstream
- Priority orders shall be in accordance with the discussion results between WRMA and stakeholders for the measures against the flood.
- Securing of the fund for the flood measures shall be strived.
- Good practices implemented at Nyando basin shall be followed.

(2) Future Proceeding of IFMC

WRMA proposed the frequency of the future committee meeting twice a year after the rainy seasons and the stakeholders agreed to it. The meeting will be held every June and December to report flood-damage conditions by respective meetings and have discussions on their analysis and revision of IFMP.

Appendix 3-14 shows the agenda, explanatory documents and minutes of meeting of the 3rd IFMC meeting for Gucha Migori river basin.

Appendix 3-15 shows the agenda, explanatory documents and minutes of meeting of the 4th IFMC meeting for Gucha Migori river basin.

4.5 Suggestion for nationwide expansion of integrated Flood Management Committee (IFMC)

In this project, Integrated Flood Management Committee (IFMC) were established in 3 target river basins such as Silo river, Lumi river and Gucha Migori river, and the 3rd IFMC meeting have already held in each river basin up to present. In the future, additional IFMCs should be established in 12 flood prone areas by WRMA, and then WRMA should also plan Integrated Flood Management Plan (IFMP) by holding the meetings.

The plan is shown below.

4.5.1 The deadline and budgets for nationwide expansion of integrated flood management plan

In this project, the project team already proposed the nationwide expansion of IFMP and the deadline of implementation and budgets, and obtained the agreement approximately with WRMA. The deadline of implementation is shown below.

(1) Deadline

- Planning period of integrated flood management in a river basin shall be set one and half years (18 months)
- Twelve (12) river basins shall be divided into two (2) groups. One (1) group has six (6) river basins.
- One (1) Regional Office should have one (1) target river basin for the first group.
- Planning for six (6) river basins in one group shall be conducted concurrently.
- Total period of expanding IFM nation-wide might be three (3) years (18 months x 2 groups = 36 months) in the shortest.
- If there are more than one flood prone river basin in one flood prone sub region, selecting one river basin for this timeframe from the sub region shall be made by WRMA.
- Groping and prioritizing river basins shall be determined by WRMA.

4.5.2 Budgets

Assumed budgets and target river basin are shown below.

- Training for WRUA and 2. Reflecting IFM to SCMP: 1million Ksh. (But, expenses for WRUA shall be covered by WSTF. We should consider WRMA's expenses)

- Formulating and holding IFMC: 0.25 million Ksh x 5 (times) = 1.25 million Ksh.

- Drafting IFMP, 5. Site survey and 6. Site survey: approximately 1 million Ksh for WRMA officers' expenses

- Fabrication and installation of FEWS: 0.05 million Ksh x 3 stations = 0.15 million Ksh

- Totally 2.5 million Ksh per one river basin

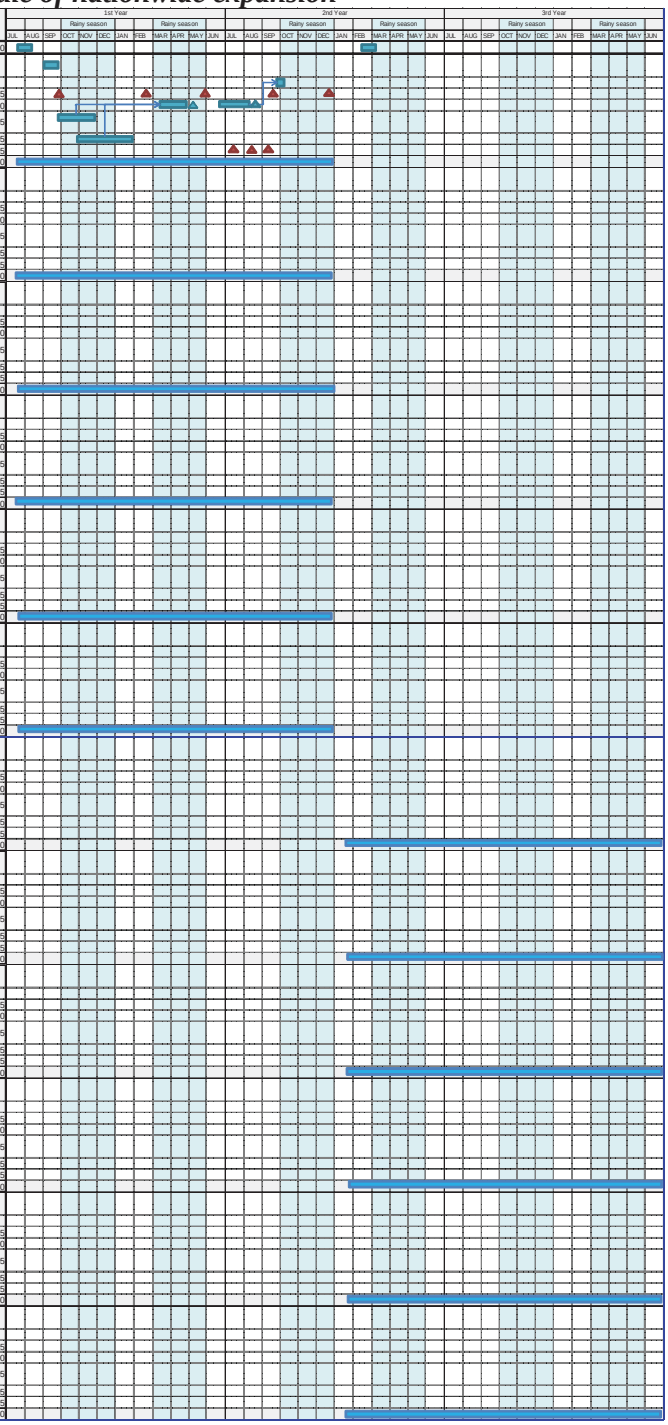
Table 4.5-1 Twelve (12) target river basins

Athi:	Lower Sabaki River Basin

	(to add one more)
Tana:	Lower Tana River Basin
	(to add one more)
ENN:	Ewaso Narok River Basin--- prioritized
	Daua River Basin
Rift Valley:	Molo River Basin--- prioritized
	Ewaso Ngiro South River Basin (Narok urban centre)
LVN:	Kitale urban centre (to identify exact river basin name)
	Yala River Basin
LVS:	Sondu River Basin
	Tende/Kibuoni River Basin

Table 4.5-2 Schedule of nationwide expansion

Group	Name of riverbasin	Name of Sub-catchmnet area / WRMA	Name of WRUAs		Activities for IFM at a river basin	Budget (Mil. KSH)
					Execution of training for WRMA	2.00
A	Lower Sabaki	Athi RO/		1	Execution of training for WRUA (Including drawing Community based hazard map)	WSTF
					Reflecting IFM to SCMP	WSTF
					Formurating and holding of IFMC	1.25
					Drafting IFMP (Including plan of flood counter measures)	1.00
					Site survey and Collecting river basin data (Natural and Socio-economic condition, Development plan)	0.05
					Site survey for flood damage data and Analysis of flood characteristics	0.05
					Fabrication and installation of FEWS	0.15
					Total	2.50
	Lower Tana	Tana RO/		2	Execution of training for WRUA (Including drawing Community based hazard map)	WSTF
					Reflecting IFM to SCMP	WSTF
					Formurating and holding of IFMC	1.25
					Drafting IFMP (Including plan of flood counter measures)	1.00
					Site survey and Collecting river basin data (Natural and Socio-economic condition, Development plan)	0.05
					Site survey for flood damage data and Analysis of flood characteristics	0.05
					Fabrication and installation of FEWS	0.15
					Total	2.50
	Ewaso Narok	ENNCA RO		3	Execution of training for WRUA (Including drawing Community based hazard map)	WSTF
					Reflecting IFM to SCMP	WSTF
					Formurating and holding of IFMC	1.25
					Drafting IFMP (Including plan of flood counter measures)	1.00
					Site survey and Collecting river basin data (Natural and Socio-economic condition, Development plan)	0.05
					Site survey for flood damage data and Analysis of flood characteristics	0.05
					Fabrication and installation of FEWS	0.15
					Total	2.50
	Molo	RV RO/		4	Execution of training for WRUA (Including drawing Community based hazard map)	WSTF
					Reflecting IFM to SCMP	WSTF
					Formurating and holding of IFMC	1.25
					Drafting IFMP (Including plan of flood counter measures)	1.00
					Site survey and Collecting river basin data (Natural and Socio-economic condition, Development plan)	0.05
					Site survey for flood damage data and Analysis of flood characteristics	0.05
					Fabrication and installation of FEWS	0.15
					Total	2.50
	Yala	LVN RO/		5	Execution of training for WRUA (Including drawing Community based hazard map)	WSTF
					Reflecting IFM to SCMP	WSTF
					Formurating and holding of IFMC	1.25
					Drafting IFMP (Including plan of flood counter measures)	1.00
					Site survey and Collecting river basin data (Natural and Socio-economic condition, Development plan)	0.05
					Site survey for flood damage data and Analysis of flood characteristics	0.05
					Fabrication and installation of FEWS	0.15
					Total	2.50
	Sondu	LVS RO/		6	Execution of training for WRUA (Including drawing Community based hazard map)	WSTF
					Reflecting IFM to SCMP	WSTF
					Formurating and holding of IFMC	1.25
					Drafting IFMP (Including plan of flood counter measures)	1.00
					Site survey and Collecting river basin data (Natural and Socio-economic condition, Development plan)	0.05
					Site survey for flood damage data and Analysis of flood characteristics	0.05
					Fabrication and installation of FEWS	0.15
					Total	2.50
B		Athi RO/		7	Execution of training for WRUA (Including drawing Community based hazard map)	WSTF
					Reflecting IFM to SCMP	WSTF
					Formurating and holding of IFMC	1.25
					Drafting IFMP (Including plan of flood counter measures)	1.00
					Site survey and Collecting river basin data (Natural and Socio-economic condition, Development plan)	0.05
					Site survey for flood damage data and Analysis of flood characteristics	0.05
					Fabrication and installation of FEWS	0.15
					Total	2.50
		Tana RO/		8	Execution of training for WRUA (Including drawing Community based hazard map)	WSTF
					Reflecting IFM to SCMP	WSTF
					Formurating and holding of IFMC	1.25
					Drafting IFMP (Including plan of flood counter measures)	1.00
					Site survey and Collecting river basin data (Natural and Socio-economic condition, Development plan)	0.05
					Site survey for flood damage data and Analysis of flood characteristics	0.05
					Fabrication and installation of FEWS	0.15
					Total	2.50
	Daua	ENNCA RO		9	Execution of training for WRUA (Including drawing Community based hazard map)	WSTF
					Reflecting IFM to SCMP	WSTF
					Formurating and holding of IFMC	1.25
					Drafting IFMP (Including plan of flood counter measures)	1.00
					Site survey and Collecting river basin data (Natural and Socio-economic condition, Development plan)	0.05
					Site survey for flood damage data and Analysis of flood characteristics	0.05
					Fabrication and installation of FEWS	0.15
					Total	2.50
	Ewaso Ngiro South (Narok urban centre)	RV RO/		10	Execution of training for WRUA (Including drawing Community based hazard map)	WSTF
					Reflecting IFM to SCMP	WSTF
					Formurating and holding of IFMC	1.25
					Drafting IFMP (Including plan of flood counter measures)	1.00
					Site survey and Collecting river basin data (Natural and Socio-economic condition, Development plan)	0.05
					Site survey for flood damage data and Analysis of flood characteristics	0.05
					Fabrication and installation of FEWS	0.15
					Total	2.50
	Kitale urban centre	LVN RO/		11	Execution of training for WRUA (Including drawing Community based hazard map)	WSTF
					Reflecting IFM to SCMP	WSTF
					Formurating and holding of IFMC	1.25
					Drafting IFMP (Including plan of flood counter measures)	1.00
					Site survey and Collecting river basin data (Natural and Socio-economic condition, Development plan)	0.05
					Site survey for flood damage data and Analysis of flood characteristics	0.05
					Fabrication and installation of FEWS	0.15
					Total	2.50
	Tende/ Kibuoni	LVS RO/		12	Execution of training for WRUA (Including drawing Community based hazard map)	WSTF
					Reflecting IFM to SCMP	WSTF
					Formurating and holding of IFMC	1.25
					Drafting IFMP (Including plan of flood counter measures)	1.00
					Site survey and Collecting river basin data (Natural and Socio-economic condition, Development plan)	0.05
					Site survey for flood damage data and Analysis of flood characteristics	0.05
					Fabrication and installation of FEWS	0.15
					Total	2.50



Chapter 5 Pilot project at the Isiolo Sub-Catchment

This chapter explains the activities which were conducted in Isiolo Sub Catchment in conjunction with WRMA and they are as follows:

- Selection of pilot area
- Implementation plan of pilot project
- Respective roles of the organizations concerned for implementing pilot community based structural activities
- Preparation and contract of construction work
- Implementation of pilot community based structural flood management activities
- Monitoring and evaluation of pilot community based structural flood management activities

5.1 Selection of Pilot Area and Pilot Project

For selection of Pilot Area and Pilot Project in Isiolo Sub-catchment, WRMA and the project team considered the some appropriate draft project types and then held the "IFMC" meeting in order to discuss this matter with the stake holders in Isiolo river basin. Through this procedure, the project type is selected.

After this, concerning the pilot area to be applied the selected project type, WRMA and the project team considered the most appropriate plan by comparison of some plans. WRMA and the project team explained the most appropriate plan to WRUA and the communities in the relevant area. And then consensus was built and pilot area and pilot project were selected.

5.1.1 Flood Management Structural Measures to be implemented in the IFMP

In the IFMP, long list of flood management countermeasures was prepared, these countermeasures were prioritized, emergency and preparation period for investigation, land survey and consultation with relevant stakeholders were taken into consideration, and the implementation time schedule of five-year plan was prepared.

5.1.2 Analysis on Flood Damage and Countermeasure

(1) Analysis on Flood Damage and Countermeasure in the Urban Area of Isiolo

1) Damage and its cause

Based on the field survey in this study, flood damage in the urban area of Isiolo was analyzed using logic tree. The following figure summarizes the specific causes of damage from the left side to the right side, i.e. kinds of damage, specific damage, condition of damage and its cause (see Fig.5.1-1).

Flooded urban area due to vulnerable drainage system (Place: Isiolo Town)

In the urban area of Isiolo, damage is occurred caused by a short term inundation of the whole city. Specifically, these damages are human damage derived from the lack of mind, knowledge and information on disaster prevention, damages to logistics and people's movement due to disturbance by inundation and loss of houses and land caused by inflow of soil and flood discharge. In addition to the lack of mind, knowledge and information on disaster prevention, the following three major causes are considered for the occurrence of large scale inundation as physical factors.

Inundated road in the urban area of Isiolo by flood (Place: Isiolo Town)

- Lack of discharge capacity of Merire River crossing the urban area
- Flow of rainfall has been changed by the airport and road newly constructed in the east side of the urban area and the flood hits the urban area directly, and
- Insufficient drainage system in the urban area of Isiolo.

2) Countermeasures

To derive the countermeasures, the objective tree analysis was carried out. Issues to be solved are placed on the left side and the measures are specifically presented therefrom(see ***Fig.5.1-2***).

Simple Rain Gauge (Place: Nkando Primary School)

In Isiolo River Basin, even if there is a heavy rain in the upstream by the effect of Mt. Kenya, there is a case having no rain in the middle and downstream. In such case, effective measure can be taken such as evacuation and activity to prevent flood by obtaining information on rainfall and water level in the upstream in advance. For this purpose, introduction of early flood warning system is effective. In the community too, rainfall in the upstream can be measured by simple hyetometer and the information transmitted to the downstream.

As the mind on disaster prevention of the residents is very low, dangerous situations are happened such as the people suffered from injury by crossing the road overflown with the flooded discharge and/or washed away by crossing the bridge submerged under water. To avoid such a situation, it is considered effective to educate the residents on disaster prevention about how much the floods are dangerous.

Shop taking measure by sand bag

(Place: Isiolo Town)

Insufficient drainage system in the urban area is one of the reasons why the flood damage spreads. Since the drainage infrastructure is not properly functioned or not well developed, inundation is occurred in the urban area with a little rainfall. Or the road is cut into pieces and the commercial activity is suspended by the inflow of water into the shops. As countermeasures, it is considered to develop drainage network in the urban area and to protect the inflow of water by banking up sand bags in front of the shops.

Very few drain channel installed in the urban area (Place: Isiolo Town)

Besides, houses and buildings are damaged and lost by overflowing of Merire River. Countermeasure to prevent overflow is to improve the discharge capacity of Merire River by way of excavation and/or widening of the river course. In addition, the following countermeasures are considered.
Restriction on land use which sets a limit to reside in a place nearby the river bank, and Trash picking campaign to remove garbage which blocks the flow.

