



# **University of Nairobi**

**School of Engineering**

**DEPARTMENT OF CIVIL AND CONSTRUCTION ENGINEERING**

*Assessing the Roles of Water Resources Users Associations in line with the Principles of Integrated River Basin Management: Case Study of the Kuywa Water Resources Users Association*

**BY**

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THESIS SUBMITTED IN PARTIAL FULFILLMENT FOR THE DEGREE OF MASTER OF SCIENCE IN CIVIL ENGINEERING (WATER RESOURCES ENGINEERING), IN THE DEPARTMENT OF CIVIL AND CONSTRUCTION ENGINEERING OF THE UNIVERSITY OF NAIROBI

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## DECLARATION

I, David Wakhisi Liambila, hereby declare that this Thesis is my original work. To the best of my knowledge, the work presented here has not been presented for a degree in any other Institution of Higher Learning.

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## **DEDICATION**

This Thesis is dedicated to my family; My Wife Lucy, Son Royal and Daughter Gracia, for providing me with inspiration to work hard.

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## **ABBREVIATIONS**

ADB	Asian Development Bank
ASAL	Arid and Semi-arid lands
AWSCR	Annual Water Sector Conference Report
BAWRMS	Basin Area Water Resources Management Strategy
BMPs	Basin Management Plans
BWRCS	Basin Water Resources Committees
CBOs	Community Based Organisations
CCNR	Central Commission for the Navigation of the Rhine
CDF	Constituency Development Fund
CMC	Central Management Committee
CMS	Catchment Management Strategy
CoK	The Constitution of Kenya (2010)
CSO	Civil Society Organization
EC	European Communities
EU	European Union
FBOs	Faith Based Organizations
FGD	Focus Group Discussions
GIS	Geographical Information System
GIZ	German International Cooperation
GWP	Global Water Partnership
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
IBM	International Business Machines
ICWE	International Conference on Water and the Environment
ICPR	International Commission for the Protection of the Rhine
IFAD	International Fund from Agricultural Development
INBO	International Network of Basin Organizations
IRBM	Integrated River Basin Management
IWMI	International Water Management Institute
IWRAP	Integrated Water Resource Action Plan Program
IWRM	Integrated Water Resources Management
IWRM and WEP	Integrated Water Resources Management and Water Efficiency Plan

JICA	Japan International Cooperation Agency
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KII	Key Informant Interviews
KNBS	Kenya National Bureau of Statistics
KSHS	Kenya Shillings
KUWRUA	Kuywa Water Resources Users Association
LVNCA	Lake Victoria North Basin Area
M.A.S.L	Metres above Sea Level
MCAAs	Members of County Assembly
MCAPs	Micro-basin Action Plans
MDBC	Murray-Darling Basin Commission
MEW and NR	Ministry of Environment Water and Natural Resources
MPs	Members of Parliament
MWI	Ministry of Water and Irrigation
NBI	Nile Basin Initiative
NEMA	National Environment Management Authority
NGOs	Non-governmental Organizations
NLC	National Land Commission
NRM	Natural Resources Management
NWMP	National Water Master Plan
NWP	National Water Policy
NWRMS	National Water Resources Management Strategy
NZOWASCO	Nzoia Water and Sanitation Company Ltd
OJEC	Official Journal of the European Communities
QMS	Quality Management Systems
RBA	Rights Based Approach
RBMP	River Basin Management Plan
RBOs	River Basin Organizations
RBP	River Basin Planning
RGS	River Gauging Station
RO	Regional Office
RQOs	Resource Quality Objectives

SCMPs	Sub-Catchment Management Plans
SDGs	Sustainable Development Goals
SOs	Support Organizations
SPSS	Statistical Package for Social Sciences
SRBP	Strategic River Basin Planning
SRM	Sub-Regional Manager
SRO	Sub-Regional Office
STDDEV	Standard Deviation
TAC	Technical Advisory Committee
TVA	Tennessee Valley Authority
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCO-IHE	UNESCO Institute for Water Education
USAID	United States Agency for International Development
USCA	University of the Sunshine Coast, Australia
WAP	Water Allocation Plan
WDC	WRUA Development Cycle
WFD	Water Framework Directive
WGC	Water Governance Centre (Netherlands)
WKCDD and FMP	Western Kenya Community Driven Development and Flood Mitigation Project
WRM	Water Resources Management
WRA	Water Resources Authority
WRUAs	Water Resource Users Associations
WSSP	Water Sector Strategic Plan
WSTF	Water Services Trust Fund
WSTG	Water Sector Technical Group
WSWG	Water Sector Working Group
WWC	World Water Commission
WWF	World Wide Fund for Nature



## **ABSTRACT**

Integrated River Basin Management (IRBM) has become a rallying call of mainstream thinking on water resources management across the world. The Dublin Principles (1992) and the Rio Conference's Agenda 21 (1992) both stressed aspects of water resources management that are supposed to be integrated at the river basin level.

In Kenya, the Water Act 2016 recognizes the river basin as the planning unit for water resources management and establishes Water Resources Users Associations (WRUAs) as vehicles for conflict resolution and collaborative management of water resources at the sub-basin level. The WRUA Development Cycle (WDC) which is the tool that guides formation of WRUAs and development of their Sub-Catchment Management Plans (SCMPs) has been developed based on the principles of Integrated Water Resources Management (IWRM) but it does not provide clear guidelines to the WRUAs towards achieving Integrated River Basin Management within the entire basins.

The objective of this research was to assess the extent to which the WRUAs' mandate as established in the WDC fits in with the principles of Integrated River Basin Management at the sub-basin level, and to establish the extent to which the WRUAs are implementing Integrated River Basin Management through their planned and funded activities. The case study was the Kuywa Water Resources Users Association operating in the Kuywa river sub-basin in western Kenya. The study reviewed the Kuywa WRUA's SCMP to identify core activities planned for implementation and how they relate with the established principles of Integrated River Basin Management.

Data for analysis was collected through semi-structured questionnaires administered to a sample of the population; through focus group discussions with the WRUA management committee; through key informant interviews with officials from Water Resources Authority (WRA) and Water Services Trust Fund (WSTF); through field observations from transect walks; and through collection of secondary data from government offices, from the WRUA's records and from other sources. Data collected was analyzed using the Statistical Package for Social Sciences (IBM SPSS Statistics, Version 20.0).

The study found out that the WRUAs' activities were generally in line with the principles of Integrated River Basin Management, and that the WRUAs were having a major impact on the conservation of their sub-basins. However, lack of technical capacity and limited funding were

the two major hindrances to the WRUA's efforts towards Integrated River Basin Management at the sub-basin level.

The study recommends that capacity building trainings, especially for the WRUA central management committees and the technical committees, should be continuously enhanced in order to equip the WRUAs with necessary skills to deliver on their mandate. Both the national and county governments should prioritize the conservation of water and natural resources so that sufficient funds are allocated towards the same in their annual budgets.

Finally the study recommends that WRA should improve on coordination of conservation efforts within each basin and should facilitate setting up of basin-wide forums which provide an opportunity for WRUAs within the same basin to interact and consolidate their efforts towards Integrated River Basin Management.

# **1. INTRODUCTION**

## **1.1 Background**

The Global Water Partnership (GWP) defines Integrated River Basin Management (IRBM) as “the process of coordinating conservation, management and development of water, land and related resources across sectors within a given river basin, in order to maximize the economic and social benefits derived from water resources in an equitable manner while preserving and, where necessary, restoring freshwater ecosystems” (GWP (a), 2000).

In practice, IRBM brings together a diverse array of stakeholders in a river basin in a process to collaboratively manage the activities and impacts on water resource use. These stakeholders include government entities, community organisations, business and industry organisations and other organisations, and individuals with a particular concern or interest. IRBM also involves the general public who also have a stake, albeit less well defined. This participatory approach results in more holistic strategies, ensures more inclusive of the diversity of goals, and produces greater support and commitment from stakeholders, which increases the likelihood of implementation (Hooper, 2005).

The Kuywa sub-basin falls under the Lake Victoria North Basin Area of the Water Resources Authority (WRA). The WRA Regional Office in Kakamega has overseen the establishment of the Kuywa Water Resources Users Association (KUWRUA) to spearhead water resources management and basin conservation for the Kuywa River sub-basin through involvement of the local communities and stakeholders. KUWRUA has already developed a Sub-Catchment Management Plan (SCMP) which has been under implementation since 2008. KUWRUA has fairly well established institutional structures and technical capacity in comparison with other WRUAs in the region. This, coupled with the high level of awareness of community members in the Kuywa sub-basin provides good justification for selection of Kuywa WRUA for the proposed study on the effectiveness of Water Resources Users Associations in implementation of Integrated River Basin Management.

## **1.2 Problem Statement**

The concept of Integrated River Basin Management has been accepted worldwide as the best approach towards effective water resources management. In recognition of this, many countries have established institutional and administrative systems that seek to address the issues of water resource management based on the ecological river basin.

In Kenya the concept of Integrated River Basin Management is yet to be fully implemented across many river basins in the country, although the government has made steps towards

embracing the internationally recognized principles of Integrated Water Resources Management. The Water Act 2016 provides for the establishment of WRUAs, which are voluntary associations of water users, riparian land owners and other stakeholders that formally come together for the purpose of cooperatively sharing, managing and conserving a common water resource. The WRUAs generally operate at the river basin level, and have the mandate of bringing together all concerned community members and stakeholders to cooperatively manage the available water resource in a given basin.

While there has been progress made by the country in its efforts towards Integrated Water Resources Management, many challenges still abound with respect to managing water, land and other natural resources within the various basins and sub-basins in the country. The concept of Integrated River Basin Management, which addresses itself to the issues of Integrated Water Resources Management within a given river basin, is a concept that if fully embraced and implemented would provide a better approach towards addressing the myriads of challenges that still exist within river basins.

### **1.3 Objectives of the Study**

The overall objective of this study was to assess the roles of Water Resources Users Associations (WRUAs) in implementing Integrated River Basin Management at the local level. The study aimed at achieving the following specific objectives:-

1. Identify from amongst the WRUA's funded activities those which are in line with the principles of Integrated River Basin Management;
2. To establish the extent to which the WRUA's activities implemented have had a positive effect on the sub-basin.
3. Establish the challenges faced by the WRUA in implementing their funded activities and how they affect the WRUA's efforts towards Integrated River Basin Management; and
4. To draw a conclusion on the extent to which the WRUAs are implementing Integrated River Basin Management within their river sub-basins, and make recommendations.

### **1.4 Justification for the Study**

The Kuywa River Sub-basin is a home to nearly 250,000 people according to the Kenya Population and Housing Census, 2009. Most of these residents depend on the basin's waters for domestic use, for agriculture, for livestock keeping, and for commercial and industrial uses. However, studies have shown that the basin's natural resources especially land and water resources have been undergoing degradation over the years. The study reviewed the key

principles of Integrated River Basin Management as established worldwide, and elements of good practice in Integrated River Basin Management, which if implemented would ensure that the river basin is managed in an effective and sustainable manner. The study sought to establish the extent to which the concept of Integrated River Basin Management was being implemented in the Kuywa River sub-basin, and make recommendations on steps to be taken in order to ensure Integrated River Basin Management in the Kuywa River sub-basin.

### **1.5 Research Questions**

This study was guided by the following research questions:

1. What were the major problems facing the Kuywa River sub-basin as identified during SCMP development (i.e. Problem Identification and Analysis)?
2. What activities were proposed for addressing these challenges and which of the proposed activities were funded?
3. Has there been an improvement with respect to the identified challenges since the WRUA started addressing them?
4. Which principles of Integrated River Basin Management are being implemented by the Kuywa WRUA through their funded activities, and how successful has this implementation been?
5. Has the Kuywa WRUA been effective in managing the funds received from WSTF towards implementation of the activities as outlined in the SCMP?
6. What are the challenges faced by the Kuywa WRUA in implementing their SCMP, and what recommendations do they have for dealing with those challenges?
7. What are the lessons learnt by WRA in establishing and working with WRUAs towards effective Integrated River Basin Management?