Further, inundation in the urban area is becoming serious as the outflow route of flood has been altered by the impact of construction of the new road and expansion of the airport in the eastern slope of the urban area. To improve such a situation, countermeasures are considered to restore the flood outflow route to the original by developing drainage channel and culvert, and to limit the outflow by flood basin.

Culvert installed near the airport

(Place: Isiolo Town)

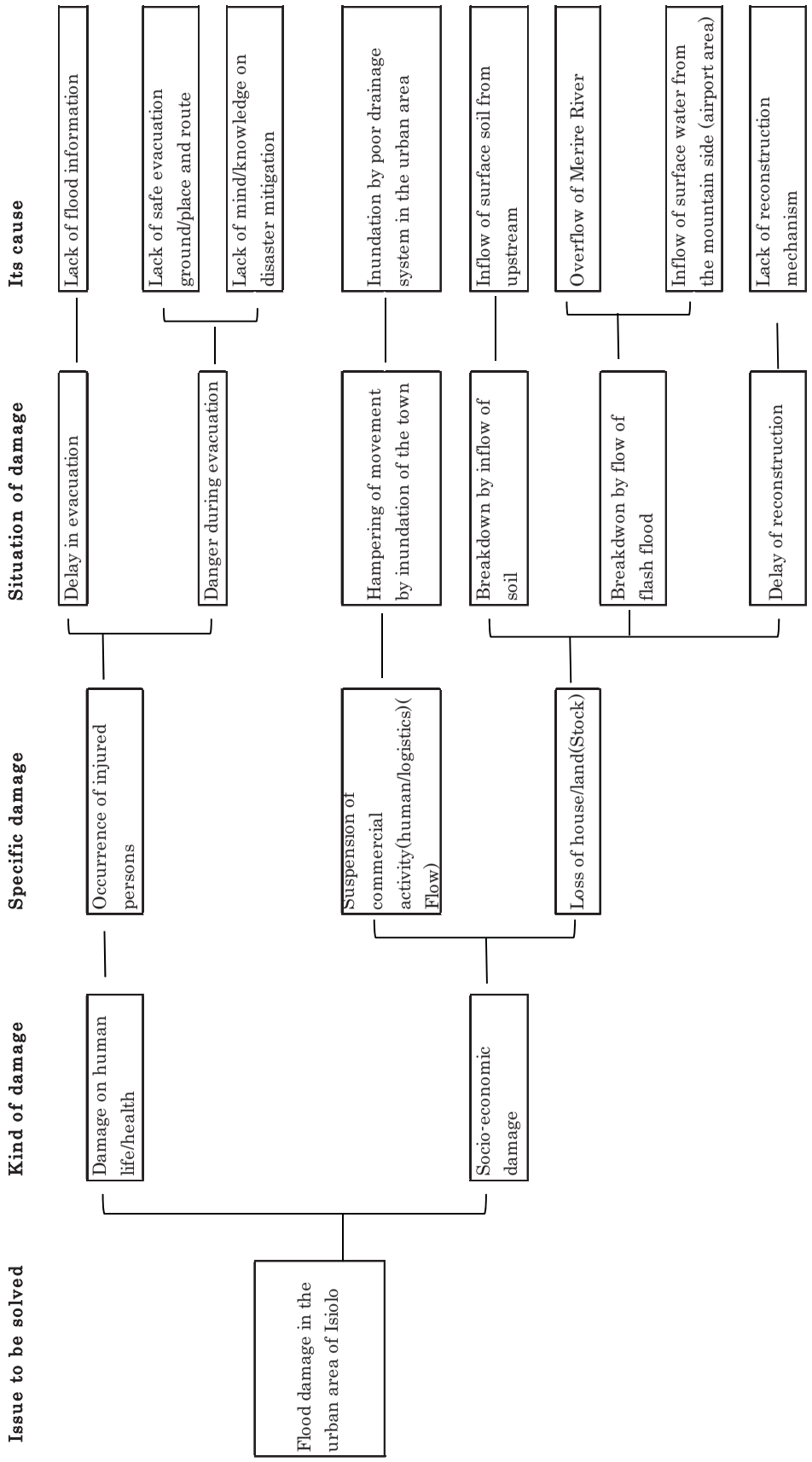


Fig. 5.1-1 Analysis on Flood Damage and its Cause

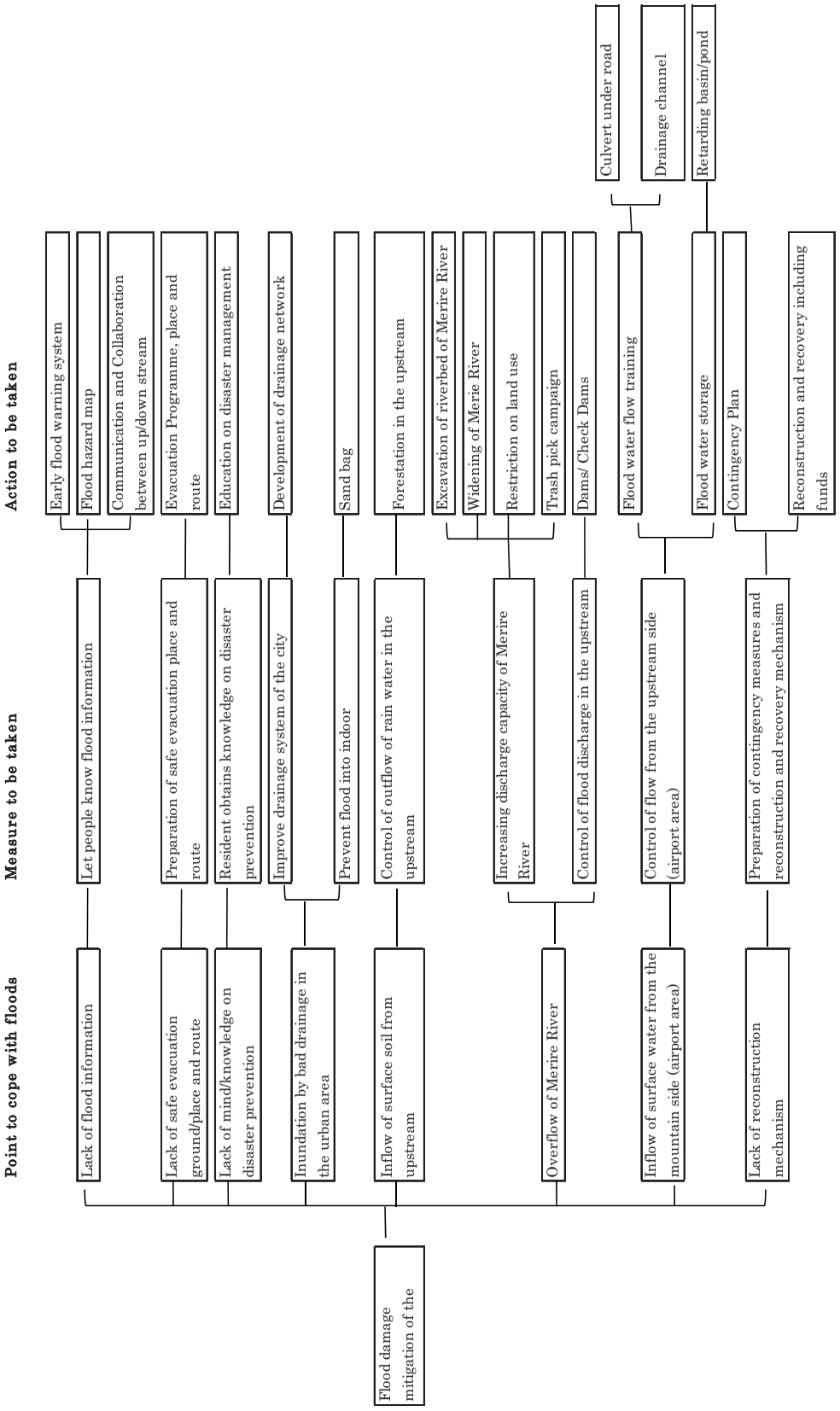


Fig. 5.1-2 Analysis on Countermeasures on daring the above, countermeasure method to be considered is summarized below.

Table 5.1.1 Countermeasure Method to be considered in the urban area of Isiolo

Countermeasure Method to be considered	Remarks	Target Area
Flood Early Warning	Collect and analyze information on flood such as rainfall and water level in the upstream of Isiolo River and transmit it to the urban area of Isiolo.	Isiolo Town
Flood Hazard Map	Flood hazard map is a tool for communicating the impact of a specific flood event in a particular community.	Isiolo Town
Communication and collaboration between up/down stream	Information sharing such as rainfall, water level, focal community members in both the upstream and downstream areas in the river basin allows for damage mitigation, evacuation, response and rescue operation	Isiolo Town
Flood evacuation programme	Establish evacuation programme including evacuation plan, safe evacuation places, route and evacuation drill	Isiolo Town
Education on disaster management	Educate the residents on how to reduce by themselves the present flood damage	Isiolo Town
Drainage network	Development in the whole urban area of Isiolo	Isiolo Town
Sand bag	Guidance on sand bag production and provision of materials	Isiolo Town
Forestation activity	Activity to promote plantation and forestation	Isiolo Town
Excavation of Merire River	Excavation of river bed of Merire River	Isiolo Town
Widening of Merire River	Widening of river width	Isiolo Town
Restriction on land use	Legislation on land use restriction	Isiolo Town
Trash picker campaign	Carrying out of trash picker campaign near Merire River	Isiolo Town
Dams/ Check Dams	Construction of dams and check dams in the upstream	Isiolo Town
Drainage canal	Development of drainage canal in the airport area	Isiolo Town
Culvert	Development of culvert in the airport area	Isiolo Town
Retarding basin/pond	Development of retarding basin/pond in the airport area	Isiolo Town
Contingency Plan	Contingency planning aims to prepare an organization to respond well to an emergency and its potential humanitarian impact.	Isiolo Town
Reconstruction and recovery including funds	A process of long-term reconstruction and economic recovery should begin while post-emergency actions aimed at restoring normality for the displaced populations returning home or settling in new places are being undertaken.	Isiolo Town

(2) Analysis on Flood Damage and Countermeasure in the Outskirt excluding the Urban Area (Mainly in the upstream of urban area of Isiolo)

1) Damage and its cause

Based on the result of field survey by this time, analysis was carried out, as the same as the urban area of Isiolo, on the damage at the outskirt area excluding the urban area, mainly in the upstream of the urban area using logic tree (see ***Fig. 5.1-3***).

Damages in the outskirt area excluding the urban area are mainly caused by, as mentioned in last chapter, displacement of river course in the middle stream, occurrence of debris flow, erosions of river bank and soil. There are a lot of agricultural lands in the outskirt of Isiolo, therefore, the damage to agriculture is remarkable and destruction of agricultural land by debris flow and washout of land by river bank erosion are occurred. In addition, infrastructures such as houses and bridges are also damaged by inundation, and it gives a great impact to the living of the residents.

Flood water went up to the elbow of the man (Place: Middle of the Isiolo River)

River bank erosion along Eastern Marania River (Place: Upstream of Isiolo River)

Bridge in the outside of Isiolo Town (Place: Upstream of Isiolo River)

2) Countermeasures

To derive the countermeasures, the objective tree analysis was carried out. Issues to be solved are placed on the left side and the measures are specifically presented therefrom(see ***Fig.5.1-4)***.

Production of agricultural crops is affected by the destruction of agricultural land by debris flow in this area. To prevent the outflow of debris flow, construction of check dam is considered effective. In addition, as a measure for river bank erosion, bank protection works are also effective to prevent washout of land.

Regarding the damage giving an impact to the living of residents by destruction of houses and infrastructures, there is a measure to prevent overflow by improvement of river course. If possible, upgrade or improvement of bridge is another option.

Example of check dam in Nzoia River

Example of river bank protection in Nzoia River

Countermeasures to be considered are summarized below.

Table 5.1.2 Countermeasures to be considered in the Outskirt Area excluding the Urban Area (mainly in the upstream of the urban area of Isiolo)

Countermeasure Method to be considered	Remarks	Target Area
Check Dam	Construction of Check dam at Isiolo River	Upstream
Bank protection and spur dike	Construction at Isiolo River	Entire basin
Improvement of river course	Improvement of river course of Isiolo River	Midstream and tributary stream
Improvement of bridge	Improvement of bridge of Isiolo River	Midstream and tributary stream

Fig. 5.1-3 Analysis on Flood Damage and its Couse

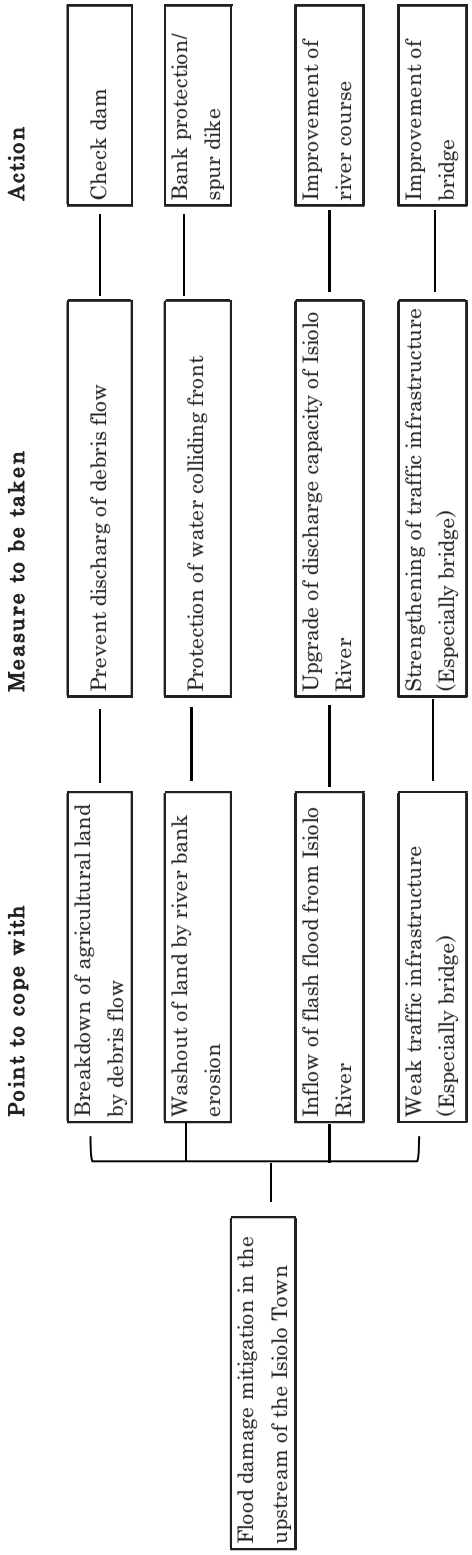


Fig. 5.1-4 Analysis on the Countermeasures

5.1.3 Long list/candidates of Countermeasures to the Flood

Long list candidates of countermeasures to the flood are presented as below.

Table 5.1.3 Long list of the Countermeasures to the Flood in Isiolo River Basin

No.	Countermeasure Method to be considered	Remarks	Target Area
1	Flood Early Warning	Collect and analyze information on flood such as rainfall and water level in the upstream of Isiolo River and transmit it to the urban area of Isiolo.	Isiolo Town
2	Flood Hazard Map	Flood hazard map is a tool for communicating the impact of a specific flood event in a particular community.	Isiolo Town
3	Communication and collaboration between up/down stream	Information sharing such as rainfall, water level, focal community members in both the upstream and downstream areas in the river basin allows for damage mitigation, evacuation, response and rescue operation	Isiolo Town
4	Flood evacuation programme	Establish evacuation programme including evacuation plan, safe evacuation places, route and evacuation drill	Isiolo Town
5	Education on disaster management	Educate the residents on how to reduce by themselves the present flood damage	Isiolo Town
6	Drainage network	Development in the whole urban area of Isiolo	Isiolo Town
7	Sand bag	Guidance on sand bag production and provision of materials	Isiolo Town
8	Forestation activity	Activity to promote plantation and forestation	Isiolo Town
9	Excavation of Merire River	Excavation of river bed of Merire River	Isiolo Town
10	Widening of Merire River	Widening of river width	Isiolo Town
11	Restriction on land use	Legislation on land use restriction	Isiolo Town
12	Trash picker campaign	Carrying out of trash picker campaign near Merire River	Isiolo Town
13	Dams/ Check Dams	Construction of dams and check dams in the upstream	Isiolo Town
14	Drainage canal	Development of drainage canal in the airport area	Isiolo Town
15	Culvert under the road	Development of culvert in the airport area	Isiolo Town
16	Retarding basin/pond	Development of retarding basin/pond in the airport area	Isiolo Town
17	Contingency Plan	Contingency planning aims to prepare an organization to respond well to an emergency and its potential humanitarian impact.	Isiolo Town
18	Reconstruction and recovery including funds	A process of long-term reconstruction and economic recovery should begin while post-emergency actions aimed at restoring normality for the displaced populations returning home or settling in new places are being undertaken.	Isiolo Town
19	Check Dam	Construction of check dam at Isiolo River	Upstream
20	Bank protection and spur dike	Construction of river bank protection works at Isiolo River	Entire basin
21	Improvement of river course	Improvement of river course of Isiolo River	Midstream and tributary stream
22	Improvement of bridge	Improvement of bridge of Isiolo River	Midstream and tributary stream

5.1.4 Selection of Flood Damage to be Managed Preferentially

(1) The Result of Workshop for Flood Damage Analysis by Community

In Isiolo river basin, the workshop was held to analyze the problems in Isiolo sub catchment with WRUA members, WRMA-SRO staff and JICA project team members on Nov. 7th, 2012.