## **2. LITERATURE REVIEW**

### **2.1 Integrated River Basin Management**

The Global Water Partnership defines Integrated River Basin Management (IRBM) as “the process of coordinating conservation, management and development of water, land and related resources across sectors within a given river basin, in order to maximize the economic and social benefits derived from water resources in an equitable manner while preserving and, where necessary, restoring freshwater ecosystems” (GWP, 2000).

There are many terms used, which in essence refer to one and the same concept of Integrated River Basin Management: integrated basin management, integrated river basin development and management, ecosystem management, ecosystem approach, integrated watershed management, integrated resource and environmental management and the watershed approach (Hooper, 2005).

Integrated River Basin Management has now become a rallying call of mainstream thinking on water resource management. The 1992 Dublin Principles and Rio Conference’s Agenda 21 both stressed aspects of management that are supposed to be integrated at the river basin level. In the wake of the Conference, the 1993 World Bank water policy underscored that “in many countries, institutional reform will focus on river basins as the appropriate unit for analysis and coordinated management (World Bank, 1993).”

The European Union’s Water Framework Directive (2000) represents probably the most ambitious attempt worldwide to reorder water resources management around the principle of river basin management (Moss, 2012). The Water Framework Directive enjoins all EU member states to “ensure the appropriate administrative arrangements, including the identification of the appropriate competent authority, for the application of the rules of this Directive within each river basin district lying within their territory” (European Communities, 2000).

The establishment of the WFD was underpinned by a realization by the European members states that the “Waters in the Community are under increasing pressure from the continuous growth in demand for sufficient quantities of good quality water for all purposes,” and therefore there was “need for action to protect Community waters in qualitative as well as in quantitative terms” (European Communities, 2000).

The WFD states that the “objective of achieving good water status should be pursued for each river basin, so that measures in respect of surface water and ground waters belonging to the same ecological, hydrological and hydrogeological system are coordinated” (European Communities, 2000). This, in essence, encapsulates the need for creation of a river basin organization that will

spearhead the application of all the WFD's rules within the river basin district towards achievement and maintenance of its good water status.

### **2.1.1 Principles of Integrated River Basin Management**

Bruce Hooper (2005) outlines the following as the key principles of IRBM;

- (i) Engaging all stakeholders to ensure that they own the process and participate under a formal, contractual arrangement, rather than ad hoc, voluntary arrangements.
- (ii) Accurate design and modeling of river basin management options while ensuring that relevant river basin decision-makers are involved throughout the process of model design, implementation and outcome review.
- (iii) Application of diverse institutional arrangements such as cost sharing programs, as well as regulatory practices such as environmental regulation, zoning laws and environmental standards for best practice. Developing countries require different approaches to institutional strengthening for river basin management than those of developed countries.
- (iv) Clear definition of the roles and jurisdiction of the RBO, which involves (a) a skills-based board of directors; (b) a democratic process, with its members elected by the regional community; and (c) accountability, with the management reporting to an independent board of directors linked to high levels of government for political influence and support.
- (v) Strong leadership that ensures strong river basin advocacy for successful river basin management. Strong river basin advocacy will ensure that both willing and stubborn resource managers are fully engaged, the case for IRBM is strongly articulated, conflicts are mediated and strong working relationships are built between the many disparate and competing players in a river basin.
- (vi) There should be prioritization of actions, with some actions designed and implemented immediately to produce visible results in the short-term, as well as formulation of long-term river basin management plans towards a cost-shared plan over a longer timeframe.
- (vii) Accountability: Need to monitor the effectiveness of a river basin management plan and the organization responsible for its implementation. This should commence right at the launch of a river basin management plan, with regular reports on the progress of river basin health in, for example, critical water quality indicators.
- (viii) Local government partnerships for effective implementation: There is continuing concern about the role and ability of local government to implement local forms of river basin management. Local government helps in planning and local zoning mechanisms which can

be used to implement broader river basin management goals. Local Government powers should be harnessed within a River Basin Management Plan to enact IRBM, and implement it through sub-basin plans.

(ix) Integrating functions for coordinated river basin management: One constant problem in IRBM is lack of coordination between and within government agencies, NGOs, the general public and other key local and regional water stakeholders. This can be solved through integration, coordination and planning mechanisms and driving coordination throughout the RBO and with its strategic stakeholders. The starting point to coordination is to establish a joint vision for the basin and an ethic of willingness to cooperate, coordinate and manage together.

The WWF Water Seminar Series (2001) highlights five key principles that can be described as ‘cross cutting’ because they apply globally to all aspects of the river basin management process;

- a) **Integration:** Integration between organizations, economic sectors and disciplines dealing with water resource management issues is required for ensuring efficient and effective river basin planning.
- b) **Scale:** The river basin is clearly recognized as the basic planning scale for water management measures. The great diversity in river basin sizes means approaches suitable to one location are not automatically transferable elsewhere, although the same basic planning principles must apply.
- c) **Timing:** Effective timing of implementation is critical, taking advantage of opportunities as they arise while working within a strategic framework. Deadlines for achieving the objectives of IRBM are extremely challenging. But they must not be seen as a step-by-step timetable for implementation as many tasks will effectively be required before such deadlines. Better start implementing early but imperfectly.
- d) **Participation:** Active participation by all relevant stakeholders in well-informed and transparent planning and decision-making is crucial to ensure that decisions are based on common understanding, shared knowledge, experiences and scientific evidence. Access to information, consultation and participation of the public and stakeholders are key elements of the process of river basin planning.
- e) **Capacity:** Adequate investment of financial and human resources in capacity building for river basin planning and participation processes is a crucial to the success of the river basin management process.



### 2.1.2 Strategic River Basin Planning

Strategic Basin Planning is defined as “a coherent multidisciplinary approach to managing basin water resources and their users in order to identify and satisfy social, economic and environmental priorities” (Pegram et al, 2013). Thus the aim of strategic basin planning is to select a set of objectives, out of all possible water management objectives, that will best contribute to a range of competing economic, social and ecological goals. Further, achieving these goals requires the participation of a range of government bodies and stakeholders, beyond those directly involved with water management.

Characteristics of strategic basin planning include the following:

- (i) Trade-offs between alternative economic, social and environmental objectives, and between existing and potential future demands;
- (ii) A sophisticated approach to recognizing environmental water needs and the importance of aquatic ecosystem functioning in providing goods and services;
- (iii) Understanding basin interactions, including the range of hydrological, ecological, social and economic systems and activities at work within a basin;
- (iv) Robust scenario-based analysis to address uncertainty in future development and climate, by assessing alternative hydro-economic scenarios; and
- (v) Prioritization, to identify which of the many demands are the key needs for economic development, social justice and environmental protection.

Pegram et al (2013) have outlined “**Ten Golden Rules of Basin Planning**”, key issues that they reckon are central to the challenge of river basin planning. These are:

- (i) Develop a comprehensive understanding of the entire system;
- (ii) Plan and act, even without full knowledge;
- (iii) Prioritize issues for current attention, and adopt a phased and iterative approach to the achievement of long-term goals;
- (iv) Enable adaptation to changing circumstances;
- (v) Accept that basin planning is an inherently iterative and chaotic process;
- (vi) Develop relevant and consistent thematic plans;
- (vii) Address issues at the appropriate scale by nesting local plans under the basin plan;
- (viii) Engage stakeholders with a view to strengthening institutional relationships;
- (ix) Focus on implementation of the basin plan throughout; and
- (x) Select the planning approach and methods to suit the basin needs.

Strategic River Basin Planning also requires the development of River Basin Management Plans (RBMPs), which are a prerequisite for consistent implementation of policies, including the allocation of water resources, pollution abatement, zoning, granting of permissions and licenses, and others. The aim of a RBMP is to provide overall vision and guidance, by clearly outlining the priorities and balancing the various sector interests in a way that facilitates clear and specific actions to address the main issues. The RBMP should outline the objectives for sustainable management of the river basin and specify concrete short-term and long-term actions towards achieving these objectives. In Europe, River Basin Management Plans are a requirement of the Water Framework Directive, with each member state required to produce a plan for each of the river basin districts within its territory.

### **2.1.3 River Basin Organizations**

River Basin Organization is a generic term used to refer to any institution that is directly involved in the management of river basins (Pegram et al, 2013). They may range from large formal basin-scale agencies down to small informal basin groups, and include trans-boundary commissions on international waters.

According to the Global Water Partnership's IWRM Tool Box (Tool B1.4), River Basin Organizations (RBOs) are specialized organizations set up by political authorities, or in response to stakeholder demands, to deal with the water resource management issues in a river basin, a lake basin, or across an important aquifer. RBOs provide a mechanism for ensuring that land use and needs are reflected in water management and vice versa. Their functions vary from water allocation, resource management and planning, to educating basin communities and developing natural resources management strategies and programmes of remediation of degraded lands and waterway. The focus of the river basin organizations is to deal with land and water resources issues that are domestic and do not transcend state boundaries (GWP (b), 2000).

Many countries across the world have established River Basin Organizations, or are in the process of doing so. Although each country is unique, the challenges they face in river basin management generally have some similarities, and an examination of the experiences various countries would reveal important lessons that can be useful in working towards Integrated River Basin Management in the Kenyan context.

## **2.2 International Experience in Integrated River Basin Management**

### **2.2.1 Australia: Murray-Darling Basin Commission**

In Australia, The Murray-Darling Basin had been subjected to widespread environmental degradation as a result of lack of coordinated action among the 5 State governments in the Basin,

which were charged with instituting programmes for the Basin's natural resources management and conservation. Thus, the Murray-Darling Basin Commission (MDBC) was established in January 1988, to ensure (Hooper, 2014):

- Efficient management and equitable distribution of River Murray water resources;
- Protection and improvement in the water quality of the River Murray and its tributaries; and
- Provision of necessary technical advice on water, land and environmental management in the Basin.

Lessons learned from the MDBC could be summarized as follows:

- (i) The participatory approach used with its Community Advisory Committee has helped the Commission to win and maintain community interest, involvement and support;
- (ii) Resource condition outcomes are more likely to be achieved where formal targets are set and accountability for achieving them clearly established and agreed by governments; and
- (iii) The strategies for action, programmes and frameworks have benefited from intergovernmental (top-down) approaches coupled with bottom-up actions, although determining how an equitable cost-sharing arrangement can be set up, implemented and maintained has been a challenge. (Hooper, 2014)

### **2.2.2 Europe: International Commission for the Protection of the Rhine**

The Rhine River is the third largest river in Europe after the Volga and the Danube. The river is about 1230 km long, traversing 9 countries, namely; Italy, Austria, Liechtenstein, Switzerland, France, Germany, Belgium, Luxemburg and the Netherlands. The river has basin area of about 185,000 Km<sup>2</sup>, and is home to about 60 million people (UNESCO, 2013). About 800km of the river is navigable, making it an important waterway for transportation of goods within the riparian states. Besides navigation the river is also used for domestic and agricultural water supply, industry (incl. water cooling), waste water disposal, hydropower generation, fisheries, recreation and other purposes (Raadgever, 2005).

The International Commission for the Protection of the Rhine (ICPR) was established in 1950, and its duties include investigation into the type, source, and extent of pollution in the Rhine, recommending appropriate measures to reduce the pollution, and preparation of agreements between the participating countries. There are three broader permanent working groups in the ICPR which focus specifically on one of three issues: water quality, ecology, and emissions (Marney, 2008).

The ICPR exists as a means for negotiation and as an advisor to the riparian states. This it does through drafting general policy statements affecting various river basin management issues,

which then need to be integrated into national programs and legislative frameworks of the individual member states. Implementation and funding of the recommended measures is the responsibility of the individual states (Kampa et al, 2003).

The ICPR also serves as a forum for exchange of information and consultation with relevant NGOs, taking their positions into account when making decisions, and informing them about the decisions that have been made (Kampa et al, 2003).

With concerted efforts from the ICPR and other bodies such the Central Commission for the Navigation of the Rhine (CCNR) and the Salmon Commission, the Rhine River has come a long way from being the ‘Sewer of Europe’ with fish completely disappearing in the mid 1900’s to seeing the return of the salmon starting in 1996 (Marney, 2008).