As a result of analysis, the causes of flood are pointed out as bellow.

Table 5.1.4 Analysis for the Causes of Flood by Interviewing to WRUA Members

Theme	Causes	Principal Influence from Flooding
Floods	Rainfall around the Mt. Kenya slope	Flash flood from immediate rising in "wadi"
	Sediment flow around upstream	
	Lack of capacity for drainage	City area inundation caused by poor drainage
	Developed condition of poundage in the airport	

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

Table 5.1.5 Damage Analysis and Priority Order Determined by WRUA Members

Priority order determined by WRUA members	Item	Primary Damage	Secondary Damage
1	Sediment erosion	-Soil outflow from farmland -Loss of agricultural products -Sediment outflow	-Lack of farmlands -Inefficiency of harvest -Lack of lands -Obstruction of culverts
2	Damage of infrastructures	-Transmission wire -Roads -Bridges -Water intakes -Culverts	-Black out -Beyond reach of goods to markets -Unable to go to hospital or school -Insufficient water, conflicts over water, drought -Water spilling
3	Water pollution	-An epidemic of diseases -Growing worse of sanitation	-Epidemic of Cholera, Dysentery and Typhoid fever
4	Damage in daily life or livelihood	-Trash scattering -Overflowing from toilet -Destruction of houses	-Obstruction of culverts, water leaking -Sanitary conditions -Moving enforcement
5	Human life	-Lost of Human life by sweeping away -Drowned livestock	

5.1.5 Selection of the Prioritized Flood Damage to be managed

As a description in previous chapter, the flood damages along Isiolo river are principally classified into four (4) types such as A) Inundation in urban area of Isiolo town, B) Inundation which is caused by overflow and dyke break, C) Debris flow in the upstream and D) Bank erosion in the entire basin.

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

Table 5.1.6 Selection of The Flood Damages should be Corresponding Preferentially

Flood type	Social impacts		Economic impact				Priority order
	Number of affected people	Number of affected houses	Merchandise	Agriculture	Transportation	Sight seeing industry	
A. Inundation in urban area of Isiolo town	**High**	**High**	**High**	Low	**High**	Mid	Extremely High
B. Inundation which is caused by overflow and dyke break	Low	Low	Low	Mid	Low	Low	Slightly low
C. Debris flow in the upstream	Low	Low	Low	Mid	Low	Mid	Slightly low
D. Bank erosion in the entire basin	Low	Low	Low	Mid	**High**	Mid	Partially high in transportation

In the 4 types of flood damages, it shows that the damage by "Inundation in urban area of Isiolo town" has strongest impacts socio-economically, and the impact of damage in the point concerned to transportation by dyke brake.

According to these review, in Isiolo river basin, "Inundation in urban area of Isiolo town" is selected as the damage should be corresponding extreme preferentially, and subsequently the dyke break in the point concerned to transportation.

Therefore, selected long list is shown in the next page.

Table 5.1.7 Selected Long List of the Countermeasures to the Flood in Isiolo River Basin

No.	Countermeasure Method to be considered	Remarks	Target Area
1	Flood Early Warning	Collect and analyze information on flood such as rainfall and water level in the upstream of Isiolo River and transmit it to the urban area of Isiolo.	Isiolo Town
2	Flood Hazard Map	Flood hazard map is a tool for communicating the impact of a specific flood event in a particular community.	Isiolo Town
3	Communication and collaboration between up/down stream	Information sharing such as rainfall, water level, focal community members in both the upstream and downstream areas in the river basin allows for damage mitigation, evacuation, response and rescue operation	Isiolo Town
4	Flood evacuation programme	Establish evacuation programme including evacuation plan, safe evacuation places, route and evacuation drill	Isiolo Town
5	Education on disaster management	Educate the residents on how to reduce by themselves the present flood damage	Isiolo Town
6	Drainage network	Development in the whole urban area of Isiolo	Isiolo Town
7	Sand bag	Guidance on sand bag production and provision of materials	Isiolo Town
8	Forestation activity	Activity to promote plantation and forestation	Isiolo Town
9	Excavation of Merire River	Excavation of river bed of Merire River	Isiolo Town
10	Widening of Merire River	Widening of river width	Isiolo Town
11	Restriction on land use	Legislation on land use restriction	Isiolo Town
12	Trash picker campaign	Carrying out of trash picker campaign near Merire River	Isiolo Town
13	Dams/ Check Dams	Construction of dams and check dams in the upstream	Isiolo Town
14	Drainage canal	Development of drainage canal in the airport area	Isiolo Town
15	Culvert under the road	Development of culvert in the airport area	Isiolo Town
16	Retarding basin/pond	Development of retarding basin/pond in the airport area	Isiolo Town
17	Contingency Plan	Contingency planning aims to prepare an organization to respond well to an emergency and its potential humanitarian impact.	Isiolo Town
18	Reconstruction and recovery including funds	A process of long-term reconstruction and economic recovery should begin while post-emergency actions aimed at restoring normality for the displaced populations returning home or settling in new places are being undertaken.	Isiolo Town
19	Bank protection and spur dike	Construction of river bank protection works at Isiolo River	Entire basin

5.1.6 Evaluation of Countermeasures to the Flood

(1) View Point of Evaluation

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

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

Table 5.1.8 Definition of 5 Items for Project Evaluation

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

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

5.1.7 Result of the Evaluation on 5 Criteria

Following figure shows the result of evaluation on 5 criteria of all candidate countermeasures. It is preferable to implement from high scored to low scored measures. However, schedule some of them require long term coordination and negotiation. JICA project team studies

Table 5.1.9 Evaluation List of 5 Criteria

Structural/ Non-structural	Countermeasure and Target Area	Score	Remarks
Structural Measure	Drainage Canal / Isiolo Town (Airport Area)	12	Study/Survey/ Discussions
	Development of Drainage Network / Isiolo Town	11	Survey and discussions
	Culvert / Isiolo Town (Airport Area)	11	Study/Survey/ Discussions
	Flood Basin / Isiolo Town(Airport Area)	11	Study/Survey/ Discussions
	Bank Protection / Entire Basin	11	
	Excavation of River bed /Isiolo Town (Merire River)	10	Study/Survey/ Discussions
	Widening of River / Isiolo Town (Merire River)	9	Study/Survey/ Discussions
	Dam/ Check Dam in the upstream /Isiolo Town	8	Study/Survey/ Discussions
Non-structural Measure	Flood Hazard Map /Isiolo Town	15	
	Contingency Plan	15	Study/Discussion
	Communication and Collaboration between up/down stream /Isiolo Town	14	Already started in the committee
	Flood Evacuation Programme /Isiolo Town	14	Study/Discussion
	Education on Disaster Management / Isiolo Town	14	
	Trash picker Campaign /Isiolo Town	14	
	Early Warning System / Isiolo Town	13	Study/Discussion
	Sandbag / Isiolo Town	13	
	Reconstruction and Recovery including Funds	11	
	Forestation Activity	10	
	Restriction on land use	8	

Structural countermeasures listed in the IFMP were as follows;

1) Development of drainage network in whole urban area of Isiolo Town
2) Development of drainage canal at airport area
3) Culvert under road at airport area
4) Flood basin (retarding basin) at airport area
5) Bank protection

6) Improvement of Merire River (widening, etc)
7) Dam/Check Dam in the upstream of Merire Rive

Out of these countermeasures, it is obvious that the size of structure for 2), 4) and 6) might become large and the time for consultation with concerned stakeholders might become long. Consequently it is impossible to implement these countermeasures within the project period. There three countermeasures therefore were eliminated from the shortlist for the selection of pilot project.

Table 5.1-10 Draft Time Schedule of Structural Measures in Isiolo River Basin

	Countermeasures	Required Preparation	Main Actor	Support Actor			WRMA's role	WRUA's role	1st year	2nd year	3rd year	4th year	5th year	6th year or later
				NGO	Administrative Authority	Techinical Authority								
Structural Measure	Development of Drainage Canal at Airport Area	Study/Survey/Discussion	County/District/WRUA		KeRRA	MWI, WRMA	coordination with related ministries	planning/ construction/ maintenance	Study and Discussion					
	Development of Drainage Network in Whole Urban Area of Isiolo Town	Study/Survey/Discussion	County/District		Ministry of Planning	MWI, WRMA	coordination with related ministries	maintenance			Study and Discussion			
	Culvert under road at airport area	Study/Survey/Discussion	KeRRA		County/District	MWI, WRMA	coordination with related ministries	maintenance	Study and Discussion					
	Retarding Basin/Pond at airport area	Study/Survey/Discussion	Airport Authority		County/District	MWI, WRMA	coordination with related ministries		Study and Discussion					
	Bank Protection (affected area to the transportation and farmlands)		WRUA		WRMA/ County/ District, Ministry of Road/ KeNHA	MWI, WRMA	approval of construction, coordination with related ministries, techinical advice	planning/construction/ maintenance						
	Improvement of Merire River (widening, etc)	Study/Survey/Discussion	NWCPC		County/District	MWI, WRMA	coordination with related ministries	maintenance			Survey and Discussion			
	Dam/Check Dam in the upstream of Merire River	Study/Survey/Discussion	WRUA/NWCPC		County/District	MWI, WRMA	coordination with related ministries	planning/ construction/ maintenance			Survey and Discussion			

5.1.8 Methodology of Evaluation of Flood Countermeasures as Pilot Project

It was decided that the basic policy for selection of the pilot project in this project was that countermeasures which main actor is WRUA or communities and which is categorized as mutual support shall be selected among the shortlisted countermeasures.

Table 5.1-11 Evaluation axis and focused points for feasibility as a pilot project

Evaluation axis	Focused points
Feasibility by WRUA	➢ Can WRUA be a main actor of the project? ➢ Can it be implemented by community level?
Project duration period	➢ Is it possible to complete within a term of SCMP that are formulated in 3 to 5 years? ➢ Is it possible to be completed within this project?
Expenditure for the project	➢ Can the budget be obtained through SCMP scheme? (Under 5 mil. Ksh) ➢ Can it be implemented under the budget provision of this project?

5.1.9 Evaluation Results of Flood Countermeasures as Pilot Project

Evaluation results for each of the flood countermeasures as a pilot project are shown as follows;

Table 5.1-12 Structural Measures Evaluation Result as a Pilot Project (1)

Target Area		**Mountainside/Airport area (Inland Water)**		
Countermeasure (Project)		**Drainage canal**		
Outline		It is a structure to gather rain water and flow toward adequate and secure direction.		
Image				
Merit		Flow volume from airport area is drastically reduced.		
Demerit		Planning, design and construction take long time. Cost is high.		
Environmental Negative Impact		Excavation of land is necessary. Heavy machinery is required for construction.		
Necessity of EIA		Yes		
Contribution by the residents		The local contribution for the WDC has been set at a minimum of 15% of budget for sub-catchments in Alarm Status and 25% for sub-catchments in Alert or Concern Status. The local contribution may be in the form of cash, labour and materials/services.		
Main Actor		County/District/WRUA		
Supporting Actor		**Administrative Authority:** KeRRA **Technical Authority:** MWI, WRMA		
Public assistance/ Mutual support /Self-help		Mutual Support/ Public Assistance		
Relevance with PCDEFM Project	**Possibility to operate the project by WRUA**	Even if the main actor is WRUA, they can implement the small-scale project through the SCMP and WSTF fund. However, such small scale drainage doesn't have suitable effect.	C	1
	Project Term	Few months are required for the implementation. There is a possibility to implement within term of PCDEM project, depending on the scale.	B	2
	Project Budget	Project cost will be decided by the scale of the project. It is not impossible to implement at the level of 4 or 5 of WSTF.	B	2
Relevance with PCDEFM Project・Total			5	
Comment		Drainage canal from the airport area is planned. Inflow from the airport area to the Isiolo town area is one of the main causes of inundation of Isiolo town centre. However, based on the technical study conducted by the JICA Project Team, the scale of the project might be large in order to mitigate flood water in Isiolo town and the estimated cost might over the project budget. Therefore, this project seems to be difficult to implement as a pilot project.		

A (3 point): Excellent / B (2 point): Good / C (1 point): Poor

Table 5.1-13 Structural Measures Evaluation Result as a Pilot Project (2)

Target Area		**Mountainside/Airport area (Inland Water)**		
Countermeasure (Project)		**Culvert under the road**		
Outline		It is a structure to flow rain water safely.		
Image				
Merit		Flow volume from airport area is drastically reduced.		
Demerit		Planning, design and construction take long time. The candidate site is at the boundary between Isiolo town and Meru town. Coordination with them can take long time.		
Environmental Negative Impact		Excavation of land is necessary. Heavy machinery is required for construction.		
Necessity of EIA		Yes (It depends on the scale of the construction work.)		
Contribution by the residents		The local contribution for the WDC has been set at a minimum of 15% of budget for sub-catchments in Alarm Status and 25% for sub-catchments in Alert or Concern Status. The local contribution may be in the form of cash, labor and materials/services.		
Main Actor		KeRRA (Kenya Rural Road Authority)		
Supporting Actor		**Administrative Authority:** County/District **Technical Authority:** MWI, WRMA		
Public assistance/ Mutual support /Self-help		Public Assistance/ Mutual Support		
Relevance with PCDEFM Project	**Possibility to operate the project by WRUA**	Even if the main actor is WRUA, they can implement the small-scale project through the SCMP and WSTF fund. However, such small scale drainage doesn't have suitable effect. Essentially, it can be implemented by road authority.	C	1
	Project Term	The candidate site is at the boundary between Isiolo town and Meru town. Coordination with them can take long time. It is supposed that negotiation with road maintenance authority (KeRRA) needs time. It is difficult to implement within the PCDEFM project term.	C	1
	Project Budget	Project cost will be decided by the scale of the project. It is not impossible to implement at the level of 4 or 5 of WSTF.	B	2
Relevance with PCDEFM Project ・ Total			4	
Comment		The candidate site is at the boundary between Isiolo town and Meru town. Coordination with them can take long time. It is supposed that negotiation with road maintenance authority (KeRRA) needs time. It is difficult to implement within the PCDEFM project term.		

A (3 point): Excellent / B (2 point): Good / C (1 point): Poor

Table 5.1-14 Structural Measures Evaluation Result as a Pilot Project (3)

Target Area		**Upstream of Isiolo River**		
Countermeasure (Project)		**Bank Protection**		
Outline		It is a structure to prevent riverbank erosion.		
Image				
Merit		Bank erosion of the construction site will be prevented.		
Demerit		Influence for downstream and other side of bank should be considered.		
Environmental Negative Impact		Heavy machinery is required for construction. It can affect environment.		
Necessity of EIA		If the size of construction work is large, EIA is need. But, if the size is small, EIA is not necessary.		
Contribution by the residents		The local contribution for the WDC has been set at a minimum of 15% of budget for sub-catchments in Alarm Status and 25% for sub-catchments in Alert or Concern Status. The local contribution may be in the form of cash, labour and materials/services.		
Main Actor		WRUA		
Supporting Actor		**Administrative Authority:** WRMA/ County/ District, Ministry of Road/ KeNHA **Technical Authority:** MWI, WRMA		
Public assistance/ Mutual support /Self-help		Public Assistance/ Mutual Support		
Relevance with PCDEFM Project	**Possibility to operate the project by WRUA**	Even if the main actor is WRUA, they can implement the small-scale project through the SCMP and WSTF fund.	B	2
	Project Term	Few months are required for the implementation. There is a possibility to implement within term of PCDEM project, depend on the scale.	B	2
	Project Budget	Project cost might be not so high. It is possible to implement at the level of 3 to 4 of WSTF.	A	3
Relevance with PCDEFM Project･Total			7	
Comment		Regarding the project cost and period, it is possible to implement within the project budget and period. WRUA can implement this type of project if they can get the budget from WSTF. There are many similar sites of eroded bank in this river basin. Therefore, this project can be a model for bank protection in the future.		