### **2.2.3 United States of America: Tennessee Valley Authority**

The Tennessee Valley Authority was one of the earliest RBOs to use top-down methods of multi-objective planning for achieving various set-out objectives such as poverty reduction, navigation improvement, soil conservation, flood management and water resources protection in the Tennessee Valley. TVA’s initial plan was not only to ‘fully’ control the river system by a series of dams, thus providing protection from floods and producing hydropower but to also tackle poverty at the root by an ambitious range of activities, including training, agricultural extension services, soil conservation, afforestation, production of fertilizers, stimulation of local enterprises and welfare-oriented programs on education, health and sanitation (Molle, 2006).

TVA has since evolved and its core functions now include a broad mandate of sustainable economic development, tied to supplying power and managing a river system. Its management responsibilities as of now include: minimizing flood risk, maintaining navigation, providing recreational opportunities and protecting water quality (World Bank, 1998).

The following are lessons learned from the TVA’s advent and evolution over the years (World Bank, 1998):

- 1 The TVA model has never been replicated in the United States, partly due to States’ rights issues and opposition by other federal agencies. Similarly, in other countries where there are strong local governments and existing national institutions, the implementation of a strong regional authority might not be appropriate or even possible.
- 2 The early success of the TVA depended on the strength of its champions, the vision of its first leaders, and its ability to show tangible results within a few years.
- 3 TVA's greatest legacy has been the integration of a healthy natural resource base, a strong infrastructure, and human capacity to foster the social and economic development of a region.

- 4 Two critical deficiencies in TVA's institutional structures were; there was no formalized mechanism for stakeholder participation in decision making and no effective means to ensure critical oversight of the agency. There is no well-established mechanism for internal, independent scrutiny of policies, while external congressional oversight has not always been consistent or rigorous.
- 5 TVA's mission as a comprehensive river basin management agency has produced its greatest accomplishments and given it greatest popularity. Yet the future of such non-power programs like flood control and environmental management, which provide immense benefits to the region, remains uncertain since they are not self-financing or revenue generators. Thus the long-term sustainability of agencies like TVA will depend upon finding innovative ways to finance resource management activities.

### **2.3 Integrated Water Resources Management**

The Global Water Partnership (GWP) defines IWRM as “a process that promotes the coordinated development and the management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems” (GWP (a), 2000).

The concept of IWRM is driven by the recognition that the world's fresh water resources are under increasing pressure resulting from growth in world population, leading to increased competition over the limited freshwater resources. A combination of social inequity, economic marginalization and lack of poverty alleviation programmes also force people living in extreme poverty to over-exploit soil and forestry resources, which often results in negative impacts on water resources. Lack of pollution control measures further degrades water resources (GWP (a), 2000).

#### **2.3.1 Principles of Integrated Water Resources Management**

The Principles of Integrated Water Resources Management (also called the Dublin Principles), were formulated during the International Conference on Water and the Environment (ICWE) in Dublin, 1992, as a preparation for the UN Conference on Environment and Development in Rio de Janeiro the same year (UNCED, 1992). The four Principles are (GWP (a), 2000):

- (i) Fresh water is a finite, vulnerable and essential resource which should be managed in an integrated manner;
- (ii) Water resources development and management should be based on a participatory approach, involving all relevant stakeholders;
- (iii) Women play a central role in the provision, management and safeguarding of water; and

- (iv) Water has an economic value and should be recognized as an economic good, taking into account affordability and equity criteria.

IWRM seeks to shift water resources development and management systems from their currently unsustainable forms, to more responsive forms that are capable of adapting to new economic, social and environmental conditions and to changing human values (GWP (a), 2000).

IWRM seeks to achieve the following key strategic objectives (WWC, 2000):

- (i) Efficiency, the need to maximize the economic and social welfare derived not only from the water resources base but also from investments in water services provision;
- (ii) Equity in the allocation of scarce water resources across different economic and social groups in order to reduce conflict and promote socially sustainable development; and
- (iii) Environmental sustainability, as ultimately all attempts at water management reform will fail if the water resources base and associated ecosystems continue to be regarded as infinitely robust and we continue to put at risk ‘the water system that we depend on for our survival’.

### **2.3.2 Integrated Water Resources Management in Kenya**

In Kenya, the Water Act 2016 recognizes the river basin as the planning unit for water resources management in the entire country. Section 14 (1) of the Water Act 2016 empowers WRA to “designate a defined area from which rainwater flows into a watercourse to be a basin area” (Water Act 2016). In accordance with this provision, WRA has designated six main basin areas in the entire country which are based on existing drainage basins. These are: Lake Victoria North, Lake Victoria South, Rift Valley, Athi, Tana and Ewaso Ng’iro North Basin Areas.

WRA has established six regional offices based on these basin areas, and has, in accordance with the provisions of the Water Act 2016, established Basin Water Resources Committees (BWRCs), which serve to advise the WRA Regional Offices and the County Governments, concerning (a) conservation, use and apportionment of water resources; (b) the grant, adjustment, cancellation or variation of any permit; (c) annual reporting to the water resources users on water issues and their performance within the basin area; (d) collection of data, analyzing and managing the information system on water resources; (e) review of the basin area water resources management strategy; (f) facilitation of the establishment and operations of water resource user associations; (g) flood mitigation activities; (h) information sharing between the basin area and WRA Regional office; (i) equitable water sharing within the basin area through water allocation plans; and (j) any other matter related to the proper management of water resources (Water Act 2016).

The Water Act 2016 empowers WRA to formulate a Basin Area Water Resources Management Strategy for the management, use, development conservation, protection and control of water

resource within each of the established basin areas (Water Act 2016). The Act also establishes WRUAs as vehicles for collaborative management of water resources and resolution of conflicts concerning the use of water resources at the sub-basin level. The WRUAs' key mandate is to enhance participation of the local community and stakeholders in water resources management, to ensure not only sustainable and equitable use of the available resource in view of the various competing demands, but also basin conservation through implementation of various conservation activities.

### **2.3.3 Integrated Water Resources Management at the Basin Level**

International discourse on IWRM has generally come to a consensus that the river basin represents the most logical, practical unit for Integrated Water Resources Management (GWP, 2000); (Butterworth et al, 2010); (Saravanan et al, 2009). GWP defines IWRM at the basin level, as a “process that enables the co-ordinated management of water, land and related resources within a given river basin so as to optimize and equitably share the resulting socio-economic well-being without compromising the long-term health of vital ecosystems” (GWP and INBO, 2009). This is consistent with GWP's definition of IRBM as “the process of coordinating conservation, management and development of water, land and related resources across sectors within a given river basin, in order to maximize the economic and social benefits derived from water resources in an equitable manner while preserving and, where necessary, restoring freshwater ecosystems” (GWP, 2000). Thus, IRBM is a subset of IWRM and involves the implementation of IWRM at the basin level through a River Basin Organization.

The GWP and the INBO have developed a handbook (*A Handbook for Integrated Water Resources Management in Basins*) which provides guidance for improving the governance of freshwater resources through implementation of IWRM. The handbook provides guidance for Integrated Water Resources Management that can be applied in basins regardless of the context (developed or developing countries, humid or arid conditions) or the current state of water governance. The handbook outlines the critical issues in integrated basin management including need for political goodwill, appropriate policies and legislation, an enabling environment, institutional arrangements (roles and responsibilities), and sound management mechanisms (GWP and INBO, 2009).

## **2.4 Kenya Water Sector's Policy, Legal and Institutional Framework**

### **2.4.1 Draft National Water Policy 2013**

The enactment of the new Constitution of Kenya 2010 necessitated the revision of the National Water Policy of 1999, resulting in the Draft National Water Policy 2013. The Draft NWP 2013 is informed by the gains made (and the challenges faced) during the implementation of reforms in

the water sector anchored on the National Water Policy of 1999, the Water Act 2002, and the IWRM Principles adopted during the UNCED conference in Rio de Janeiro. The Draft NWP 2013 takes into account provisions of the new Constitution of Kenya 2010, the aspirations of Kenya's Vision 2030; the Sustainable Development Goals (SDGs), and other National Policies and Strategies (Draft NWP, 2013).

The Draft NWP 2013 provided for the development of the new Water Act 2016, which replaced the Water Act 2002.

The Draft NWP 2013 has outlined, as one of its policy objectives, the need to “to ensure a comprehensive framework for promoting optimal, sustainable, and equitable development and use of water resources for livelihoods of Kenyans.” Under this objective, the following policy statements are envisaged:

- (i) Ensure provision of clean and safe water sources in adequate quantities for every person in Kenya above the international benchmark of 1,000 m<sup>3</sup> by the year 2030;
- (ii) Ensure availability of the reserve flow for maintenance of progressive restoration and protection of ecological systems and biodiversity in strategic water basins;
- (iii) Enable inter-basin water transfer in Kenya as a strategic intervention for efficient and equitable allocation of water resources;
- (iv) Enforce pollution control;
- (v) Establish sound research and development in the water sector;
- (vi) Establish monopolistic and unified regulatory function of water resources at regional and National level;
- (vii) Ensure sustainable groundwater resources for present and future generations;
- (viii) Sufficient funds for sustainable development and management of water resources;
- (xii) Resolve conflicting mandates by better cross-sectoral coordination; and
- (ix) Develop a water management system which contributes to the protection of the environment.

#### **2.4.2 The Water Act 2002**

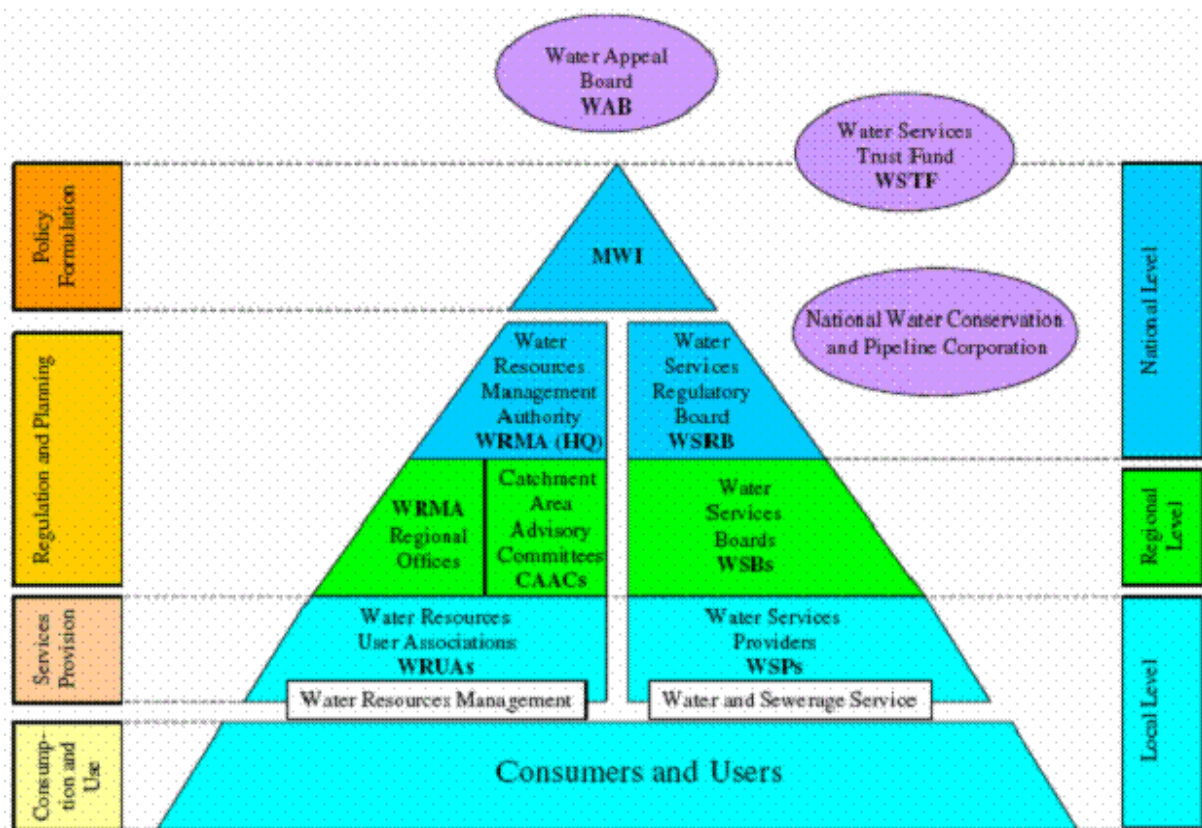
The Water Act 2002 introduced key reforms in the institutional framework for management of the water sector in Kenya. These key reforms included, amongst others (Water Act, 2002):

- (a) Separation of water resources management from water supply services provision;
- (b) Separation of policy making from day to day administration and regulation;
- (c) Decentralization of operational functions to lower level state organs; and
- (d) Involvement of non-government entities and communities in water resources management and provision of water supply and sanitation services.