A (3 point): Excellent / B (2 point): Good / C (1 point): Poor

Table 5.1-15 Structural Measures Evaluation Result as a Pilot Project (4)

Target Area		**Isiolo Town (General)**		
Countermeasure (Project)		**Dam/Check Dam**		
Outline		Check dams are relatively small, temporary structures constructed across a swale or channel.		
Image		 (Source: WRMA, NALEPO Project in Athi CA)		
Merit		They are used to slow the velocity of concentrated water flows, a practice that helps reduce erosion. As storm water runoff flows through the structure, the check dam catches sediment from the channel itself or from the contributing drainage area.		
Demerit		Preparation before actual construction work such as discussion with stakeholders, survey, planning, design needs long term.		
Environmental Negative Impact		There might be an impact to the downstream river channel caused by stopping the sediment movement and an impact to living things caused by blocking of water flow.		
Necessity of EIA		Yes (in case the size of structure is large)		
Contribution by the residents		The local contribution for the WDC has been set at a minimum of 15% of budget for sub-catchments in Alarm Status and 25% for sub-catchments in Alert or Concern Status. The local contribution may be in the form of cash, labour and materials/services.		
Main Actor		WRUA/NWCPC		
Supporting Actor		**Administrative Authority:** County/District **Technical Authority:** MWI, WRMA		
Public assistance/ Mutual support /Self-help		Public Assistance/ Mutual Support		
Relevance with PCDEFM Project	**Possibility to operate the project by WRUA**	Efficient planning and implementation require high technical knowledge and skill. Therefore it is necessary for WRMA and WRUA to prepare a long time for implementation.	C	1
	Project Term	Adequate planning is important. It needs a long time.	C	1
	Project Budget	Depending on the scale and the number. It is possible within WSTF budget, if in a small scale.	B	2
Relevance with PCDEFM Project･Total			4	
Comment		Construction of small scale check dams is not so difficult technically. But, effect of small single check dam is limited. If plural check dams are installed in effective arrangement, some certain effect for sediment discharge control will be able to be shown. Therefore, effective planning and implementation of check dams is difficult technically and it needs long period.		

A (3 point): Excellent / B (2 point): Good / C (1 point): Poor

5.1.10 Selection of Type of Pilot Project

WRMA and the JICA Project Team evaluated the four possible candidates for structural measures explained in the previous section and the result was summarized as shown in the table 5.1-16 below.

Table 5.1-16 Evaluation Result of Candidate Structural Measures as Pilot Project

No.	Candidate Structural Measure	Score
1	River Bank Protection	7
2	Development of Drainage Canal / Airport Area	5
3	Culvert Under Roads/ Airport Area	4
4	Dam/ Check Dam/ Upstream of Merire River	4

It is herein noted that, there was an opinion that selection of pilot project should be done by stakeholders. In this regard, the final determination of pilot project was through the discussions held in the IFMC and public consultation meeting with community members that reside near the site. Thereafter, the four countermeasures were evaluated from the three evaluation axes and wherein the prioritization was undertaken.

Table 5.1-17 Three Evaluation Axes

Evaluation axis	Focused points
Feasibility by WRUA	➢ Can WRUA be a main actor of the project? ➢ Can it be implemented by community level?
Project duration period	➢ Is it possible to complete within a term of SCMP that are formulated in 3 to 5 years? ➢ Is it possible to be completed within this project?
Expenditure for the project	➢ Can the budget be obtained through SCMP scheme? (Under 5 mil. Ksh) ➢ Can it be implemented under the budget provision of this project?

From the result of discussion in the 2nd IFMC, evaluation of type of pilot project was conducted and river bank protection scored the highest and therefore it was selected as pilot project.

Table 5.1-18 Evaluation of Proposed Flood Management Measures

Proposed measures	**Feasibility**	**Term**	**Expenditure**	**Total Score**
River Bank Protection	A(3)	A (3)	A (3)	9
Dam/ Check Dam/ Upstream of Merire River	C(1)	B (2)	B (2)	5
Development of Drainage Canal / Airport Area	C(1)	B (2)	C (1)	4
Culvert Under Roads/ Airport Area	C(1)	B (2)	C (1)	4

Note: A (3Points): Excellent / B （2Points） : Good / C （1Point） : Fair

5.1.11 Selection of Pilot Project and Site

(1) Extraction of candidates of the pilot project sites

Outline plan of river bank protection project in Isiolo river basin was determined with consideration of actual site. Two (2) candidates of the pilot project sites were extracted as shown below.

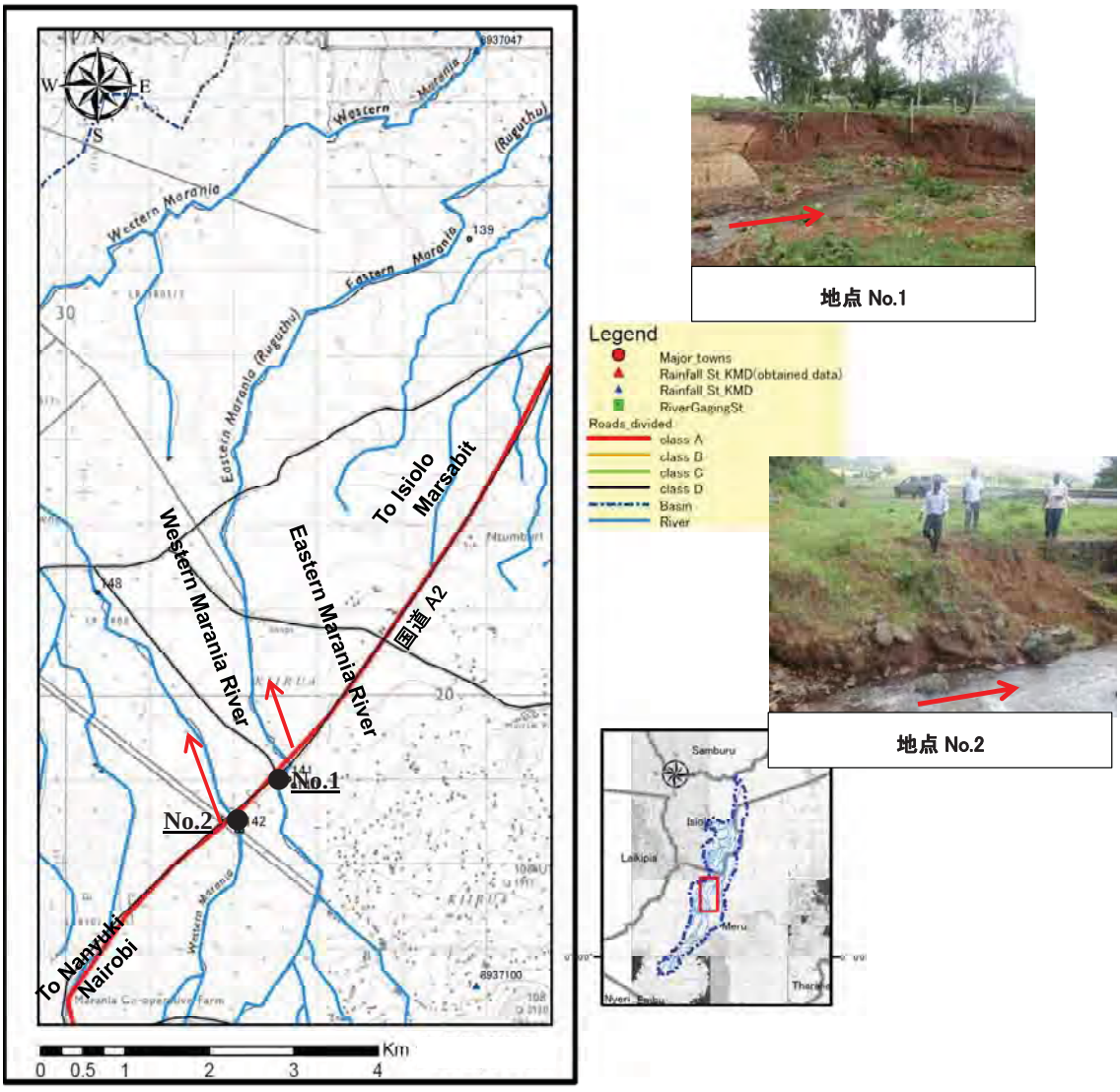


Fig. 5.1-5 Candidate Site for Isiolo Pilot Project

(2) River Bank Erosion Site No.1

The site of No.1 is located in the upper and middle Isiolo River Basin and it is in the administrative boundary of Buuri District, Ntumburi Location, KamareteSub Location. The site is the crossing point of the Highway A2 and the Eastern Marania River. Bridge piers and its surrounding part are protected by gabions and mortar masonry. The length of the section of bank erosion is around forty (40) meters, height is around four (4) meters and the width of the river channel is around ten (10) meters.

Fig. 5.1-6 View from the left bank at the eroded section of Eastern Marania River

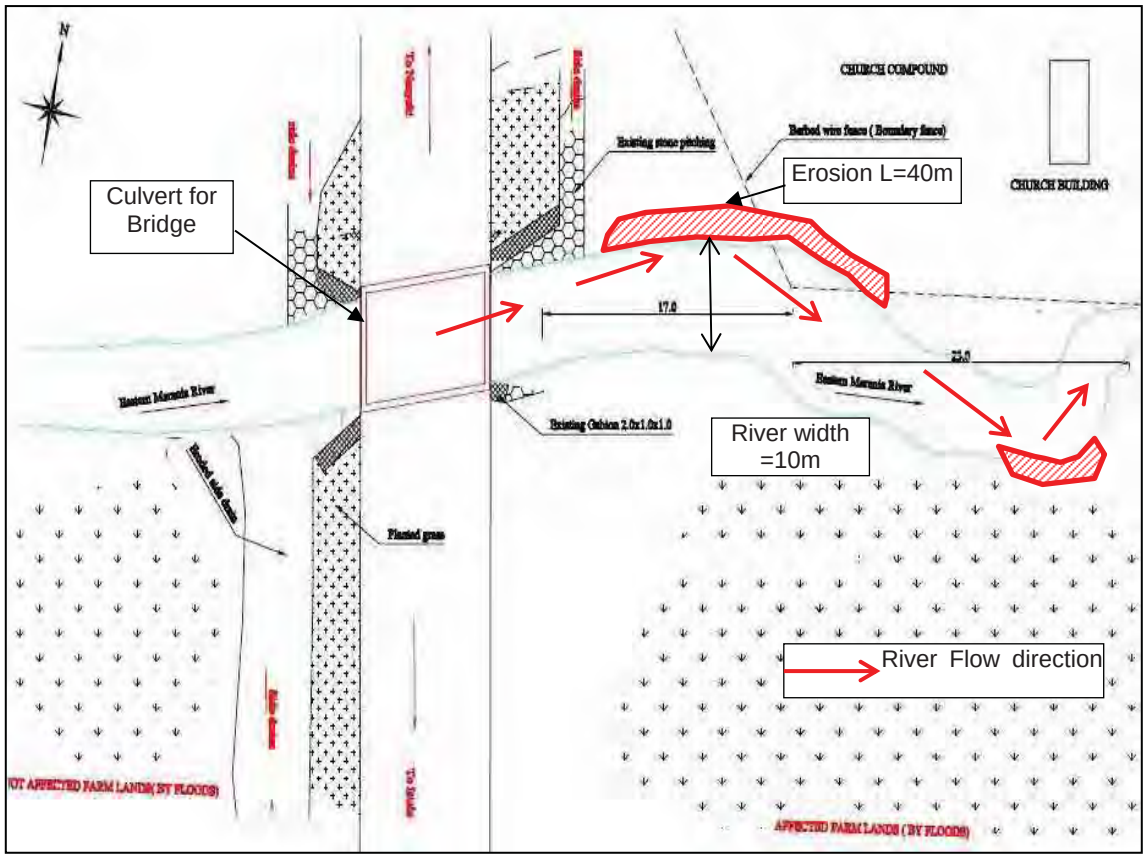


Fig. 5.1-7 Rough Plan View of Eroded Section of Eastern Marania River

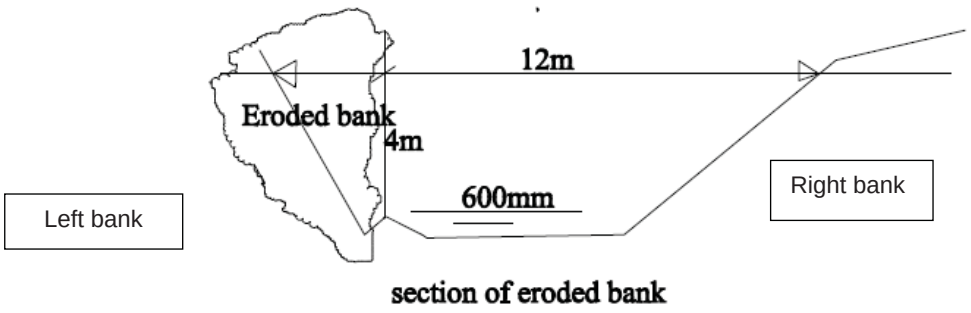


Fig. 5.1-8 Rough Cross Section

Bank erosion is found in the downstream of the bridge. As confirmed by pictures below, it is especially prominent on the water colliding front of left river bank. Moreover, it is seen that the river is meandering by the satellite data.

Fig. 5.1-9 Satellite Image of the Site of River Bank Erosion

Photo 5.1-1 View of Upstream from the Crossing Point of Highway A2

(Left: View of upstream from the bridge, Right: View of bridge from upstream)

Photo 5.1-2 View of Downstream from the Crossing Point of Highway A2
(Left: View of downstream from center of the bridge,
Right: View of left bank from right bank of downstream of the bridge)

The cause of river bank erosion seems to be an effect of culvert bridge installed at the upstream. The culvert cross sectional area is smaller than the cross section of upper stream. Consequently, when the flood water pass the culvert, flow velocity is increased. And then, the flood flow which velocity is increased hits to the left side of the river channel at the lower section of the culvert. This is the cause of bank erosion. Additionally, flood flow hit at the left bank reflects to the right bank of lower section, and then right bank is also eroded.

Photo 5.1-3 Culvert Type Bridge

Photo 5.1-4 Eroded section of the lower right bank

(3) River Bank Erosion Site No.2

The site of No.2 is located in the upper and middle Isiolo River Basin and it is in the administrative boundary of Buuri District, Ntumburi Location, Ntumburi Sub Location. The site is the crossing point of the Highway A2 and the Western Marania River. Bridge piers and its surrounding part are protected by gabions and mortar masonry.

Bank erosion is found at the upstream of the bridge. As confirmed by pictures below, it is especially prominent on the water colliding front of left river bank. The part of river bank where is the downstream of the A2 bridge, are protected by gabions and mortar masonry and there is less damage. It is 12-meter wide of water surface at the No.2 site.

View of upstream from the crossing point of Highway

View of upstream from the crossing point of Highway

Photo 5.1-5 River Bank Erosion Site No.2

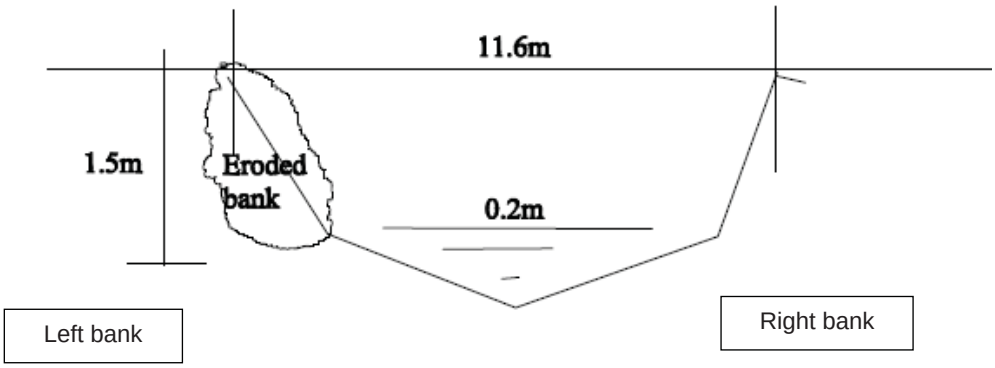


Fig. 5.1-10 Rough Cross Section

(4) Evaluation and Selection of River Bank Protection

Out of these 2 sites, one site was selected based on the following evaluation criteria.