(e) The Ministry of Water and Irrigation (MWI) was vested with the responsibility for overall sector oversight including policy formulation, coordination and resource mobilization, with new semi-autonomous institutions being established to handle water resources management and water service provision in the country. The objective was to ensure better management of water resources and equitable allocation towards the various competing uses.

Figure 2-1 shows the institutional framework governing the water sector in Kenya, under the Water Act 2002.



**Figure 2-1:** Institutional Framework for the Water Sector in Kenya under Water Act 2002

Source: Athi CMS (WRA (a), 2009)

### 2.4.3 The Water Act 2016

The Water Act of Kenya 2016 was enacted in September 2016, and is set to replace the Water Act of Kenya 2002. Some of the notable deviations of the new Water Act 2016, from the old Water Act 2002 include the following (Water Act, 2016):

- (a) Establishment of the Water Resources Authority instead of the Water Resources Management Authority;
- (b) Adoption of Basin Areas instead of Catchment Areas;

- (c) Basin Area Water Resources Management Strategy replacing Catchment Management Strategy;
- (d) Basin Water Resources Committee replacing the Catchment Area Advisory Committees;
- (e) National Water Harvesting and Storage Authority replace the National Water Conservation and Pipeline Corporation;
- (f) Water Works Development Agencies replacing the Water Services Boards;
- (g) Establishment of the Water Tribunal in place of the Water Appeal Board;
- (h) Transformation of the Water Services Trust Fund into the Water Sector Trust Fund;
- (i) Recognition of trans-boundary waters in classifying water resources for the purpose of determining water resources quality objectives; and
- (j) The new Act also introduces the concept of sector wide approach aimed at achieving “coordinated development in the water sector to achieve national goals, including sector wide planning and coordination.”

The Water Act 2016 also seeks to align itself with the provisions of the Constitution of Kenya 2010, including the following, amongst others (CoK, 2010):

- (a) That every person in Kenyan has the right to clean and safe water in adequate quantities and to reasonable standards of sanitation, as stipulated in Article 43 of the Constitution;
- (b) Recognition of the Salaries and Remuneration Commission, as established under Article 230 of the Constitution of Kenya 2010, as the constitutional authority to advise on salaries and remuneration of public servants;
- (c) Recognition of the development of water resources (and national public works) as a function of the national government and water supply and sewerage service provision as a function of the county government, and formulation of mechanisms towards achievement of the same;
- (d) Recognition of the role of the Equalization Fund, as established under Article 204 of the Constitution of Kenya 2010, in financing the development and management of water and sewerage services in all the counties in Kenya.

## **2.5 Water Resources Management in Kenya**

### **2.5.1 Water Resources Authority**

The Water Resources Authority (WRA) is the national body responsible for managing, protecting, apportioning and conserving Kenya’s water resources, including trans-boundary waters. The Water Act 2016 outlines the functions of WRA as being (Water Act, 2016):

- (i) To formulate and enforce standards, procedures and regulations for the management and use of water resources and flood mitigation;

- (ii) To receive water permit applications for water abstraction, water use and recharge and determine, issue, vary water permits; and enforce the conditions of those permits;
- (iii) To collect water permit fees and water use charges;
- (iv) To determine and set permit and water use fees;
- (v) To advice to the Cabinet Secretary for formulation of policy on national water resource management, water storage and flood control strategies; and
- (vi) To coordinate with other regional, national and international bodies for the better regulation of the management and use of water resources.

### **2.5.2 WRA Regional Offices**

The Water Act 2016 provides for decentralized water resources management and stakeholder involvement, which should be implemented through WRA's regional offices. The Authority has six regional offices, which are based on basin areas as follows (WRA, 2013):

- (i) Lake Victoria North Basin;
- (ii) Lake Victoria South Basin;
- (iii) Rift Valley Basin;
- (iv) Athi Basin;
- (v) Tana Basin; and
- (vi) Ewaso Ng'iro North Basin.

The regional offices have the mandate to manage the water resources in their basin areas while the WRA head office is mandated to provide overall supervision and policy guidance. In addition to the 6 regional offices, WRA also has 26 sub-regional offices distributed across the country, in an effort to ensure closer interaction with the communities and stakeholders at the grassroots level (WRA, 2013).

Figure 2-2 shows the WRA Regional and sub-regional offices and the six WRA basin areas.

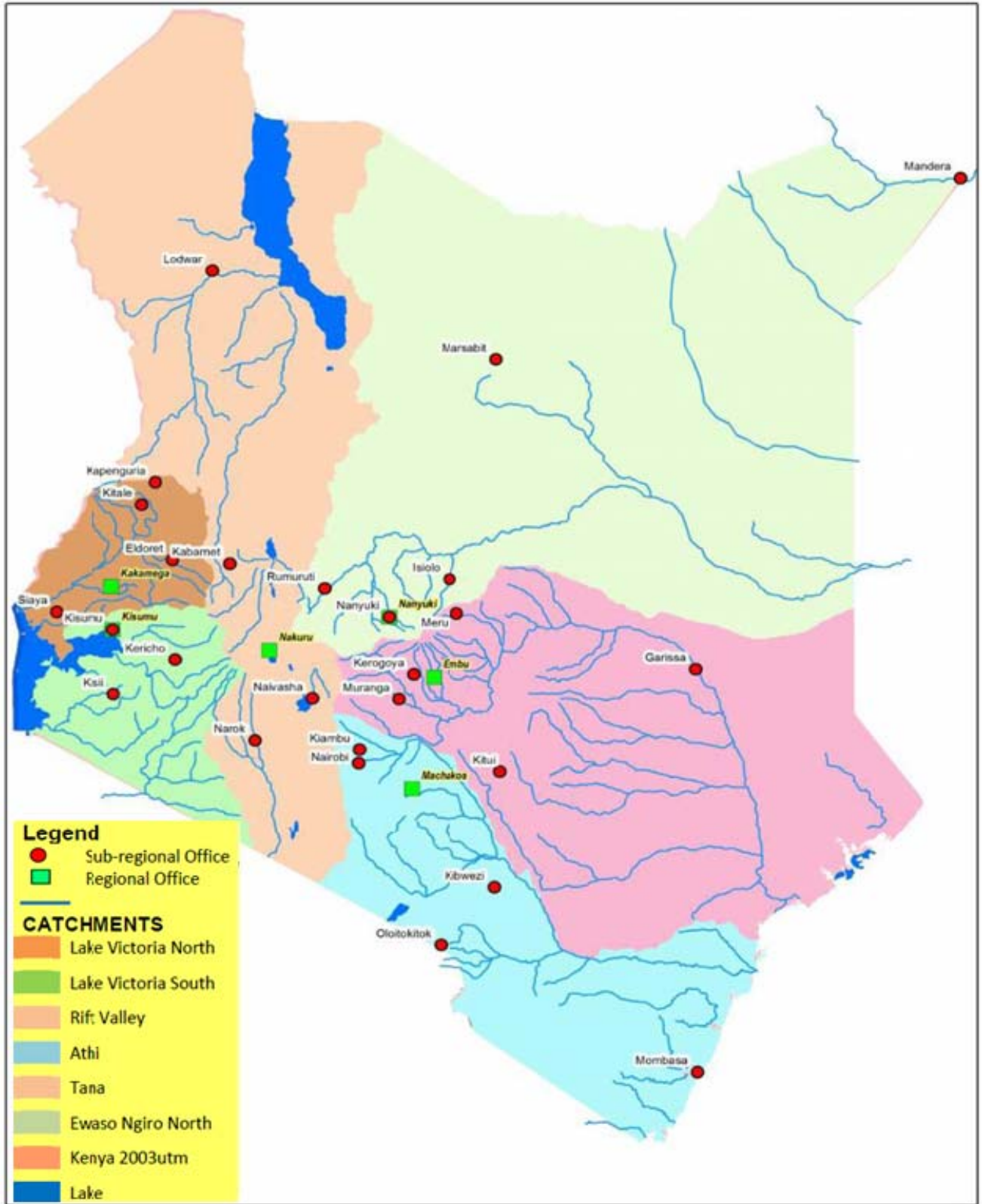


Figure 2-2: WRA Offices and River Drainage Systems

Source: WRA (2013)

### **2.5.3 Basin Water Resources Committees**

Each of WRA's six regional offices is supported in performance of their functions through the Basin Water Resources Committees (BWRCs), whose membership is drawn from representatives of various groups in the basin area such as pastoralists, farmers, business community, water NGOs, Government Agencies, Local Authorities, Regional Development Authorities, Water Users Associations, etc (Water Act 2016).

The BWRCs' responsibilities include advising the WRA regional offices on water resources conservation, use and apportionment; the grant, adjustment, cancellation or variation of any permit; and; any other matters pertinent to the proper management of water resources (Water Act 2016).

The BWRCs also work in close collaboration with WRA's sub-regional offices and the WRUAs.

### **2.5.4 Water Resources Users Associations**

The WRA Rules (2007) define a WRUA as "an association of water users, riparian land owners, or other stakeholders who have formally and voluntarily associated for the purposes of cooperatively sharing, managing and conserving a common water resource".

The Water Resource Users Association is a model for community based participation in water resources management. The model is based on the following premise (WRA, 2008):

- (i) The water resources users, being the principle beneficiaries or direct stakeholders of the water resources, should be integrally involved in the management of the water resources;
- (ii) Since their livelihood depends on the water resources and is at stake, the water resource users can be mobilized to undertake water resources management activities that serve their best interest (e.g. surveillance on illegal activities, adoption of best land use practices, basin area management activities, etc); and
- (iii) It is more efficient (with respect to the WRA) for the WRUA to mobilize the water users to solve problems at the grassroots level.

WRUAs operate at the lowest basin level where they provide opportunity for active participation of local communities and local water stakeholders in decision making regarding water resources management, basin area conservation and other water-related issues. WRUAs work closely with the BWRCs in their region in providing support to WRA's regional offices as they carry out their mandate.

Objectives of WRUAs include (WRA, 2008):

- (i) Promote controlled and legal water use activities;

- (ii) Promote good management practices which make efficient and sustainable use of the water resources;
- (iii) Safeguard the reserve flows for downstream ecological demands and basic human requirements;
- (iv) Promote water conservation practices to ensure sufficient water reserves that meet the demands of the environment, the wildlife, the livestock and all the communities;
- (v) Reduce and solve water use conflicts;
- (vi) Increase the usage of the water for economic and social improvements; and
- (vii) Develop sustainable and responsive institutions for water resources management.

### **2.5.5 National Water Resources Management Strategy**

The National Water Resources Management Strategy (NWRMS) is developed by WRA to guide its implementation of water resources management activities on a national level. The NWRMS (2006-2012) has the following specific objectives: to improve equal access to water resources for all Kenyans; to promote integrated water resources planning and management at basin level; and to enhance the availability of water resources of a suitable quality and quantity (NWRMS, 2007).

The Water Act 2016 provides that the NWRMS “shall prescribe the principles, objectives, procedures and institutional arrangements for management, protection, use, development, conservation and control of water resources and, in particular, for: (a) determining the requirements of the reserve for each water resource; (b) classifying water resources in accordance with this Part; and (c) identifying areas which, in accordance with this Act, should be designated protected areas and ground water conservation areas”.

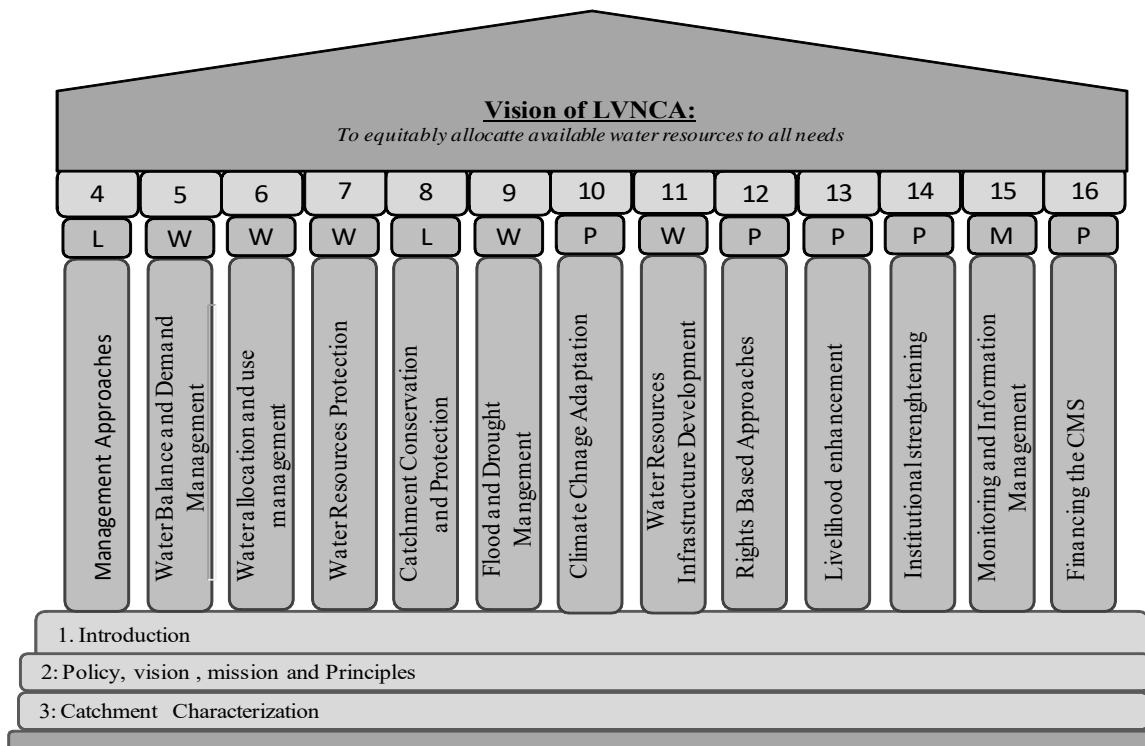
### **2.5.6 Basin Area Water Resources Management Strategies**

WRA has a responsibility to formulate a Basin Area Water Resources Management Strategy (BAWRMS) for each of its six designated basin areas in Kenya. The BAWRMS provides guidance to WRA regional offices in the management, use, development, conservation, protection and control of water resources within their basin areas. Its objective is to provide strategy and guidelines for achieving the outlined water resources management objectives, including providing guidelines on the following issues (LVNCA CMS, WRA (a), 2015):

- (i) Determination of basin area management units and classification of water resources in each management unit;
- (ii) Setting the Resource Quality Objectives (RQOs) and measures to achieve the RQOs;
- (iii) Water balance and water demand management;
- (iv) Water allocation and water use management;

- (v) Water resource protection and reserve management;
- (vi) Basin area protection and riparian conservation;
- (vii) Institutional development support including WRUAs formation and SCPMs development;
- (viii) Water infrastructure development for surface and ground water storage, flood mitigation, etc.;
- (ix) Rights Based Approach (RBA)/ Poverty Reduction in water resources management;
- (x) Monitoring networks and water resources information management systems (WRIMS); and
- (xi) Strategies for BAWRMS financing and implementation.

Figure 2-3 shows the conceptual framework for development of basin area water resources management strategies across Kenya’s basin areas.



**Figure 2-3:** BAWRMS Conceptual Framework

Source: LVNCA CMS (WRA (a), 2015)

### **2.5.7 Sub-Catchment Management Plans**

The Sub-Catchment Management Plans (SCMPs) are developed at the sub-basin level which is the lowest level in the water resources management hierarchical system in Kenya. Objectives of a SCMP may include but not limited to the following (WRA (c), 2015);

- a) Providing the WRUA members with a prioritized plan of action and budget for their planned activities in water resources management and basin area conservation;
- b) Helps document crucial information regarding the sub-basin, including information on the available water resources versus the demand etc.
- c) Provides a basis for development of proposals for seeking funding;
- d) Provides clarifications of roles amongst stakeholders in support of common objectives; and
- e) Identifies key issues, problems, priorities and enumerates the required interventions.

### **2.6 Water Resources Users Association Development Cycle**

Formation of WRUAs and development of SCMPs in Kenya is guided by the Water Resources Users Associations Development Cycle (WDC), developed by WRA in conjunction with WSTF. The WDC process provides technical guidelines and financial support for formation of WRUAs and for development of their SCMPs.

#### **2.6.1 The WDC and the IWRM Concept in Kenya**

The WDC framework is based on the Integrated Water Resources Management (IWRM) approach that adopts a holistic view of the water resources, incorporating social, environmental and economic aspects of the water resources. IWRM recognizes that basin conservation and water resource management is a long term process that requires continuous participation by many stakeholders involving different kinds of interventions. WDC has therefore been designed to foster a long term relationship between WRA and the WRUAs to continuously build WRUA capacity to implement IWRM activities.

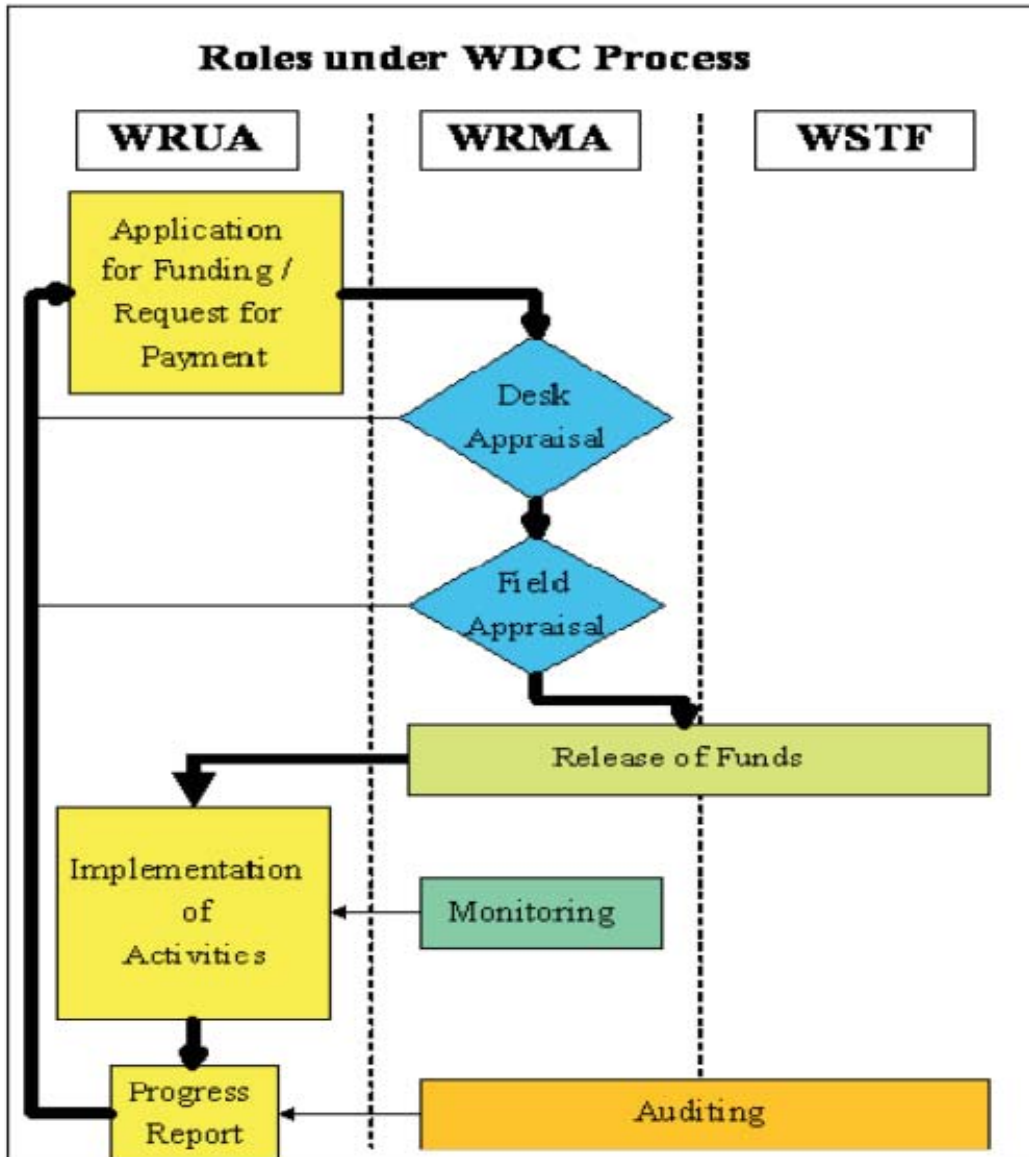
IWRM champions for the need to balance the available water resources with the multiple users and their competing demands, objectives and perspectives, and underscores the need for continuous stakeholder participation in all issues related to water resources management in any given basin.

WDC also emphasizes the need for Rights Based Approach (RBA) in water resources management, which takes the view that proactive steps must be taken to help disadvantaged groups to engage in water resources management so that their voice might be heard and their needs addressed.



The WDC provides guidelines for development of Sub-Catchment Management Plan (SCMP), which sets out a plan of activities to address the water resources management problems faced in the particular sub-basin, including a budget thereof, which is then submitted to the WSTF for funding. Funds channeled through WRUAs are used for capacity building of WRUAs, development of water resources infrastructure and Implementation of Sub-Catchment Management Plans. Table 2-1 shows an overview of the WDC Framework.

Figure 2-4 shows the Roles of various Institutions under the WDC Funding Process.



**Figure 2-4:** Roles of various Institutions under the WDC Funding Process

*Source: WDC (WRA and WSTF, 2009)*

**Table 2-1: WDC Document Overview**

Vol.	Title	Content	Ref.	Details
1	WDC FRAMEWORK	<ul style="list-style-type: none"> <li>• Introduction to WDC</li> <li>• Policy and Legislative Framework</li> <li>• Overview of WDC Approach</li> <li>• WRUAs</li> </ul>		
			<b>App.</b>	
2	WDC OPERATIONAL GUIDELINES	<ul style="list-style-type: none"> <li>• Eligible areas and activities</li> <li>• WDC Funding Process</li> <li>• WDC Financial Guidelines</li> </ul>	A1	WSTF-WRA Memorandum of Understanding (signed 22/10/2007 but with suggested modifications)
			A2	WRA- WRUA Memorandum of Understanding Framework
			B	Categorization of sub-basins according to status
			C	Sub-basins selected for piloting
			D1	WDC Request for Funds (RFF) WRUA to WRA
			D2	WDC Fund request forwarding form WRA to 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)
			K1	WRUA Registration Criteria
			K2	WRUA Implementation plan format WRUA Implementation report format WRUA Expenditure statement format All excel
			<b>Mod.</b>	

Vol.	Title	Content	Ref.	Details
3	WDC TOOLKIT	Introduction to WDC Toolkit	1	Water Sector Reforms
			2	WDC Overview
			3	Basin Characteristics
			4	SCMP Development
			5	Water Balance and Water Demand Management
			6	Water Allocation and Use
			7	Water Resource Protection
			8	Basin and Riparian Conservation
			9	Institutional Development and Collaboration
			10	WRM Infrastructure Development
			11	Rights Based Approach
			12	Water Resources Monitoring
			13	Financial Management
			14	Training Module Volume 2 Operational Guidelines

*Source: WDC (WRA and WSTF, 2009)*

The WRUA formation process is coordinated by the WRA regional and sub-regional offices. The concept of WRUA formation was operationalized in 2005 (WRA (b), 2015).