<Evaluation criteria for selection of the pilot project site>

1. Effectiveness to be obtained by the flood protection project
   - Magnitude and severity of present damage
   - Frequency of damage occurrence
   - Existence of surrounding important facilities and public facilities
2. Viewpoint of WRUA development cycle (WDC)
   - Easy participation of the community members around the site
   - No large project budget and period
3. Viewpoint of environmental and social considerations
   - Existence and magnitude of impacts to natural environment
   - Existence and magnitude of impacts to social environment

Based on the result, the site No.1 was selected. And the owner of farm at opposite riverbank accepted the risk of riverbank erosion near his farm from the influence of the riverbank protection works under the consideration of whole merit in the target area.

Table 5.1-19 Comparison of Candidate Sites of River Bank Protection

Evaluation Criteria		Site No.1	Site No.2
1) Effectiveness	Magnitude and severity of present damage	Length: 40m Damage of farmland Possibility of damage on National Highway No.2 Good	Length: 10m Damage of farmland Possibility of damage on National Highway No.2 Good
	Frequency of damage occurrence	Increasing damage expansion in every rainy season Good	Damage expansion is limited Fare
	Existence of surrounding important facilities and public facilities	Church Good	Nothing particular Bad
2) WRUA Development Cycle (WDC)	Easy participation of the community members around the site	Church community can support Good	There is no community based organization Bad

	No large project budget and period	Length 40m, Height 4m ○	Length 10m, Height 1.5m ○
3) Environmental and Social Consideration	Existence and magnitude of impacts to natural environment	Consideration of cross section and plan design for effect to downstream Good	Consideration of cross section and plan design for effect to downstream Good
	Existence and magnitude of impacts to social environment	Nothing Good	Nothing Good
Overall Evaluation		Site No. 1 is superior to No.2 in effectiveness and WDC. And measures in environmental effect can be conducted. Therefore, No.1 is superior to No. 2.	

5.2 Preparation of Implementation Plan of Community Based Activities

The structural measure for community based activities was decided as a revetment work (riverbank protection work) by means of gabion at the bight near the intersection of national road on the Eastern Marania River, in the south of Isiolo town.

Design drawings are shown below. And the estimated cost of works was Kshs. 3,400,000 based on the unit cost of the Nyando Project implemented in July 2007. However, there was consideration of rise in prices between July 2007 and 2013 and therefore the cost was tagged at Kshs. 5,000,000/-.

Detailed explanations of these activities are shown in Appendix3-16.

Rough time schedule of the pilot project is shown in the table 5.2-2.

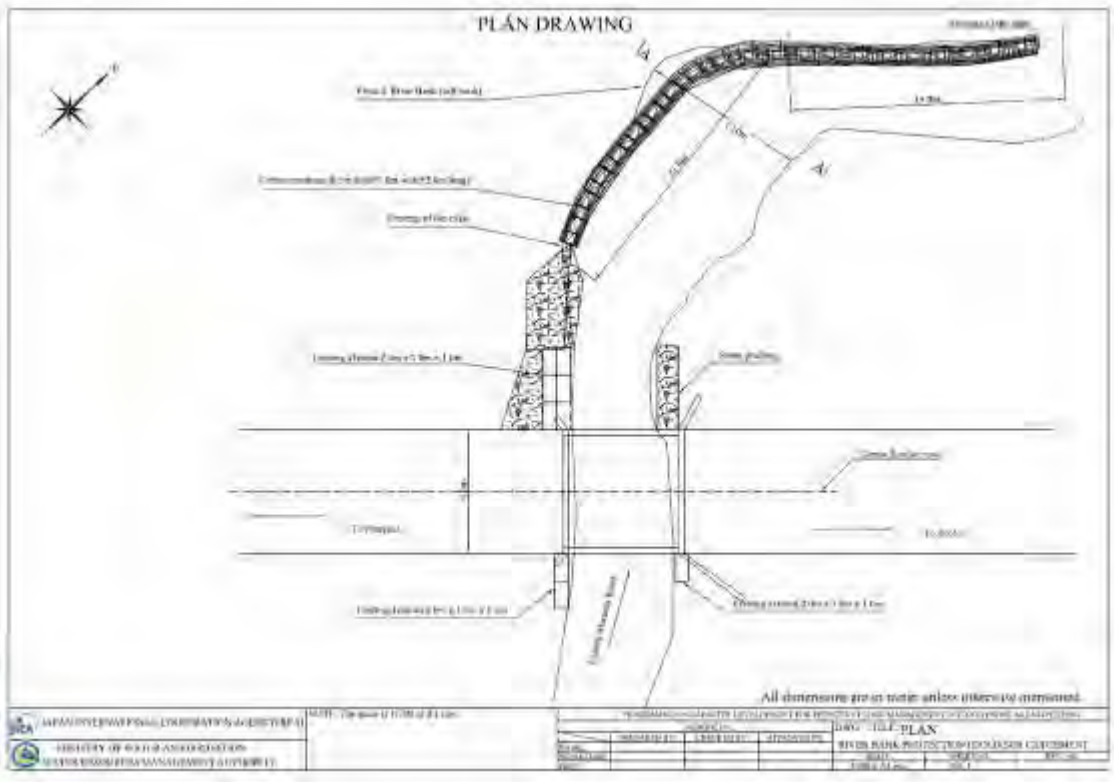


Fig. 5.2-1 Plan of River Bank Protection

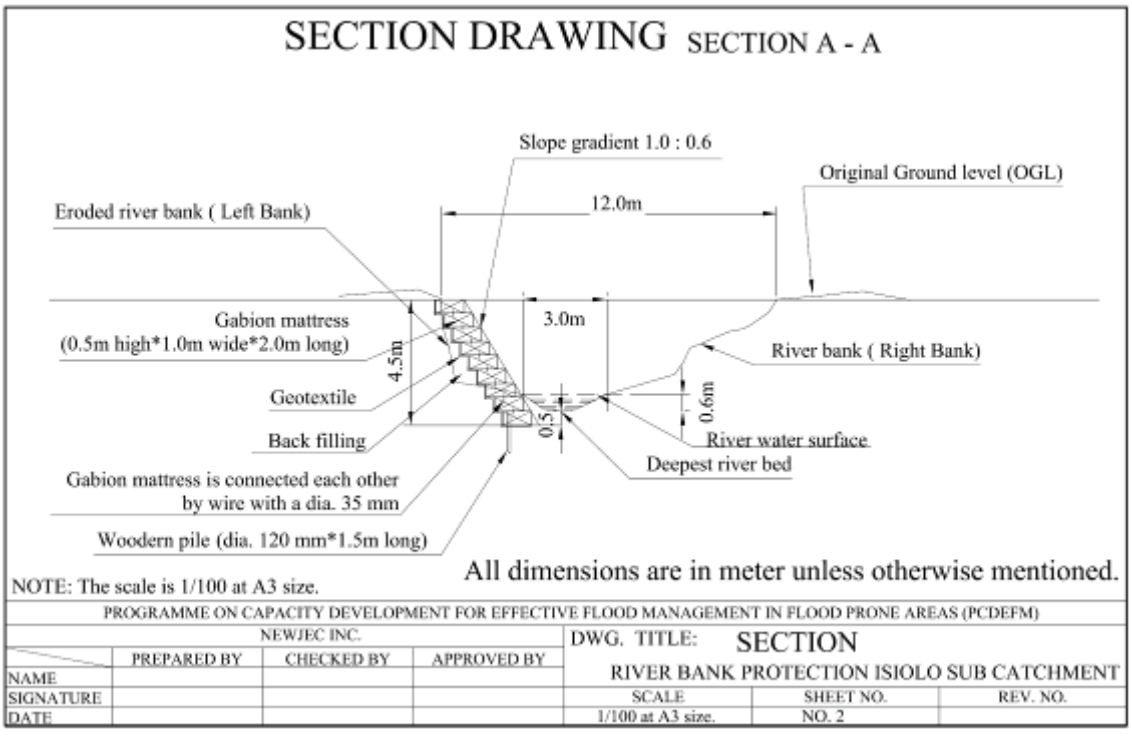


Fig. 5.2-2 Cross Section of River Bank Protection

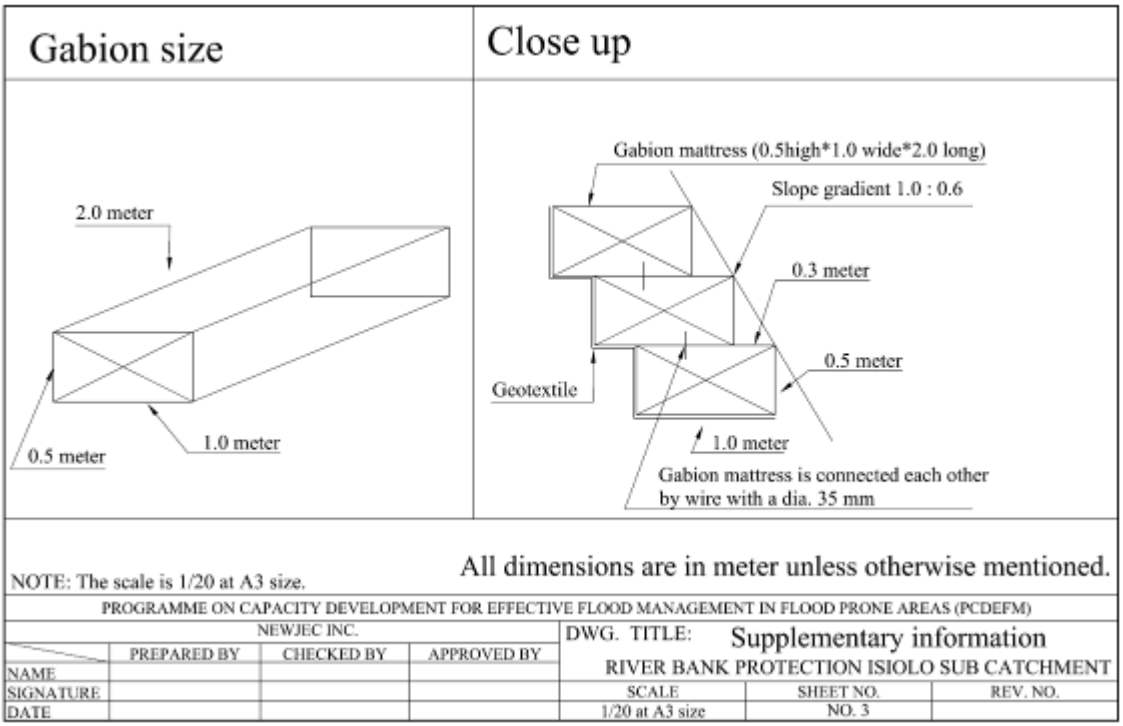


Fig. 5.2-3 Supplementary Information of River Bank Protection

Table 5.2-1 BOQ and the Cost

No.	Work Item	Unit	Quantity	Unit Cost(Ksh)	Amount(Ksh)
1	Restoration of damaged riverbank by Gabion mattress (40m long)				
1.1	Mobilization	LS	1	50,000	50,000
1.2	Earth work				
1.2.1	Care of water	LS	1	120,000	120,000
1.2.2	Clearing and grading	m^2	120	100	12,000
1.2.3	Excavation of slope in the lower part	m^3	80	300	24,000
1.2.4	Transport of soil from site to stockpile and from stockpile to site	m^3	80	300	24,000
1.2.5	Back fill	m^3	75	300	22,500
1.2.6	Disposal of waste soil	m^3	5	300	1,500
1.2.7	Sodding 1m long from top of slope	m^2	40	800	32,000
1.2.8	Miscellaneous	LS	1	30,000	30,000
	subtotal of earth work				**266,000**
1.3	Piling up of gabion mattress				
1.3.1	Placing gravel on riverbed (riprap stone; size: 2 to 3cm)	m^3	12	2,000	24,000
1.3.2	Gabion mattress (size of stone: 15 to 25 cm, size of gabion mattress: 1m wide, 0.5m high, 2.0 m long, galvanized wire: minimum diameter = 3.5 mm, size of mesh: not greater than 7.5cm)	m^3	180	7,000	1,260,000
1.3.3	Geotextile	m^2	340	5,000	1,700,000
1.3.4	Wooden pile (dia. 0.125 m* 2.0 m long) per 1m	no	40	200	8,000
1.3.5	Placing gravel on the river slope (slope at lower end, size of stone: 2 to 3 cm)	LS	2	2,500	5,000
1.3.6	Miscellaneous	LS	1	20,000	20,000
	subtotal of piling up gabion mattress				**3,017,000**
1.4	Demobilization	LS	1	30,000	30,000
1.5	**Total**				**3,363,000**

Note: Unit Cost of Nyando Project in July 2007 was used

Table 5.2-2 Rough Time Schedule of the Pilot Project

Pilot Project Implementation Timeline

FY in Japan	FY2013												FY2014				Remarks
	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	
2nd Integrated Flood Management Committee					△												
Procurement Committee of WRUA in cooperation with WRMA and JICA					△												
Bidding Process					□												
Contract						△											
River bank Protection Work						□	┈	┈	┈	┈	┈						
Training for Construction Work for WRMA and WRUA						□											
Training for Maintenance for WRMA and WRUA							□										
Maintenance										┈	┈						
Monitoring and Evaluation						□	□	□									
Development of Manual on Riverbank Protection Works for WRMA							□	□									
Development of Manual on Community Based Flood Management Activities for WRUA								□	□								
Remarks					△												□ Plan △ Event

□ :Rainy season

5.3 Roles of the Respective Organizations Concerned for Implementing Pilot Projects

Many organizations will be involved in the construction of structural measures categorized as community flood management activities. WRUA is the main organization and WRMA works closely with WRUA.

The following guidelines are elaborated in implementation of activities by WRUA:

- WRUA to propose to WRMA through the process of SCMP formation;
- WRMA to judge technically suitable countermeasures;
- WRMA to advise appropriately to the organizations concerned; and
- WRUA to implement the project by obtaining the WSTF fund.

WRUA is responsible for cooperation, adjustment and co-working with Community Based Organization (CBO), the land owners and community members. WRUA is also required to provide work force or monetary contribution or by any other means.

WRMA-SRO is required to provide WRUA with technical advice and support for WRUA to implement the project.

When WRUA makes contracts with the contractors for the project, WRMA-SRO is responsible for giving instructions to WRUA concerning procurement procedures and contractor's technical supervision and instruction.

The national and regional administration organizations may be involved in WRUA and WRMA works, especially when the construction of infrastructures concerns the lives of the population.

There will be other relevant organizations for the specific work category and project implementation location, such as Ministry of Education, the principal and PTA in case schools are involved in sensitization of and cooperation to the project.

As for the raising work of toilet facilities, cooperation with Ministry of Health is necessary, and cooperation with KeRRA is necessary for provision of culvert constructed on the road.

Such cooperation is to be provided at regional offices of relevant authorities, and at central offices in case such cooperation be not approved by the regional offices. As for the requirement for assessment of environmental impacts and the procedures therein would be determined based on the project contents and magnitude.

As mentioned above, WRMA and WRUA have respective roles and responsibilities under WDC scheme. In the execution of pilot projects of this Project, WRUAs and WRMA were given roles and responsibilities as per WDC guidelines and this provided an occasion for learning by doing for both WRUAs and WRMA.

Following figure 5.3-1 shows ideal role, responsibility and cooperation among the relevant organizations so that WRMA and WRUA can proceed with the project.