### **2.6.2 The WDC and the IRBM Principles**

A review of the WDC document shows that its concepts, which are based on IWRM, are consistent with the internationally accepted principles of IRBM which is a subset of IWRM. These concepts include but not limited to the following (WRA and WSTF, 2009):

- (i) Integration of basin, riparian and water resources;
- (ii) Scale (basin as a planning unit);
- (iii) Participatory approaches (stakeholder involvement);
- (iv) Coordination with other sectors;
- (v) Monitoring and evaluation;
- (vi) Capacity building;
- (vii) Prioritization;
- (viii) Institutional development and collaboration;

- (ix) Sustainability/ cost effectiveness; and
- (x) Rights based approach (RBA).

Thus it can be said that although the WDC document has no mention of IRBM, its concepts which are anchored on the IWRM principles, are consistent with the internationally accepted principles of IRBM. A detailed assessment of the WRUAs’ activities could help to establish to what extent these IWRM concepts being implemented by WRUA’s through their SCMPs are consistent with the IRBM Principles.

### 2.6.3 Status of WRUA Formation

As per the WRA Performance Report 4 (WRA (b), 2015), the estimated potential number of WRUAs to be established in the whole country is 1,868. As at June 2014, only 571 out of the potential 1,868 WRUAs had been established, about 31% of the total potential. A total of 320 out of the 571 established WRUAs had developed their SCMPs, representing 56% of the total potential. Thus a lot still needs to be done in terms of setting up the requisite institutional structures for effective water resources management and basin conservation in Kenya.

Table 2-2 shows the status of WRUA formation and SCMP development in Kenya as June 2014.

**Table 2-2:** Status of WRUA formation and SCMP development in Kenya

Region	WRUAs Up to June 2014			SCMPs up to June 2014		
	Potential	Achieved	Proportion (%)	Potential	Achieved	Proportion (%)
LVN	106	99	93	106	92	87
LVS	137	98	72	137	85	62
RV	175	68	39	175	52	30
Tana	240	121	50	240	147	61
Athi	309	121	39	309	159	51
ENN	901	73	8	901	63	7
Total	1868	571	31	1868	320	17

Source: WRA Performance Report 4 (March 2015)

### 2.6.4 Review of Some Key Challenges in the Kenyan Water Sector

#### 2.6.4.1 Challenges with the WDC Process of Water Resources Management

A major challenge with the Kenyan system of water resources management is the fact that the WRUAs have been established at the sub-basin rather than at the basin level. For large river basins, and based on the recommended size of a WRUA of not more than 200 km<sup>2</sup> (WRA, 2016),

there could be as many as 200 different WRUAs in one river basin, all implementing separate SCMPs. In most cases there is very little coordination between the different WRUAs operating within the same river basin. A good example is the Tana River Basin, which consists of over 240 sub-basins, but with just about 56 WRUAs established. The rest of the sub-basins have no WRUAs to oversee them. The 56 established WRUAs have each developed their own Sub-Catchment Management Plans (SCMPs), with just about half of the SCMPs currently being implemented (Knoop et al, 2012). Some of the SCMPs implementation has failed due to lack of finances, while others the WRUAs lacked technical capacity to implement them or were bogged down with conflicts at the management level. This has often resulted in uncoordinated and fragmented efforts in river basin management. WRA regional offices are the ones charged with coordinating these WRUAs but that has not been effective in most cases due to the size of the sub-basins that they oversee.

A collaborative project was initiated by JKUAT, WRA and University of the Sunshine Coast, Australia, to carry out a “*Scoping Study on Tana River Basin Water Resources Management*”. The Project undertook a study on the Thika sub-basin within the Tana River basin, consisting of seven operational WRUAs, namely; Sasumua, Kiama, Thika Upper, Thika middle, Thika Lower, Ekalakala and Lower Chania. The study came up with the following as some of the gaps that needed to be addressed (JKUAT, WRA and USCA, undated):

- (i) Lack of a one-stop-shop database of all stakeholders, achievements, activities, and challenges in the Thika sub-basin;
- (ii) The WRUAs seem to concentrate more on livelihood projects rather than their core function of protecting and conserving the basin;
- (iii) Lack of a geo-referenced database of water infrastructure in the basin;
- (iv) Ground water exploration and use has attracted little attention;
- (v) Scientific research in water resources management has been given low priority;
- (vi) Lack of coordinated basin-wide monitoring of all activities within the Tana River basin;  
and
- (vii) There is need for carrying out an abstraction survey in the entire basin.

The above study by JKUAT, WRA and University of the Sunshine Coast, came up with the following recommendations as the way forward (JKUAT, WRA and USCA, undated):

- (i) Capacity building, especially on sustainable water management;
- (ii) Installation of RGSs along major rivers to enhance data collection and to help in monitoring and evaluation;
- (iii) Need to carry out regular abstraction and pollution surveys;

- (iv) Community mobilization, especially in WRUA activities;
- (v) Infusing research, science and technology in WRUA activities;
- (vi) Strengthening links with research institutions and other stakeholders; and
- (vii) Strike a balance between WRUAs and County/National Governments.

#### **2.6.4.2 Capacity of WRUAs for Water Governance in Kenya**

The Water Governance Centre (WGC), a CSO from Netherlands with operations here in Kenya, carried out a capacity assessment on water governance for two WRUAs in the Lake Naivasha basin, namely LANAWRUA and Mkungu Kitiri WRUA. The capacity assessment was carried out with the help of a WRUA Capacity Assessment Tool which was developed as part of the Integrated Water Resource Action Plan Program (IWRAP) that is funded by the Governments of United Kingdom of the Netherlands. The Capacity Assessment Tool is a flexible methodology to score organisational capacity of WRUAs, along a number of defined indicators, with clearly described standards for four stages of organisational development, i.e. Stage 1, Stage 2, Stage 3 and Stage 4. Stage 1 is the lowest level of development while Stage 4 is the highest (WGC, 2015).

The Capacity Assessment Tool assesses the water governance capacity of the WRUAs comprising of three inter-related layers, as follows (WGC, 2015):

1. a content layer (water management policies, knowledge and skills in water management, information management);
2. an institutional layer (the organizational framework, legislation and legal instruments and the financing structure); and
3. a relational layer (communication and cooperation between different actors and with the public, stakeholder participation, transparency, ethics, culture, values and trust).

The Capacity Assessment Tool aims at achieving the following objectives (WGC, 2015):

- (i) For the WRUA to self-assess and understand where the WRUA stands, in terms of organisational capacity, how strong it is and where its strengths and weaknesses are. It can thus help in determining, what the WRUA can be expected to be able to do or not. This requires an honest and open scoring process that is meant for learning, not for punishment;
- (ii) For the WRUA and support agencies to have a needs assessment how and in what areas the WRUA can be further strengthened. This requires an action plan for follow-up;
- (iii) As a baseline and subsequent monitoring tool to assess whether capacity is indeed increasing over time, as a result of organisational change, training and inputs provided. This requires regular update of the exercise;

- (iv) To create a shared awareness, understanding and agreement among key stakeholders about the WRUA and about actions to be taken to strengthen it. As a self-assessment, it provides a platform for exchange of viewpoints and opinions to create a common vision. This does require a workshop environment in which scores and findings are discussed to come to a common agreement on the level of development; and
- (v) As a learning tool to increase knowledge about governance and management of an organisation, through the explanation of the standards of different levels of development.

As per the outcome of the capacity assessment, both the LANAWRUA and Mkungu Kitiri WRUA were ranked between the seedling and maturing stage of development in terms of their water governance capacity, i.e. between stages two and three of development (WGC, 2015).

This shows that a lot still needs to be done in order to bring the WRUAs' water governance capacity to Stage 4 of development.

The following were some of the indicators that were recommended to be prioritized in order to grow the WRUAs' water governance capacity (WGC, 2015):

- (i) Organisational skills;
- (ii) Local community/member financial contribution;
- (iii) Funding model, other external financial resource mobilisation and diversification of funds;
- (iv) Monitoring and communication of output and outcomes as an organisation;
- (v) Links and cooperation with government agencies;
- (vi) Information management; and
- (vii) Financial planning, budgeting, monitoring and administration.

#### **2.6.4.3 Challenges of Coordination in the Kenyan Water Sector**

The Integrated Water Resources Management and Water Efficiency Plan for Kenya (WRA (b), 2009) noted that there was a lack of proper inter-linkages with other water related key sectors of the economy such as agriculture, industry and tourism and social issues such as health, education and poverty which was not evident during the formulation of the national water policy of 1999.

The IRWM and WEP notes the importance of overall coordination in the water sector between the GoK and other stakeholders including private sector, NGOs, CBOs, etc., which at the time was taking place through the Water Sector Working Group (WRA (b), 2009).

There was also the Water Sector Technical Group (WSTG) which was formed to improve co-ordination and harmonization among the development partners on one side, and the government

agencies and NGOs on the other side, which is still an active forum that is in operation to date (MWI, AWSCR, 2015).

The 9<sup>th</sup> Annual Water Sector Conference in Kenya (April 2015) noted that there was need for transparency and predictability of planning and budgeting in the water sector between the two levels of government – national and county – noting that poor information flow was “the weakest link in the water sector.” The Conference routed for development of a national framework to facilitate cooperation between all stakeholders – national government, county governments, development partners, non-state actors, water sector institutions, and the private sector (MWI, AWSCR, 2015).

#### **2.6.4.4 Challenge of Lack of Investment in Water Resources Management**

Recent trends in the water sector in Kenya has seen the government invest heavily in water supply in its effort to achieve its target of water supply coverage countrywide (MWI, WSSP, 2009). This has resulted in less investment in water resources management compared to water supply. Government’s budgetary allocations as well as donor funding has traditionally gone more towards improving water supply coverage than towards developing systems for Integrated Water Resources Management. Although there has been improvement in the recent years with the government investing more in development of water resources infrastructure such as dams, the overall national investment in water resources management still falls short.

During the 9<sup>th</sup> Annual Water Sector Conference in Kenya, held at Safari Park Hotel, Nairobi in April 2015, the participants noted that the water sector in Kenya “suffers from huge budget deficits and as a result the sector may not be able to realize its goals by 2030 as set out in the Water Master Plan and Vision 2030.” In order to address this problem, at least two options were discussed during the Conference: resort to public/private partnerships, and the establishment of a water sector financing authority or a “benki ya maji”. Borrowing lessons from Colombia, Philippines and India, the water sector financing authority would essentially operate like a bank; it will issue long-term bonds (20-30 years) and the funds collected will be invested in the water sector (MWI, AWSCR, 2015).

The Water Resources Sector Memorandum (World Bank, 2004) noted that the multi-sectoral nature of water resources meant that water resources management had been everyone's concern but no-one's business. The memorandum recommended that the government ensures water resources management becomes everyone's business, by amongst others, developing an environment that promotes investment in water resources infrastructure development and



management; and devolving responsibility for water resources management, as far as possible, to regional and local groups, including the private sector.

#### **2.6.4.5 Lack of Basin-Wide Coordination amongst Water Users**

One of the challenges facing WRA in its quest towards Integrated River Basin Management has been lack of coordination amongst the various WRUAs working within a larger river basin. Some of the larger river basins such as the Tana, Nzoia, Athi, etc, could have as many as 100 WRUAs operating within the same basin. Thus there is need for coordination of the activities that each of them carry out to ensure there is synergy and harmonise so that the ineffectiveness of one does not hamper the good efforts of the others.

The 9<sup>th</sup> Annual Water Sector Conference in Kenya (April 2015) noted the existence of this challenge and recommended for establishment a forum for engagement of upstream and downstream water users (MWI, AWSCR, 2015).

In their published document “*WRA’s Framework for Engaging County Governments*” WRA pledges to provide crucial water resources information to the County Governments that are sharing a common River Basin or aquifer, in order to enable harmonious resource management and development. The Authority also promises to facilitate information dissemination through the basin management forums where the County Governments sharing a common water body will be members (WRA, 2013).

### **3. MATERIALS AND METHODS**

#### **3.1 Introduction**

This chapter describes the research methodology incorporating data collection tools, data collection procedures and data analysis methods for achieving the aims of the study. The chapter starts with a detailed description of the case study area, its location, climate and topography, population, socio-economic activities and details of the Kuywa WRUA SCMP including the challenges identified in the sub-basin as well as the planned activities and the prioritized activities for funding.

Section 3.3 outlines the methodology framework for carrying out this research, followed by a description of the data collection methods and tools, a description of the methodology for sample size determination from the study population, sampling methodology, and survey questionnaire administration procedures, in Sections 3.4, 3.5, 3.6 and 3.7 respectively.

Section 3.8 outlines the data cleaning and data entry procedures used, while Section 3.9 describes the software program used for data analysis and the formats of presentation of the analysed data, including tables, bar charts, frequency polygons and histograms. Section 3.10 describes the rating system adopted by the researcher in evaluation of the WRUA's implementation of the WDC process followed by an outline of the measures undertaken by the researcher in meeting the ethical and confidentiality requirements in the course of the research.

#### **3.2 Review of the Case Study Area**

##### **3.2.1 Description of the Kuywa River Sub-basin**

###### **Location of the Sub-basin Area**

The study was carried out in the Kuywa River sub-basin, which is a tributary of the Nzoia River that flows from Cherangani hills to the Lake Victoria. The Kuywa River sub-basin is bounded by latitudes 0° 25'24" N and 0° 49'40" N and longitudes 34° 35'53" E and 34° 45'32" E (Nyakora and Ngaira, 2014).

The Kuywa River sub-basin is sub-divided into three zones; upper, middle and lower Kuywa, also called Kuywa 'A', Kuywa 'B' and Kuywa 'C'. Kuywa 'A' lies between Mpakani and the confluence of Kibisi and Kuywa rivers. Kuywa 'B' lies between the Kibisi-Kuywa confluence and the Matisi bridge along Webuye-Bungoma Road. Kuywa 'C' lies between the Matisi bridge and Khalala area where the Kuywa river enters the Nzoia river (KUWRUA, 2008).

The entire Kuywa River is about 96 km long, originating from Mt. Elgon and draining into River Nzoia at Khalala. The river passes through six main business centres; Kapkateny, Nandolia, Kuywa, Chebukaka, Bokoli and Matisi and several coffee factories and the Nzoia Sugar Company. Two water intakes are located on the Kuywa River; at Kapsambu for the Kibichori-Bokoli water supply system; and at Matisi for Webuye-Bungoma water supply, which is administered by Nzoia Water and Sewerage Company Ltd (NZOWASCO). Figure 3-1 shows the map of the Kuywa River sub-basin (Kisaka, 2014).

### Topography and Climate

The altitude ranges from 1637 m.a.s.l at the edge of Mt. Elgon Forest to 1505 m.a.s.l at the confluence with the Nzoia River (Kisaka, 2014). The area slopes southwards, with the upper parts consisting of steep slopes but the middle and lower section have gentle slopes.

The rainfall pattern in the sub-basin is bimodal, with the long rains season experienced from March to June, the short rains season from September to November and the dry spell from December to February. The long rains season is from March to June, with mean annual rainfall of about 1800 mm, while the dry season is from December to February with mean annual rainfall of about 250 mm. The long rains season coincides with the highest flows in the river, up to a maximum of 17 cubic meters per second at the Matisi RGS. The temperatures range from a maximum of 30<sup>0</sup>C during day time to a low of 15<sup>0</sup>C at night (Kisaka, 2014).

### Population Distribution

The population of Kuywa River sub-basin was estimated at 241,422 people based on the 2009 population and housing and census (KNBS, 2010). Estimated population density is 512 persons per km<sup>2</sup> as shown in Table 3-1.

The main ethnic groups in the sub-basin consist of Sabaot, Dorobo and Bukusu (a sub-tribe of the Luhyia ethnic group).

Table 3-1 shows the population distribution within the Kuywa River sub-basin.

**Table 3-1:** Population Distribution in the Kuywa River Sub-basin

No.	Location	Population (2009)	Area (Km <sup>2</sup> )	Density (Persons/Km <sup>2</sup> )
1	Mukuyuni	23,710	40.4	587
2	Misikhu	42,295	70.1	684
3	Bokoli	32,891	68.9	477

No.	Location	Population (2009)	Area (Km <sup>2</sup> )	Density (Persons/Km <sup>2</sup> )
4	Sitikho	30,055	80.1	375
5	East Bukusu	65,411	125.1	523
6	Bukembe	47,060	87.1	540
7	<b>Total</b>	<b>241,422</b>	<b>471.7</b>	<b>512</b>

Source: KNBS (2010)

### Socio-Economic Activities

The Kuywa River sub-basin is mostly in a rural setting with an economy driven by agricultural activities. Favourable climatic conditions, good soils, and abundant human resources has supported the development of agricultural activities in the area and has led to the growth of market centres which provide supporting services and market for the agricultural products. Farming within the sub-basin is both subsistence and commercial (KUWRUA, 2008).

Commercial farming includes sugarcane, potatoes, bananas, coffee and horticulture, with sugarcane as the major cash crop, forming a major part of the Nzoia Sugar factory's sugar belt. Sugarcane growing is mainly in lower Kuywa, including areas around Matisi, Milo, Sikalame, Kongoli, Khalala, Sitikho, Mwibale, Khalumuli, Malaha, Bokoli and Mang'ana. Coffee farming is mainly in the upper Kuywa including areas such as Kimalewa, Mukuyuni, Kimorong, Kapsambu, Nakayonjo, Chebukaka, Kapkateny and Terem. Potatoes and bananas are grown all over the sub-basin, while horticultural crops are mainly in zone A especially around Kimalewa, Kapkateny, Teremi and Kuywa market. Subsistence farming involves growing of maize, beans, arrow roots, cassava, sweet potatoes, ground nuts, yams and millet. Irrigation in Kuywa River sub-basin is carried out near riverine areas to support horticultural farming including cultivation of cabbages, tomatoes, and kales (Kisaka, 2014).

Although the agricultural sector provides employment and food for the population and the larger western region it is highly dependent on the Kuywa River leading to high levels of water abstraction and water pollution. The Nzoia Sugar Factory and the coffee factories are major water abstractors and polluters in the Kuywa River sub-basin. Other challenges include the deforestation of riverine areas, draining of wetlands, high sediment loads in the water, river bank erosion and pollution from fertilizers used in farming and pesticides applied on the vegetables (Kisaka, 2014).



Livestock farming is also practiced, mainly involving the indigenous cattle, goats, sheep, donkeys, chicken and ducks. This economic activity has led to the construction of several cattle dips which are a major infrastructural development in the area. However, a major concern is the construction of cattle dips close to water resources where the over-spills and wash off from the cattle dips enters the rivers thereby polluting them. Brick making is another economic activity that is mainly practiced by the youths. It takes place near swamps and springs where there is clay soil and the ground is wet. However, if this activity is not done with caution, it can threaten riverine soil stability leading to bank erosion. The youth also engage in establishment of tree nurseries and selling of tree seedlings as an income generating activity. These economic activities are serviced by tarmac roads, earth roads with the Trans-African Highway (Eldoret-Malaba) and the Rift Valley Railway line traversing the area. The major roads are Bungoma – Chwele – Kimilili – Kitale road, Kimilili – Bokoli –Skata road, Kuywa – Kapkateny road, Chepkaka – Mpakani road and Teremi – Bokoli road (Kisaka, 2014).

The fast growing market centres within the sub-basin, such as Matisi, Kuywa, Chebukaka and Kapkateny have led to increased demand for water while also contributing significantly to the challenge of waste disposal. Increase in population within the Kuywa River sub-basin has also put more pressure on the available land resources. Most of the areas in the sub-basin that were previously covered by natural indigenous forests are now settlement areas. Due to increased human activities, the hilly areas are deforested and the sub-basin encroached resulting in rampant soil erosion. This has led to deterioration of the water quality and quantity over time. During the wet seasons, the available water is highly turbid and unsuitable for human use. The poor quality of the water has led to persistent waterborne diseases like cholera and typhoid. The major contributors to pollution of the water resources include coffee and sugar processing factories, market centres, cattle dips among others. The magnitude of these problems has led to increasing poverty and food insecurity among community members, deteriorating environmental conditions and continued depletion of natural resources in the sub-basin (KUWRUA, 2008).

### **3.2.2 Challenges Identified in the Kuywa River Sub-basin**

The Kuywa Water Resources Users Association (KUWRUA) has developed a Sub-Catchment Management Plan (SCMP) which has been under implementation since 2008. The following were the water and natural resources management challenges identified in the Kuywa River sub-basin during data collection for SCMP development (KUWRUA, 2008):

- (i) Water pollution due to washing, bathing and watering of animals directly in the river, sewage from institutions, foul water from coffee factories, and dumping of solid wastes near the water courses;

- (ii) Inappropriate solid waste disposal in market and town centers;
- (iii) Inefficient irrigation practices;
- (iv) Encroachment on and drainage of wetlands;
- (v) Clearance of indigenous trees cover and other forested areas for farming and for settlements due to rapid population growth in the sub-basin;
- (vi) Encroachment on basin areas;
- (vii) Inappropriate use of agro-chemicals in wetlands to plant sugarcane;
- (viii) Introduction of Eucalyptus species at water sources;
- (ix) Soil erosion on the farms, footpaths, and roadsides;
- (x) High sediment loads in the river during the high rainfall seasons, as a result of soil erosion upstream;
- (xi) Water accessibility in some areas;
- (xii) Inadequate water resource information (water quality, quantity, rainfall data, water use, sediment load);
- (xiii) Poor sanitation;
- (xiv) Overgrazing of livestock; and
- (xv) Human and wildlife conflicts.

Figure 3-2 shows high sediment load during the rainy season, as a result of soil erosion upstream.



**Figure 3-2:** High Sediment Load in the Kuywa River

*Source: Nile Basin Initiative (2009)*

The above challenges as identified by the WRUA can be grouped into six main categories, as shown in the following sections:

**(i) Water Quality Issues**

- a) Water pollution from coffee factories, washing, bathing, watering of animals directly in the river, sewage from institutions, dumping of solid wastes near the water courses and run-off from the road sides;
- b) High sediment loads in the river during the high rainfall seasons, as a result of soil erosion upstream;
- c) Inappropriate use of agro-chemicals in wetlands to plant sugarcane; and
- d) Accessibility to clean water for domestic use.

**(ii) Sanitation Issues**

- a) Inappropriate solid waste disposal in markets and town centers; and
- b) Poor sanitation.

**(iii) Basin Degradation Issues**

- a) Encroachment on and drainage of wetlands;
- b) Encroachment on basin areas;
- c) Soil erosion on the farms, footpaths, and roadsides;
- d) Clearance of indigenous trees cover and other forested areas for farming and for settlements due to rapid population growth in the sub-basin; and
- e) Overgrazing of livestock.

**(iv) Water Quantity Issues**

- a) Illegal water abstraction for horticultural activities;
- b) Inefficient irrigation practices; and
- c) Introduction of Eucalyptus species at water sources.

**(v) General Issues**

- a) Human wildlife conflict (monkeys);
- b) Poor roads network; and
- c) Inadequate water resource information (water quality, quantity, rainfall data, water use, sediment load).

**(vi) Cross cutting issues**

- a) High poverty levels;
- b) Food insecurity (low farm yields, poor farming methods, lack of crop diversification);
- c) High prevalence of Malaria and HIV/AIDS;



- d) Gender disparity (gender violence, child labour, lack of investment of time in family, income mismanagement);
- e) Insecurity; and
- f) Lack of market for agricultural produce.

### **3.2.3 Review of the Kuywa WRUA's SCMP**

The magnitude of the above stated challenges led to increasing poverty and food insecurity among community members, deteriorating environmental conditions and diminishing natural resources, particularly water, soil, and wood products in the basin. These challenges informed the KUWRUA's decision to prioritize appropriate water resource management as their core agenda in the management of the Kuywa River sub-basin (KUWRUA, 2008).

The objectives of the KUWRUA SCMP are as follows (KUWRUA, 2008):

- (i) To improve the quality of water resources by controlling and managing sources of pollution;
- (ii) To reduce conflicts over water arising from illegal water abstractions and over-abstraction for irrigation, by enforcing rules on water abstraction and promoting efficient irrigation practices;
- (iii) To conserve and manage the water resources in the basin by protecting and rehabilitating water sources such as springs, wetlands and other degraded areas;
- (iv) To discourage planting of high water consuming trees at water sources and support the re-introduction of indigenous trees in the basin;
- (v) To minimize soil erosion through soil conservation measures; and
- (vi) Encourage the use of water for economic gain.