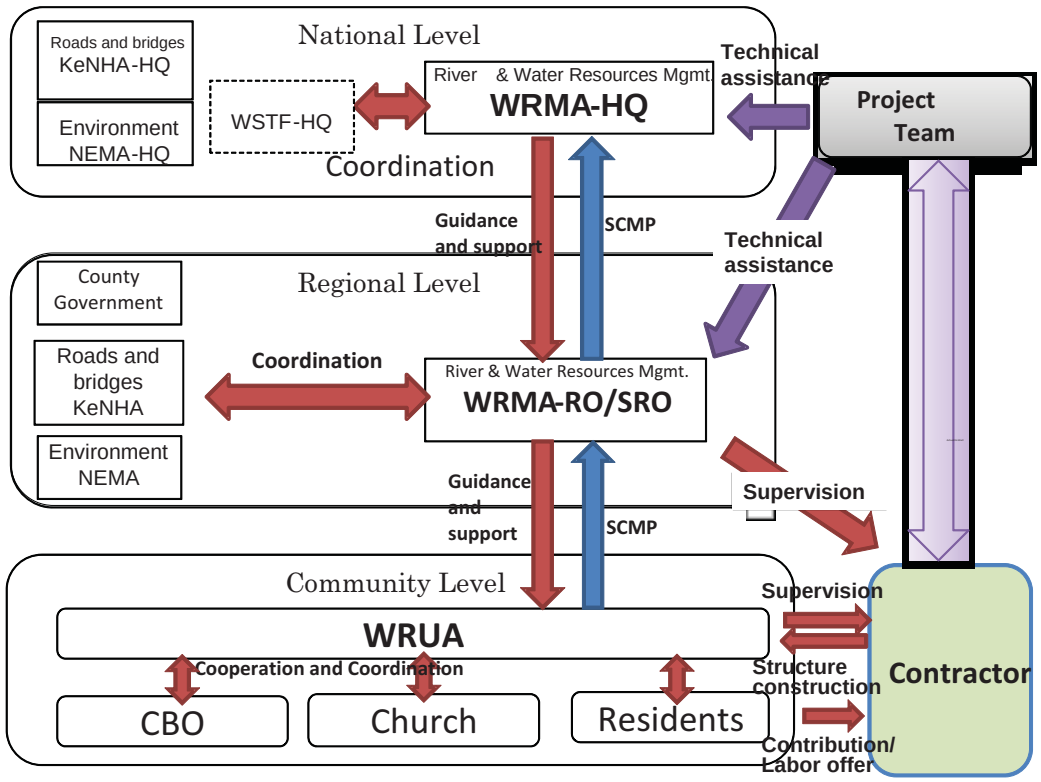
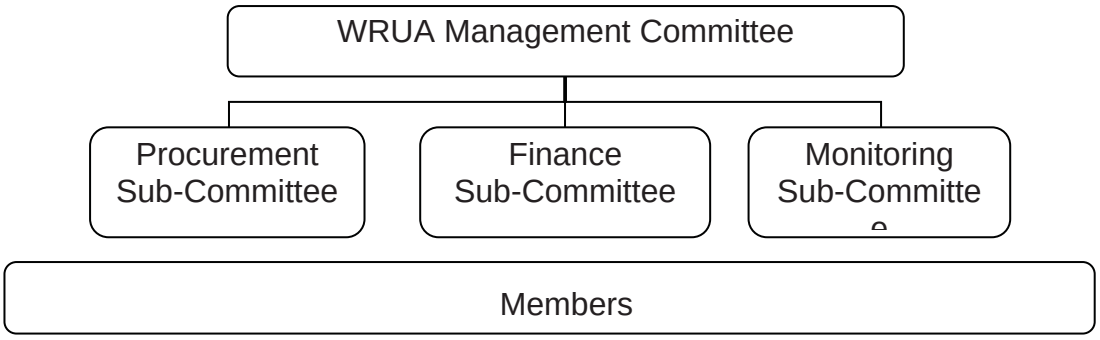


Fig. 5.3-1 Implementation Organization of the Pilot Project

5.3.1 Internal Organization and Role of WRUA according to WDC

WDC specifies to establish management organizations in WRUA such as Management Committee, Procurement Sub-Committee, Finance Sub-Committee and Monitoring Sub-Committee as follows.



Source: Prepared by Project Team based on WDC Toolkit

Fig. 5.3-2 Management Organization of WRUA

Table 5.3-1 Roles of WRUA Management Organization

Committee	Role
Management Committee	Overall management and construction management to superintend the fund usage and resultant efficiency.
Procurement Sub-Committee	Selection of products and services providers with inquiry and receipt of those estimations of products and services. Check and storage of the procured goods.
Finance Sub-Committee	Responsible for all financial process and independent account reporting. Publicize of the fund usage information.
Monitoring Sub-Committee	Monitoring of the fund usage, quality and amount value of the activities and products. Check of product quality and its delivery. Independent monitoring report at the committee and confirmation of the product provided by other sub-committees.

Source: Prepared by Project Team based on WDC Toolkit

5.3.2 Role Allocation of WRUA and WRMA according to WDC

WDC stipulates cooperation during the works including role allocation of WRUA and WRMA on the planning, feasibility study, design, legal approval, procurement, construction and operation.

Thus, the pilot projects were implemented by the Project Team and WRMA from planning to execution. WRUA's committees were given similar roles as stipulated in the WDC guidelines concerning projects, and ensuring committees' respective functions.

The Project Team based on WDC guidelines determined the roles of WRMA and WRUA to enhance their understanding, and also provide them with necessary support. Also the Project Team incorporated the findings on the supporting process into the supporting manual for WRMA and activity manual for WRUA.

Table 5.3-2 Allocated Roles of WRUA and WRMA for Implementation of Structure Construction

Work Stage	Work Item	Role of WRUA and WRMA
Legal approval	Land usage, etc.	・WRUA is mainly responsible for negotiation with the land owner. ・WRMA is mainly responsible for negotiation with administration office.
Procurement	Pre-qualification of bidders	・WRMA-SRO to obtain long-list of the suppliers prepared by MWI ・WRMA jointly with WRUA Procurement Committee to examine necessary requirements to prepare pre-qualification document ・Approval of Pre-Qualification Document by WRUA Management Committee
	Bidding	・WRMA-SRO jointly with WRUA Procurement Committee to prepare bid document (specifications, drawings, bill of quantity, etc.) ・WRUA Procurement Committee to notify the pre-qualified bidders to request for bid proposal submission
	Evaluation of bid proposals	・WRUA Procurement Committee to prepare bid opening and evaluation ・WRUA Procurement Committee to open the bid proposals, and evaluate jointly with WRMA-SRO ・WRUA Procurement Committee to prepare the evaluation process and submit for selection of the successful bidder by Management Committee
	Negotiation and contract with successful bidder	・WRUA Procurement Committee to prepare contract document ・WRUA Management Committee to execute the contract
Construction	Supervision	・WRUA Monitoring Committee to supervise the contractor's works
	Inspection	・WRUA Monitoring Committee to inspect the contractor's works to approve them
	Completion Inspection and Payment	・WRUA Finance Committee to execute completion inspection and to pay the contract price
Operation	Operation and Maintenance	・WRUA Monitoring Committee is responsible.

Source: Prepared by Project Team based on WDC Manual

5.4 Project Team's Support to WRUA and WRMA

5.4.1 Current Capacity for Project Implementation of WRMA and WRUA

The Project Team discussed with WRMA about the above-mentioned allocated roles to assess WRUA's capacity for implementing the pilot project. The following issues concerning WRUA's capacity are recognized in terms of WDC's approach through SCMP.

Table 5.4-1 SCMP's Respective Applications for WDC Frame Works

	LOGUMI WRUA	Isiolo WRUA	Lower Lumi WRUA
Current Situation (Not revised for all 3 sites)	Revision issued in May 2012 for 5-year plan, approved by WRMA head quarter	1st edition issued in March 2009 for 3-year plan	1st edition issued in December 2009 for 3-year plan
Description of flooding	Described	Described	Described
Revision	Scheduled in 2017	Having scheduled in 2012	Having scheduled in 2012
	Revision time is specified in the SCMP, which is the basis for revision, provided in case the revision time should have passed but under the WRUA's application of WDC fund, the revision by SCMP should not be allowed unless the approval of the application, fund disbursement and all the projects' application process have been finalized.		
WDC level	2nd step	3rd step	2nd step
Application Situation to WDC	1st step : finished Applied on JAN/13/2010 Approved on APR/21/ 2010 Completed on OCT/21/ 2010 2nd step : under Application Applied on JUN/4/2012 Passed examination of WRMA and submitted to WSTF on NOV/6/ 2012	1st step : finished 2nd step : finished 3rd step : Applied (K.S. 4,994,600) for 3 installments of disbursement, and the 1st disbursement finished for forestation at K.S. 771,000.	1st step : finished 2nd step : Applied and under project implementation for dredging of water channel and preservation of the fountain of water supply source
Expected approval of Project under application to WDC	Normally 6 months to 1 year to pass the examination	By NOV/2013 at earliest	Unknown
Inclusion of Flood Protection in the project under WDC application	Not included	Not included	Included (dredging of water channel)

LOGUMI WRUA and Isiolo WRUA are at the second step (possible to apply WSTF fund of Ksh 2,000,000/-), and Lower Lumi WRUA is at the third step (possible to apply WSTF fund of Ksh 5,000,000/-). Although water channel dredging is under construction for Lower Lumi WRUA, it was revealed that it did not require much of structural designing. Further, it was revealed that there was no WRUA that had experience in contracting procedures.

Therefore, it was anticipated that it would be difficult for WRUA to implement any pilot project on its own by means of the procurement procedures up to the awarding of contract.

In consideration of the said situation, the Project Team discussed with WRMA and judged that WRUA should gain experience on procurement, for which following arrangements were targeted for implementation:

- Establishment of procurement committee consisting of the members of WRUA, WRMA and the Project Team.
- Execution of procurement of the contractor and other necessary facilities by supporting the Sub-Procurement Committee of WRUA.

Through the above-mentioned arrangements, it aimed at capacity-building of the persons of WRMA and WRUA for procurement of the contractor, construction supervision and inspections among other activities.

Detailed explanations of these activities are shown in Appendix 3-17.

5.4.2 Assistance in Preparation of Bidding Document

The Project Team judged it would be necessary for the Team to prepare the draft bid document for the purpose of above-mentioned works, and present it to the procurement committee.

For preparation by the Project Team, the Project Team examined whether the past bid and contract documents were available, however, it was found that almost all such documents for procurement were at the second step of WDC, and appropriate sample documents were not available. On the other hand, sample contract documents for training service supplied by WSTF were so simple and could not be used for purposes of construction works.

Based on the above mentioned situation, the Project Team therefore used a WRMA's bid documents for construction work and simplified them to be as practicable as possible so that the document could be used by the then inexperienced personnel of WRUA.

The sample bid document of WRMA that was used was the "Procurement of works for the construction of Mombasa sub-region offices block".

WRMA also provided the Project Team with another sample document "Standard Tendering Document, Procurement of Works, Small Works (Public Procurement Oversight Authority)". The "Standard Tendering Document" had been prepared for small scale project, but applicable to the project budget of up to Kenya shillings two hundred million (Kshs. 200,000,000), which was much larger than the pilot project of Kenya shilling five million (Kshs. 5,000,000). The contents of the document were similar to that of WRMA bid document, and therefore, the Project Team started process of simplification of the document based on the WRMA bid document in order to make it applicable to small scale projects.

The description of the bid document including the contents, and how the contract document is to be prepared by modifying is shown in the table 5.4-2 below.

Table 5.4-2 Contents of Bid Document and Contract Document used by WRMA

	Bidding documents		Contract documents
			Agreement Letter of Acceptance Contractor's Bid
Section I	Instructions to Bidders		General Conditions of Contract
Section II	General Conditions of Contract		Special Conditions of Contract
Section III	Special Conditions of Contract		Specifications and Performance Requirements
Section IV	Bidding Data Sheet, Forms of Bid, Qualification Information, Letter of Acceptance, Agreement		Drawings
Section V	Drawings		Bill of Quantities
Section VI	Bill of Quantities		
Section VII	Specifications and Performance Requirements		

As for the Technical Specifications for the pilot project, the Project Team utilized the contents of the above bid document as well as the similar specifications which the Project Team possesses and also the related items that were used in the Nyando Project.

Further, since the pilot project was not an abstract idea but a practical idea that was going to be implemented in reality and therefore a contract between the Project Team and a local contractor was prepared, the Project Team also confirmed that the bid document met the requirements of contract guidelines of JICA.

5.4.3 Holding of Procurement Committee Meeting

Procurement Committee Meeting was held on September 20, 2013 in Nairobi for the purpose of supporting WRUA Procurement Sub-committee by WRMA and the Project Team for implementing the pilot project.

The agenda for the meeting was as follows:

i) Explanation and mutual understanding of the role of WRUA Procurement Sub-Committee according to WDC guidelines,
ii) Explanation of the project supervisor as to outline of the pilot project, work scope, pre-qualification of bidders, method of notification of the pre-qualified bidders for bid proposal submission, process of the bidding, bid document, etc.,
iii) Discussion about pre-qualification criteria,
iv) Evaluation of pre-qualification documents submitted by the bidders who submitted "Expression of Interest" to the projects.

All the participants agreed above-mentioned matters, of which minutes of meeting is as per Appendix 3-18.

5.4.4 Community Contribution

WDC prescribes that the community that carries out the community activities under the WSTF fund should bear a certain rate of quota of the project cost.

The quota in Isiolo and Lumi regions, designated as Red Alert areas, is 15%.

The WDC requirement was therefore agreed upon to be used for the pilot project so that the

pilot projects would be implemented within the WDC framework project. And the Project Team therefore discussed with WRMA and WRUAs about the contribution requirement.

The Project Team proposed that the community members should supply cobble stones to be used for Gabion (wire mat) for revetment works in Isiolo pilot project, and that the community members should supply and install sandbags for road-raising in a school in Lumi pilot project.

The above mentioned proposals were discussed at the meeting with the community members, and they agreed to the proposals. Appendix 3-19 is Memorandum of Understanding (MOU) where the approval of the community members is mentioned.

5.4.5 Execution of Bidding and Contract

The bidding process was held on October 4, 2013 for Isiolo pilot project and on October 31, 2013 for Lumi pilot project and it was attended by respective chairman of WRUA Procurement Sub-Committee, the respective manager of WRMA Sub-Regional Office and the Project Team.

Immediately after the opening of bid proposals, contract negotiations were done and several matters concerning the contract and the works were confirmed.

Contractual processes including signing of the contracts were concluded on November 8, 2013 for Isiolo pilot project.

5.4.6 Evaluation of Activities by WRMA and WRUA

During the implementation of pilot projects the Project Team review results were as follows:

- ✓ There is no WRUA which has conducted a process of procuring construction works for themselves. Therefore, the capacity of WRUAs, and procurement sub-committees thereof, on carrying out a bidding process is very limited. It was difficult for the WRUA members to contribute in the Procurement Committee meeting held together with WRMA and the Project Team. Therefore, a continued support to WRUAs by WRMA in the procurement process will be needed.

- ✓ Also, it seemed that the contents of the contract document were not all understood by the local contractors. The document had been simplified from WRMA's standard documents, but was still too thick. Further simplification of bidding documents/contract documents will be necessary.

5.5 Implementation of the Pilot project at the Isiolo Sub-Catchment

Riverbank protection works alongside the Eastern Marania River, as a pilot project in Isiolo WRUA, was implemented using wire mat. Entrust-contract was concluded between the Project Team and local contractor (construction firm) was as outlined below:

1) Contract : Construction of Riverbank Protection along the Eastern Marania River
2) Contractor: Waso Building and Road Works Co., Ltd.
3) Person responsible for the contract: Mr. Osman Maalim Daud (Managing Director)
4) Address: 403-60300, Isiolo
5) Phone No. : 0721-701-741
6) Contract Term : November 8, 2013 to February 8, 2014 (3 months)
7) Contract Amount: Kenya shillings four million nine hundred and eighty thousand nine

hundred and seven (KShs. 4,980,907/-).

a. The amount is subject to reduction depending on the community's contribution.

8) Substance of the Contract :

9) Revetment work (riverbank protection work) by means of wire mat at the bight near the intersection of national road on the Eastern Marania River, in the south of Isiolo town.

5.5.1 Construction Supervision

The construction work was supervised by sub-regional manager of WRMA (Project Manager), flood management officer of WRMA (Sub-Project Manager) assisted by local supervisor of the Project Team.

(1) Commencement

In accordance with the Contract, the contractor commenced the works dispatching labors, materials and equipment on November 8, 2013 incorporating a site manager and labors (skilled and unskilled).

(2) Cleaning, Grubbing and Riverbed Arrangement

Those works started on November 9, 2013.

(3) Survey and Setting Out

Prior to excavation, survey and setting out for installation of wire mat was carried out on November 13, 2013, and the contractor prepared construction drawings.

Survey Work

Survey Work

(4) Material Procurement

The contractor purchase 180 wire mats in accordance with BOQ (Bill of Quantity).

Prior to procurement, the contractor submitted letter with photo, specification and sample to the Project Manager of WRMA for approval on November 12.

Project Manager approved it on November 14. The procured wire mats were stored in the contractor's warehouse.

WASO BUILDING AND ROAD WORKS CO. LIMITED
P.O. BOX 403- 60300 ISIOLO,

Date: 12 November, 2013
Our Ref: PCDEFM-WASO-01

Your Ref:
Project Manager,
C/o Water Resources Management Authority,
Middle Ewaso Ngiro Sub- Region,
P.O. Box 171-60300.

Attn: Mr. John Kinyanjui-ATCM

Dear Sir,

RE: REQUEST FOR APPROVAL FOR PROCUREMENT OF GABION BOXES.

In accordance to Specifications and Performance Requirements Clause 6.2.3, "Gabion baskets may be those standard products available in the market.... The Contractor shall submit the specifications of the product for approval of the Project Manager, prior to the Procurement of the products."

We have attached the photograph and the specifications of the standard Gabion basket available in the market for your approval. In addition, we have carried the sample Gabion basket accompanied by this letter to your office for actual observation.

Your prompt action is highly appreciated.

Kind regards,

Osman Daud Maalim
MD- Waso Building and Road Works Co. Ltd

CC. Team Leader- JICA Project.

Contractor's letter for approval

WATER RESOURCES MANAGEMENT AUTHORITY

WRMA/ENNCA/MEN/DEV/F/V/240 — 14th November 2013

Managing Director,
Waso Building and Road Works Co. Ltd,
P.O. Box 403- 60300,
ISIOLO

RE: APPROVAL FOR PROCUREMENT OF GABION BOXES.

Your letter PCDEFM-WASO-01 dated 12th November, 2013 refers.

We have examined the sample Gabion basket submitted to us against the specifications and Performance Requirements for this contract and the availability of such Gabion basket in the market.

We have no objection to your request of approval. In view of this, kindly go ahead and procure the required number of gabions with similar specifications as the one submitted to us for approval.

Kind regards.

John N. Kinyanjui
Assistant Technical Coordination Manager

CC
Team Leader- JICA Project.

accounting for every drop

Project Manager's approval letter

Work explanation was made to the community members on August 28, 2013, where it was agreed that Isiolo WRUA and Community members would supply gravels as a contribution by the Community, and Memorandum of Understanding thereof was concluded among WRMA, Isiolo WRUA and the Project Team on September 2, 2013.

Out of the designed gravel volume of 180m^3, 140m^3 was supplied by Isiolo WRUA.
Project Manager asked several times the chairman of Isiolo WRUA for supply of 40m^3, however, the community members almost consisting of farmers were unable to collect those gravels due to farmer's busy season in small rainy season (beginning of November to end of December).
It was agreed that the contractor would supply the remainder.

Gravels delivered to the site

Wire mat

(5) Excavation

Excavation work started on November 18. The labors started excavation manually, but conglomerate (cobble gravel) layer was encountered in the deep riverbed, then the work method was changed by using heavy duty machine (bulldozer) as well.
However, on account of difficulty even using bulldozer, the contractor sent a letter to the

Project Manager asking for the excavation depth, then, it was agreed not to excavate furthermore with design revision.

WASO BUILDING AND ROAD WORKS CO. LIMITED
P.O. BOX 403- 60300 ISIOLO,

Date: 18 November, 2013
Our Ref: PCDEFM-WASO-02

Your Ref:
Project Manager,
C/o Water Resources Management Authority,
Middle Ewaso Ngiro Sub- Region
P.O. Box 171-80300

Attn: Mr. John Kinyanjui-ATCM

Dear Sir,

RE: EXCAVATION FOR BOTTOM GABION BASKET.

In accordance to Specifications and Performance Requirements Clause 6.1.2, "Gabion baskets at the bottom shall be laid over the excavated surface, approximately 50cm below the existing river bed."

In examining the design drawings and the site where to construct the gabion works, it shows that excavation from the surface should be done more than 1.1m to reach 50cm below the existing deepest river bed.

We would like to bring to your attention that during the excavation for bottom gabion basket we encountered rock outcrop that have limited our effort to achieve an excavation depth of 1.1m as per the contract requirement. We have managed to excavate 40 cm from the toe of the river bank.

In regard to this, we would like to request your office for advice before we could continue with laying the bottom gabion mattress.

Your prompt action is highly appreciated.

Kind regards,

WASO BUILDING ROAD WORKS CO. LTD P.O. Box 403-60300 ISIOLO

Osman Daud Maalim
MD- Waso Building and Road Works Co. Ltd

CC: Team Leader- JICA Project

Letter from the contractor

WATER RESOURCES MANAGEMENT AUTHORITY

MIDDLE EWASO NGIRO SUB REGION
P.O. BOX 171 - 60300
ISIOLO

WRMA/ENNCA/MEN/DEV/I/5/261 19th November 2013

Managing Director,
Waso Building and Road Works Co. Ltd,
P.O. Box 403- 60300,
ISIOLO *Attn: Mr. Osman Daud Maalim*

RE EXCAVATION FOR BOTTOM GABION BASKET.

Your letter PCDEFM-WASO-02 dated 18 November, 2013 refers.

Having visited the site to confirm site conditions as stated in your letter, we would like to advice you not to break the rock out crop further. The rock out crop shall provide a stable base for Bottom Gabion laying.

We advise you to continue with laying the bottom gabion basket immediately you receive this approval letter.

Kind regards.

John N. Kinyanjui
Assistant Technical Coordination Manager

CC
Team Leader- JICA Project.

accounting for every drop

Letter from the Project Manager

(6) Design Revision

Due to difference of actual riverbed conditions from the design stage, the Project Team revised the design consulting with the Project Manager as follows.

1) Revision of pile number of wire mat

It was designed originally to secure 2-embedment with revetment height of 4.5m where 9 piles of wire mats were to be installed. Due to existence of conglomerate in deep riverbed, it was revised to 7 piles for 3.5m.

Photo 5.5-1 Revetment by wire mat at the left bank (view from upstream)

Photo 5.5-2 Revetment by wire mat at the left bank (view from front)

Photo 5.5-3 Excavation of riverbed

Photo 5.5-4 Excavated riverbed

2) Change of scouring-countermeasure method
Prevention of scouring at the foundation is the most important work for achieving firm structure of revetment work by wire mat. In the original design stubbing method was adopted for scouring prevention, but it was changed to parallel method to install 20 wire mats for one pile in front of the lowest part.

① Stubbing Method slope line suck-preventive material (left)
② Parallel Method (right)

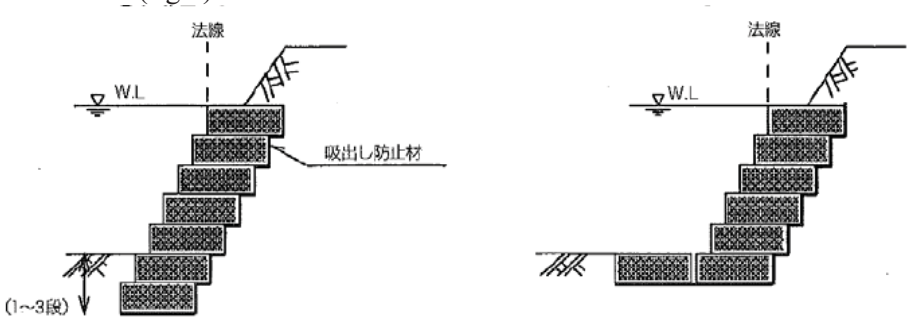


Fig. 5.5-1 Scouring-countermeasure Method

3) Extension of revetment downstream end
Wire mat was installed in 20 rows in upstream-downstream direction.
While during the installation work, community members neighboring the site asked for conservation of the trees at the downstream end of the revetment work site because the tree was an indigenous species.
The root had possible scouring in the draft design, thus one additional wire mat was placed in row for the purpose of their roots protection.
Eventually one row of wire mat was added at the downstream side to become 7 piles and one wire mat in front of the lowest part to become 8 wire mats in total.

Photo 5.5-5 Downstream end

Photo 5.5-6 Downstream end

4) Countermeasure against overflow from side gutter of road

While construction work, the Project Team and community members found hole in the church site located at the rear side (land side) of the left bank.

Hole was thought to have appeared by flowing water. If no countermeasure be taken, it was anticipated the hole would reach rear side of the new revetment to flow out the earth causing stability risk of the revetment.

Source of the flowing water was searched and found it could be rainfall overflowed from the side gutter of the road.

Overflowing was thought to have occurred at partly narrow portion of the side gutter.

Effective countermeasure was thought to install the wire mat in parallel with side gutter to let rainfall flow into the river.

Photo 5.5-7 Hole appeared at the rear side of revetment site

Photo 5.5-8 Side gutter of road

Insufficient drainage due to improper side gutter of road occurs everywhere in Kenya when heavy rainfall. Provisions of wire mat or cylinder, provision of small scale dike, are one of the countermeasures to reinforce the side gutter to control water flow, which can be implemented by the community.

Seven (7) wire mats were installed in order to reinforce the side gutter to resolve this problem, which was demonstrative measure in a sense that the community people could

take up as well.

5) Repair and reinforce in the future, and Installation application to other site
In general the durability of revetment by wire mat is short and repair or reinforcement is required for maintenance. Also it cannot be denied that the installed revetment by wire mat should affect further upstream side, downstream side or opposite bank since the water flow features cannot be perfectly predicted. For the purpose of measures for the said phenomena, 5 sets of spare wire mats were provided and stored by WRUA.

6) Summary of design revision applied
➢ Pile number of wire mat at the left bank was changed from 9-pile by 20 to 7-pile by 20.
➢ As the foot protection for revetment by wire mat at the left bank, wire mat of 1-pile by 20 pieces was installed at the front of the lowest part.
➢ Downstream end of the revetment at the left bank was extended by 2m and the wire mat of 7-pile by 1 row and 1 piece at the lowest part were installed to become 8 pieces in total.
➢ 7 pieces of wire mats were installed for reinforcing road side gutter.
➢ 5 spare wire mats were supplied and stored at WRUA for repair or reinforcement work by WRUA and community in the future.

7) Increase or decrease of the contract amount due to design revision
Number of wire mat was 180 pieces regardless of design revision, thus the contract amount was not altered.
Before design change: 9-pile x 20 rows = 180 pieces
After design change:

Revetment	7-pile x 20 rows	140 pieces
Foot protection	1-pile x 20 rows	20 pieces
Revetment at downstream end	7-pile x 1 row + 1 piece	8 pieces
Reinforcement of road side gutter		7 pieces
Spare		5 pieces
[Total]		[180 pieces]

Supply of gravel stones filled in the wire mat is contributed by the Community.
The Contract stipulates the contract value for gravel material shall be adjusted in accordance with the balance of the quantity to be supplied by the contractor and the community.

(7) Assembly and Installation of the Wire Mat
November 18: Assembly of 20 pieces for the lowest pile
Up to November 22: Installation of 2 piles from the bottom
Up to November 29: Installation of the 3rd and 4th piles from the bottom
Up to December 6: Installation of the 5th and 6th piles from the bottom
Up to December 13: Installation of the 7th pile from the bottom

Assembly

Installation of the bottom pile

Installation of the 2nd pile

Installation of the 4th pile

(8) Installation of Geo-Textile

Geo-textile was installed at the rear side of the wire mat (land side) for protection of sucking of earth.

Installation of Geo-textile

Geo-textile installed

(9) Backfilling

Backfilling was carried out so that revetment area and adjacent ground should be smoothly connected at the rear area of the location where wire mat had been installed using earth materials brought from temporary yard and quarry site.

(10) Treatment of both ends

Upstream end and downstream end are most likely to be affected by flowing water and special care must be paid when revetment work.

Stone Masonry was used for connecting existing revetment made of stone masonry and wire mat at the upstream end.

Wire mat extended by one row resulted from design change was rolled toward river bank side with gravel stones in order to protect the connecting portion between wire mat and river bank at the downstream end.

Condition after backfilling

Treatment of upstream end

5.5.2 Participation of Community Members and Community Contribution

Following the 2nd Integrated Flood Management Committee (IFMC) Meeting, project outline was explained to the WRUA and Community Members in August, where it was agreed that the Community would contribute to the community disaster prevention activity in the manner of collecting gravel stones.

Table 4.5-1 Community's Activity and Contribution at Isiolo Sub-Basin

Date	Activity	Participation of community members
JAN/23/2013	1st IFMC	Regional representative of WRUA
AUG/14/2013	2nd IFMC	ditto
AUG/28/2013	Public Explanation	-40 farmers, 20 WRUA members and other 15 persons -Attendants agreed to local contribution of more than 15% in WDC. Collection of gravel stones for wire mat by community, was agreed.
SEP/20/2013	Procurement Committee	WRUA procurement sub-committee members attended, learned how to evaluate bidders.
OCT/4/2013	Bid Opening	WRUA procurement committee chairman attended, evaluated bid proposals jointly with WRMA and Project Team.
OCT/29/2013	Community Meeting for collection of gravel	Isiolo WRUA management, WRMA and Project Team confirmed community's cooperation for collecting gravel stones as well as holding the training of community members on Operation & Maintenance.
NOV/1-5/2013	Supply of gravel stones	WRUA supplied gravel stones. (Collection by the community was given up due to difficulty of reward.)
NOV/8/2013	Contract with the contractor	
NOV/8/2013	Mobilization of the contractor	Contractor employed unskilled labors of the community.

Date	Activity	Participation of community members
DEC/11/2013	O&M training	About 50 persons from WRUA and church community members participated. Contractor trained the community members on the repair work of gravel-filling in wire mat. Confirmed the community members' ability for maintenance work.
MAR/14/2014	Completion test	WRUA together with WRMA and Project Team inspected the revetment works, which is WRUA's role under WDC.
MAY/31/2014	Maintenance inspection	ditto

Evaluation work process as to bidders to be qualified and evaluation of bid proposals were done in September and October respectively. Meeting for the Community's preparation of gravel stone collection, was held in the end of October. Thereafter, since it was revealed that some amount of gravel stones existed in the land of WRUA, it was decided they would be supplied by WRUA.

Training for operation and maintenance toward the Community was held in December, where the community members learned the collection of the gravel stones and repair of the wire mat, and then, the members could proceed with maintenance works of the wire mat by themselves.

(1) Supply of Gravel Stones by WRUA

It was agreed at the explanatory meeting to the resident community members on August 28, 2013 that it was the responsibility Isiolo WRUA to collect and supply gravel stones for gabion works as the community's contribution, for the riverbank protection work by means of wire mat for Isiolo pilot project, and this was encapsulated in the Memorandum of Understanding therefor was concluded among WRMA, Isiolo WRUA and the Project Team on September 2, 2013.

It was planned originally that 180m^3 of gravel stone was to be collected, and that 140m^{3}out of 180m^3 was supplied by Isiolo WRUA.

However, due to shortage of 40m^3, the sub-region office manager of WRMA Isiolo who was the project manager, requested Isiolo WRUA on several occasion to collect and supply that balance. The farming community members, were unable to collect the balance since that particular time was farming season as a result of short rainy season (beginning of November to end of December).

In order to expedite the short-term works of 3 months, the project manager from WRMA decided the shortage amount should be procured by the contractor, to which the Project Team agreed.

(2) Training for Maintenance

1) Background and Purpose

Main purpose for the training was to let the community members acquire skills including the manufacturing techniques of the wire mat using the tools provided by the Project Team to enhance sustainability of the riverbank protection work and also to transfer the techniques to the community.

Those techniques are indispensable to the community members for their self-acquisition and mutual acquisition as well. Materials, tools and equipment necessary for maintenance and repair works for them, were included in the bill of quantity for

procurement.
It was mutually agreed that the usual maintenance works after completion of riverbank protection works was to be carried out by the Matunda Full Gospel Church Community in collaboration with Isiolo WRUA, and this was stipulated in the Memorandum of Understanding that was agreed upon by WRMA, WRUA, Church Community and the Project Team on April 17, 2014, i.e.

2. The ordinary maintenance of those facilities shall be done by the Matunda Full Gospel Church community in cooperation with the Isiolo WRUA.

Furthermore, reserved gabion is stored in the space of the church, and the manager of this material is the chairman of church community.

2) Implementation of Training
Maintenance training on the knitting of wire mat was done at the riverbank protection work site of the Eastern Marania River on December 11, 2013.

Participants to the training were forty nine (49) persons of WRMA-SRO, WRUA Chairman, Secretary, Community members and the Contractor as well as more than 10 children.

Community chairman invited the people to congregate at the church on December 8, 2013, and the training that was held on December 10 and rice, vegetable and drink were provided for the lunch.

The community chairman welcomed the participants who introduced themselves, distributed the manual of wire mat manufacture and explained the manufacturing process. They moved then to the riverbank protection work site, wrote their names on the stones for memorial purposes, putting them into the mats and lashed them by wire under the advice and help of the contractor.

After the manufacturing, they enjoyed the lunch that was served. Eventually, the chairman of the community and WRUA summarized the training and it was confirmed that the community members would be responsible for the further maintenance work of the wire mat on their own. The procedures for the day are highlighted below:

Explanation by the Chairman

Haulage-in of the Gravel Stones

Stone Filling

Filling of the Named-Stones

Binding of the Wire Mat

3) Recommendation and Future Development

The site supervisor explained the manual in Kiswahili to the community member. The Project Team therefore suggested that the manual should be prepared in both English and Swahili and this was agreed upon by the participants.

As the countermeasure against water-flow into the church land from the side gutter beside the church, WRUA and the Community members suggested an idea that the gutter should be reinforced by the wire mat and they proposed to do it as part of the community contribution to the works. This countermeasure thereafter was implemented through the design revision in the contract works.

5.5.3 Completion Report

(1) Completion Inspection and Certificate

WRMA Isiolo Sub-region manager (Project Manager), monitoring sub-committee of Isiolo WRUA and the Project Team witnessed the completion inspection of the structures at the site that was carried out on March 14, 2014. Thereafter the Project Manager issued the Completion Certificate on March 17, 2014 incorporating the instructive matters raised by the evaluation team for completion at the completion ceremony on the same date.

The instructive matters were as follows:

a) Additional back filling should be done near the downstream end of the revetment.
b) Monitoring sub-committee of WRUA should observe the scouring conditions anticipated at the opposite bank at the downstream end.

WATER RESOURCES MANAGEMENT AUTHORITY

RIVER BANK PROTECTION COMPLETION CERTIFICATE

Completion Certificate

(3) Final Quantity and Amount

The contractor submitted Final Amount and As-Built Drawings on March 26.

The Project Team checked and confirmed them as proper as stipulated in the final contract amount.

Contract price to be paid on the completion was to be Ksh 3,221,145.75 deducting advance payment of Ksh. 1,245,227.65 (25% of the contract price) and retention money of Ksh. 496,263.60 (10% of final contract price). The retention money was to be paid on expiration of 60 days of maintenance period as per the contract.

Table 4.5-2 Bid Price and Final Agreed upon Price

	Bid Price (Ksh)	Final Settle Price (Ksh)	Difference (Ksh)
1.Monilization, Civil Work	1,227,385.00	1,224,704.00	-2,681.00
2.Wire Mat Placement Work	2,668,600.00	2,655,530.00	-13,070.00
3.Maintenance Tools	47,900.00	47,900.00	0
4.Demobilization	350,000.00	350,000.00	0
5.Total (excluding VAT)	4,293,885.00	4,278,134.00	-15,751.00
6. VAT (16%)	687,022.00	684,502.00	-2,520.00
7.Total (including VAT)	4,980,907.00	4,962,636.00	-18,271.00
8.Advance Payment	1,245,227.65	1,245,227.65	0
9.Retention	498,090.70	496,263.60	-1,827.10
10.Final Payment on Completion	3,237,589.65	3,221,145.75	-16,443.90

Details of 2.Wire Mat Placement Work are as follows.

Table 4.5-3 Details of Wire Mat Placement Work

Item	Unit	Rate (Ksh)	Initial Quantity	Final Quantity	Initial Amount (Ksh)	Final Amount (Ksh)
(1)Procurement of Gravel Stone	m3	2,500	180	122	450,000	305,000
(1')Transportation of Gravel Stone (for the stone supplied by the Community, not included in the initial contract)	m3	1,250	-	140	-	175,000
(2)Procurement of Wire Mat	Nos.	4,500	180	180	810,000	810,000
(3)Procurement of Sucking Prevention Material	m2	1,500	340	319	510,000	478,500
(4)Wooden Pile	Nos.	7,000	40	40	280,000	280,000
(5)Foundation Treatment for Wire Mat	m3	1,550	12	12.6	18,600	19,530
(6)Installation of Wire Mat	m3	2,500	180	175	450,000	437,500
(7)Appurtenant Works	Lump Sum	150,000	1	1	150,000	150,000
Total					**2,668,600**	**2,655,530**

1) Quantity Change due to Design Revision

a) Wire Mat

Quantity of the wire mat was changed as follows.

Table 5.5-4 Details of Wire Mat

	Before Design Revision	**After Design Revision**
Wire Mat for Revetment	9-pile x 20 rows = 180 pcs.	7-pile x 20 rows = 140 pcs.
Revetment (root protection)	-	1-pile x 20 rows = 20 pcs.
Revetment (treatment of downstream end)	-	7-pile x 1 row + 1 pcs. = 8 pcs.
Reinforcement of road side gutter	-	1-pile x 7 pcs. = 7 pcs.
Spare for repair and reinforcement	-	5 pcs.
Total	180 pcs.	180 pcs.

Explanations on design revision are as follows:

- Due to difficulty of excavation to the deep portion where enough embedment could be secured facing with gravel layer at the riverbed, the pile numbers were reduced by 2 piles.
- For the purpose of scouring countermeasure coping with insufficient embedment, 1-pile of wire mat was installed for root protection.
- 20 rows of wire mats were placed in the upstream-downstream direction according to the draft design, however, the community members asked for conservation of trees of indigenous species near the downstream-end. Since scouring at the root was anticipated in the draft design, another pile of wire mat was placed at the downstream-end so as to protect the tree root.
- Overflow from the side gutter on the road was protected so as to avoid erosion at the rear side of the revetment work site.
- Spare wire mat was provided and stored for the future repair, reinforcement for installation at other site.

b) Change of Excavation Volume due to Embedment Depth

Since it revealed that excavation up to the depth where embedment could be secured was difficult, excavation depth was changed and resulted in reduced excavation volume.

[Initial Design]

Excavation volume was determined in consideration of sectional excavation Area in the standard one of 2.0m^2, i.e. 2.0 (m^2) x 40 (m) = 80.0 (m^3)

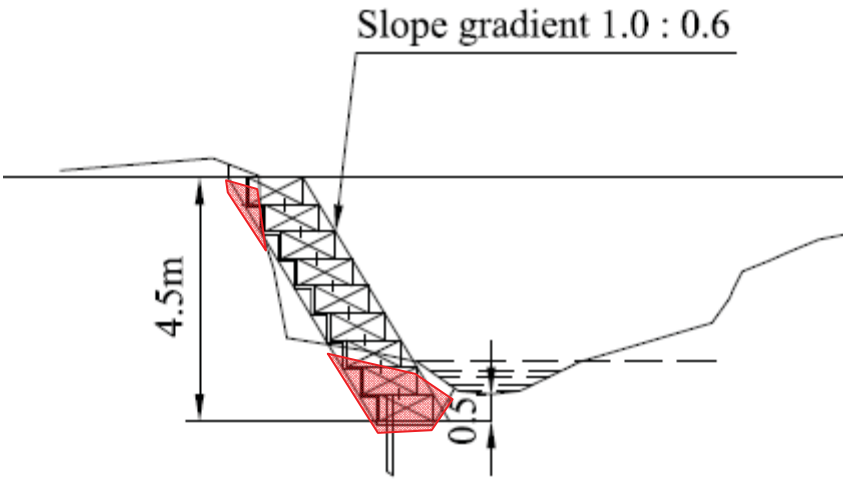


Fig. 5.5-2 Standard Section (Initial Design)

[Design Revision]

(Section area) x (Section length) = (0.5 x 0.3 ÷ 2 + 2.5 x 0.5 + 0.5 x 0.3÷2) m^2 x 40.0 (m) = 1.4 x 40 = 56 (m^3)

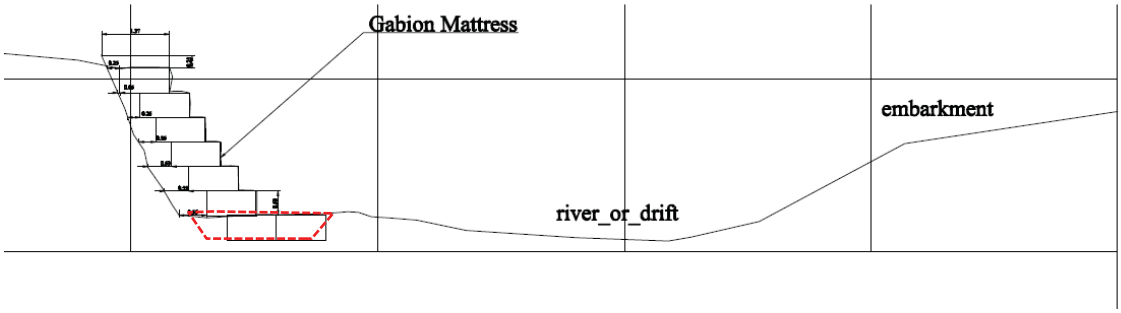


Fig. 5.5-3 Standard Section (after Design Revision)

c) Treatment of Downstream End

Civil work volume (excavation and back-filling) for the treatment of downstream end, was calculated assessing the whole volume calculation as shown in 2) below.

d) Reinforcement of Road Side Gutter

Volume of excavation and back-filling for this purpose was decided as nil.

e) Spare wire mat

Only the wire mat quantity was estimated.

2) Quantity Alteration according to the Site Topography

a) Back Filling

At the time of bidding: 75 m^3

At the time of final settlement: 406.7 m^3

Reason of alteration: Since the revetment pit projected toward the river so as to let the linear shape of the revetment bank close to that before erosion, back-filling volume was increased.

b) Gravel Stone

At the time of bidding: 180m^3

At the time of final settlement: 262m^3

140m^3 out of 262m^3 was supplied by the community and the remaining 122m^3 was procured by the contractor.

Quantity substance of the gravel stones:

[1] Increase in quantity

Gravel stones were utilized for other purpose than for wire mat as well, thus, the quantity was increased.

Quantity used for wire mat: 175m^3

Note : 180m^3 was planned in the initial design, but changed to 175m^3 due to design change as explained in (1)-a).

For back filling at the eroded rear side of the revetment: 64m^3

For treatment of downstream end: 23m^3

Total: 262m^3

[2]Transportation

180m^3 was applied for the bidding and contract as the quantity for procurement and transportation; however, it was not sure whether the full quantity could be secured by the delivery to be done by the Community. Therefore, the contract specified that the final quantity should be settled balancing the quantity to be supplied by the community.

As the result, 140m^3 was supplied by WRUA under the community's contribution; however, the consumed volume was increased as shown above with supply of 122m^3 by the contractor.

Whereas, the contractor transported the gravel stones supplied by the Community up to the site at the cost of the contractor, thus, the cost of transportation incurred by him was paid at the actual sub-contracted cost, i.e. Ksh 5,000 per one dump track for 4m^3 and priced at Ksh 1,250 for m^3.

5.5.4 Handing-over of the Facilities and Tools

Facilities and maintenance tools were handed over to WRMA from JICA Kenya Office at the completion ceremony on March 17, and then further handed over to Isiolo WRUA.

	
Handing-over of the Facilities & Maintenance Tools from JICA Kenya Office to WRMA ENNCA Regional Office Manager	Further Handing-over of the Facilities & Maintenance Tools from WRMA ENNCA Regional Office Manager to Isiolo WRUA through WRMA sub-regional office manager

Memorandum of Understanding regarding the right of use and maintenance was concluded among WRMA, WRUA, Church Community and the Project Team on April 17, 2014 as follows:

1. *The property rights of facilities and tools shown in the list of Attachment 1 shall be transferred to Isiolo WRUA from WRUA having received the same from JICA Project Team after completion of the construction work;*

2. *The ordinary maintenance of those facilities shall be done by the Matunda Full Gospel Church community in cooperation with Isiolo WRUA.*

MEMORANDUM OF UNDERSTANDING
FOR
THE PROJECT FOR CAPACITY DEVELOPMENT FOR EFFECTIVE FLOOD MANAGEMENT IN FLOOD PRONE AREAS
AMONG
WRMA, ISIOLO WRUA, MATUNDA FULL GOSPEL CHURCH
AND JICA PROJECT TEAM
UNDER
RIVERBANK PROTECTION WORKS ALONG THE EASTERN MARANIA RIVER

Whereas Japan International Cooperation Agency (hereinafter referred to as "JICA") under technical cooperation have partnered with Ministry of Environment, Water and Natural Resources (hereinafter referred to as "MEWNR) to undertake the Project on Capacity Development for Effective Flood Management in Flood Prone areas (hereinafter referred to as the "Project"). The MEWNR is represented by Water Resources Management Authority (hereinafter referred to as "WRMA") has a mandate to manage floods within the Republic of Kenya. Riverbank protection works along the Eastern Marania River was conducted as a pilot project in the Project.

Whereas WRMA has supported formation of Water Resource Users Associations (WRUAs) in all river basins to help in water resources management at sub-catchment level. WRMA and Water Service Trust Fund (hereinafter referred to as "WSTF") have developed a WRUA Development Cycle (WDC) Manual which is instrumental in implementation of water resources management activities including flood management activities.

Now therefore, in considerations of roles and responsibilities of parties to the project and mutual support, the parties herein agree as follows:

1. The property rights of facilities and tools shown in the list of **Attachment 1** shall be transferred to Isiolo WRUA from WRMA having received the same from JICA Project Team after completion of the construction work;
2. The ordinary maintenance of those facilities shall be done by the Matunda Full Gospel Church community in cooperation with the Isiolo WRUA;

Whereas WRMA, Isiolo WRUA, the Matunda Full Gospel Church community and the JICA Project Team agreed to honour this Memorandum of Understanding with respect to the Pilot Project on Riverbank Protection works along the Eastern Marania River.

WRMA, Isiolo WRUA, the Matunda Full Gospel Church community and JICA Project Team mutually agreed that

In witness whereof the parties here to have caused this Memorandum of

- 1 -

Understanding to be effective as at the day the parties signed herein.

Attachment List
- Attachment 1: List of Facilities and Tools
- Attachment 2: Drawings

Eng. John P. Olum
Chief Executive Officer
Water Resources Management Authority (WRMA)
Date: 17th April 2014

Mr. Felix Karimba
Chairman
Isiolo Water Resource Users Association (WRUA)
Date: 17th April 2014

Mr. David Ochillo
Deputy Technical Coordination Manager
WRMA Ewaso Ngiro North Catchment Area
Date: 17th April 2014

Mr. Wilson Kirutt
Chairman
Matunda Full Gospel Church
Date: 17th April 2014

Mr. John Kinyanjui
Assistant Technical Coordination Manager
WRMA Isiolo Sub – Regional Office
Date: 17th April 2014

Mr. Hideki Sawa
Team Leader
JICA Project Team
Date: 17th April 2014

- 2 -

Fig. 5.5-4 MoU

Further, Certificate of Handover of the facilities and tools for both Isiolo and Lower Lumi, was concluded between the Project Team and WRMA on April 25, 2014.

CERTIFICATE OF HANDOVER

List of Facilities and Tools

Fig. 5.5-5 Certificate of Handover

5.5.5 Defect Liability Inspection

Date : May 31, 2014 (15:00 pm to 16:00 pm)
Venue : Matunda Full Gospel Church
Attendants: WRMA Isiolo SRO & FMO, WRUA Chairman, monitoring SC chairlady, other 1 person, Contractor (WASO), JICA Project Team (Chief, Site Supervisor)

Inspection Contents and Result:

Any damage or malfunction envisaged to have been caused by sole responsibility of the contractor during 60 days of defect liability period from the date of work completion, were inspected. If any damage or malfunction be found or indicated by the Project Manager, they should be rectified by the contractor at his costs, and in such case, Defect Liability Certificate should be issued on confirmation of those rectified works, and then 10% of retention money should be paid to the contractor.
Under the above-mentioned contract stipulation, the attendants executed the inspection.

(1) Conditions Inspected
1) Any damage of wire mat
2) Back filling conditions at the rear side of the revetment work
3) Any collapse of wire mat

(2) Results of Inspection
1) Damage of wire mat

Condition	Countermeasure
No damage was found.	None
Wire was cut partially and wire-interval was loosened partially on the wire mat installed at the road side gutter.	The contractor shall re-bind the wires at those portions.

2) Back filling at the rear side of the revetment work

Condition	Countermeasure
Level of the back-filling portion was lower than that of the surrounding area.	The contractor shall further implement the back-filling with sufficient compaction.

3) Collapse of wire mat

Condition	Countermeasure
No collapse was found.	None

(3) Impression
1) Attendants of WRUA were few, though they had another meeting on that date. They were not sure to attend it without receiving offer of transport fee.
2) The Project Team suggested Isiolo WRUA should promote to invite other regional persons to the revetment works in the same manner as preservation activity for the fountains, to which the attendants agreed.

5.6 Monitoring and evaluation of the Pilot project at the Isiolo Sub-Catchment

5.6.1 Monitoring Result of the Structures

There has been no major phenomenal impact that has affected the safety of the riverbank protection because since its construction there has been no heavy rainfall or flow that has occurred.

5.6.2 Consideration of Influencing Effects

It can be judged that other authorities are interested more in the prevention of erosion method by means of wire mat or cylinder as implemented in this Project. It was identified that Meru County Government Authority had implemented erosion protection works at the road side gutters using wire mat, however, it is desirable for WRMA to render them with technical support and instruction since they had some problems in their design.

Foundation of Revetment Works and Opposite Downstream Bank

Erosion Protection Using Wire Mat Implemented at Surrounding Region