The Kuywa WRUA has carried out various activities as required by the WDC framework, which have been included in its Sub-Catchment Management Plan. These include:

- (i) Description of the sub-basin's characteristics including the sub-basin's topographical, climatic, geological and socio-economic characteristics;
- (ii) List of water abstractors and the amount abstracted per day;
- (iii) List of water polluters;
- (iv) Detailed situational analysis showing existing challenges in the basin;
- (v) Proposed management (intervention) measures; and
- (vi) Proposed budget for the prioritized intervention options.

Table 3-2 shows the issues prioritized by KUWRUA for seeking funding (KUWRUA, 2008).

**Table 3-2:** Prioritized budget for prioritized issues

No.	Proposed Intervention	Activities
1.	Afforestation and reforestation	<ul style="list-style-type: none"> <li>• Awareness creation</li> <li>• Tree nursery establishment</li> <li>• Planting of tree seedlings</li> </ul>
2.	Soil erosion control	<ul style="list-style-type: none"> <li>• Awareness creation</li> <li>• Construction of terraces</li> <li>• Improvement of drainage system</li> <li>• Training on proper farming methods</li> </ul>
3.	Improved Sanitation	<ul style="list-style-type: none"> <li>• Awareness Creation</li> <li>• Construction of latrines and bathrooms for homesteads</li> </ul>
4.	Alternative water source	<ul style="list-style-type: none"> <li>• Sink wells</li> <li>• Rainwater harvesting</li> <li>• Protect springs</li> </ul>
5.	Raised income	<ul style="list-style-type: none"> <li>• Training on micro-entrepreneurship (agri-business)</li> <li>• Income generating activities</li> </ul>
6.	Establishment of water information database	<ul style="list-style-type: none"> <li>• Establish one regular gauging station on every stream</li> <li>• Two full meteorological stations in the basin</li> <li>• Establish a data base of all water abstractors</li> <li>• Regular sampling for water quality</li> </ul>
7.	Intensification of security	<ul style="list-style-type: none"> <li>• Public awareness on community continuous policing</li> <li>• Arrest and prosecute law breakers</li> <li>• Establish police patrol base</li> </ul>
8.	Gender mainstreaming	<ul style="list-style-type: none"> <li>• Involvement of women, youth and the disabled</li> <li>• Awareness creation</li> <li>• Create special programmes for vulnerable groups</li> </ul>
9.	Widening and opening accessible roads	<ul style="list-style-type: none"> <li>• Community sensitization</li> <li>• Resource mobilization</li> <li>• Clearing and opening of roads</li> </ul>
10.	Promotion of food diversification	<ul style="list-style-type: none"> <li>• Intensify agro-forestry</li> <li>• Enhance production of traditional food stuff</li> </ul>
11.	Reduce prevalence of HIV-AIDS	<ul style="list-style-type: none"> <li>• Establishment of post-tested groups</li> <li>• Establish home-based care</li> </ul>

### **3.3 Methodology Framework for Carrying out the Research**

The thesis research was guided by four main objectives as outlined in Section 1.3 above. In order to achieve each research objective, the researcher employed a specific methodology consisting of concrete steps that were followed in order to deliver the required outcome. Each of the key research questions as summarized in Section 1.5 above were linked to the specific research objective they sought to achieve. This was done in order to focus the research towards the most important activities only, and to avoid unnecessary procedures that would not lead to the desired outcome.

Table 3-3 shows a summary of the methodology framework used to carry out this research.

**Table 3-3:** Proposed Methodology Framework for Carrying Out the Research

No.	Research Objectives	Proposed Research Questions	Methodology for Achieving the Objectives	Research Tools
1.	To identify from amongst the WRUA’s funded activities those which are in line with the principles of Integrated River Basin Management;	<ol style="list-style-type: none"> <li>1. What were the major problems facing the Kuywa River sub-basin as identified during SCMP development?</li> <li>2. What activities were proposed for addressing these challenges and what was the budget for each?</li> <li>3. Which of the proposed activities were funded, by funds from WSTF or from other donors?</li> </ol>	<ol style="list-style-type: none"> <li>1. Literature review to identify the major principles of Integrated River Basin Management;</li> <li>2. Review of the WRUA’s SCMP to identify proposed activities;</li> <li>3. Review of the funding agreement with WRA/WSTF to identify their funded activities; and</li> <li>4. Interview with the WRUA management committee members to understand background information about the funded activities from the WRUA’s SCMP.</li> </ol>	<ol style="list-style-type: none"> <li>1. Literature review; and</li> <li>2. Focus group discussion guide for WRUA Management Committee.</li> </ol>
2.	To establish the extent to which the WRUA’s activities implemented have had a positive effect on the sub-basin.	<ol style="list-style-type: none"> <li>1. Which activities has the Kuywa WRUA implemented to ensure water resources management and basin conservation?</li> <li>2. How sensitized are the WRUA members towards conserving water and other natural resources in their</li> </ol>	<ol style="list-style-type: none"> <li>1. Interview the WRUA management committee to understand background information about the funded activities from the WRUA’s SCMP;</li> <li>2. Interview the WRUA members to assess their opinion regarding environmental conservation efforts in the Kuywa River</li> </ol>	<ol style="list-style-type: none"> <li>1. Transect walks checklist;</li> <li>2. Field photographs;</li> <li>3. Spatial analysis tools (Google earth, etc.);</li> <li>4. Semi-structured</li> </ol>

No.	Research Objectives	Proposed Research Questions	Methodology for Achieving the Objectives	Research Tools
		<p>sub-basin?</p> <p>3. Has there been an improvement in the state of the environment in the Kuywa River sub-basin with respect to the identified challenges since the WRUA started implementing the conservation activities?</p>	<p>sub-basin;</p> <p>3. Transect walk to assess the state of water and natural resources in the entire Kuywa River sub-basin;</p> <p>4. Field visits to assess the status of the implemented activities;</p> <p>5. Field photographs for capturing key environmental conservation features; and</p> <p>6. Spatial analysis tools for monitoring environmental changes in the sub-basin over time.</p>	<p>household survey questionnaires for WRUA members;</p> <p>5. Focus group discussion guide for WRUA Management Committee;</p> <p>6. Key informant interview guide for WRA Regional Office; and</p> <p>7. Key informant interview guide with WRA National Office.</p>
3.	<p>To establish the challenges faced by the WRUA in implementing their funded activities and how they affect the WRUA's efforts towards Integrated</p>	<p>1. Has Kuywa WRUA been effective in managing the funds received from WSTF and other sources, towards implementation of the activities in their SCMP?</p> <p>2. What are the challenges faced by the Kuywa WRUA in implementing their SCMP, and</p>	<p>1. Interview with the WRUA management committee members to understand the challenges faced and lessons learned;</p> <p>2. Interview with WRA regional office to obtain their views on the challenges facing the Kuywa WRUA as well as other WRUAs in the region; and</p> <p>3. Interview WRA and WSTF national</p>	<p>1. Semi-structured household survey questionnaires for WRUA members;</p> <p>2. Focus group discussion guide for WRUA Management Committee;</p>

No.	Research Objectives	Proposed Research Questions	Methodology for Achieving the Objectives	Research Tools
	River Basin Management.	<p>what recommendations do they have for dealing with those challenges?</p> <p>3. What are the lessons learnt by WRA in establishing and working with WRUAs towards effective Integrated River Basin Management?</p>	<p>offices to obtain their views on which challenges are faced by WRUAs in implementation of their SCMPs.</p>	<p>3. Key informant interview guide for WRA Regional Office; and</p> <p>4. Key informant interview guide with WRA National Office.</p>
4.	To draw a conclusion on the extent to which the Water Resources Users Associations are implementing Integrated River Basin Management within their river basins, and make recommendations.	<p>1. What are the cross-cutting principles of Integrated River Basin Management, as identified through the literature review in Chapter Two?</p> <p>2. Which of the WRUA's implemented activities are in line with the principles of Integrated River Basin Management?</p> <p>3. How effective have the WRUAs been as the country's vehicles for implementation of Integrated River Basin Management?</p>	<p>1. Analyse the data collected, using appropriate tools;</p> <p>2. Interpret the results from the data collected and make conclusions;</p> <p>3. Summarise the literature review regarding Integrated River Basin Management and outline the major (cross-cutting) principles of Integrated River Basin Management; and</p> <p>4. Review the WRUA's implemented activities and determine whether they are in line with the principles of Integrated River Basin Management.</p>	<p>1. Data entry and analysis tools.</p>

### **3.4 Data Collection Tools**

Data from the field was collected through semi-structured questionnaires administered to a sample of the population (Appendix 3.1.1); through focus group discussions with the WRUA management committee (Appendix 3.1.2); through key informant interviews with officials from WRA Regional Office (Appendix 3.1.3), WRA National Office (Appendix 3.1.4) and WSTF (Appendix 3.1.5); through field observations from transect walks (Appendix 3.1.6); and through collection of secondary data on the study area from government offices and from the WRUA officials in the study area.

The proposed tools for data collection from the field are outlined below:

#### **(i) Semi-structured household survey questionnaires**

These were specifically developed to obtain the demographic and socio-economic situation of the WRUA members being interviewed. An understanding of the demographics of the people being interviewed will help to provide background on the results of the survey, and shed light on some of their responses regarding sub-basin conservation issues. For instance, understanding their key source of income, if it is dependent on water resources, will help the researcher to understand why they have been interested in water resources management issues. The semi-structured questionnaire used for the households survey is shown in Appendix 3.1.1 of this Thesis.

#### **(ii) Focus group discussion guide**

The focus group discussion guide was used to guide a discussion with members of the Kuywa WRUA central management committee, to have an understanding of the background information about the WRUA, their involvement in the SCMP development, their implementation of the funded activities, the challenges faced and lessons learned. The focus group discussion guide used for interviewing the WRUA management committee members is shown in Appendix 3.1.2 of this Thesis.

#### **(iii) Key informant interview guides**

These were used for guiding interviews with officials from WRA regional and national offices in charge of community development, as well as with the WSTF officers in charge of water resources investment. The key informant interview guides used during this research have been attached as Appendices 3.1.3, 3.1.4 and 3.1.5 of this Thesis.

#### **(iv) Spatial and temporal analysis tools for environmental monitoring**

Land use changes, which might not be accurately captured through interviews, field observations or through secondary data collection, is best analysed by use of satellite images of the area of a specified period of time. If positive land use changes over the sub-basin could coincide with the period of implementation of the WRUA's activities, then it could be rightly attributed to concerted conservation efforts of the WRUA.

Use of **Google Earth** imagery can enable the researcher to review environmental changes over a geographical location through a specified period of time.

**Spatial Analysis:** GIS is a powerful software technology that allows a virtually unlimited amount of information to be linked to a geographic location. Coupled with a digital map, GIS allows a user to analyse locations, events, features, and environmental changes, showing layer upon layer of information such as environmental trends, soil stability, migration corridors, outfalls of hazardous wastes, dust pollution source points, at-risk water wells, etc. Spatial features that can be monitored with GIS include land and air quality, vegetation and land-use type, population density, urban development, land physical features, etc. (Available at <http://www.esri.com/environment>, accessed on 24<sup>th</sup> June 2016).

**Temporal Analysis:** Observing environmental change over time indicates trends and patterns.

ArcGIS Tracking Analyst provides tools for display and analysis of time series data. It is useful for playing back historical data, integrating temporal data within the GIS, and charting and analysing change in historical or real-time data. (Available at <http://www.esri.com/environment>, accessed on 24<sup>th</sup> June 2016).

#### **(v) Field observations checklist for transect walks**

A transect walk is a tool for describing and showing the location and distribution of natural resources, physical features, changes in vegetation cover, cropping systems, landscape, main land uses, etc., along a given transect. It is useful in identifying and explaining the cause and effect relationships among topography, soils, natural vegetation, cultivation, and other production activities and human settlement patterns, identifying major challenges and problems affecting the sub-basin, and for triangulating data collected through other tools. (Available at [http://siteresources.worldbank.org/exttoppsisou/resources/1424002-1185304794278/4026035-1185375653056/4028835-1185375678936/1\\_Transect\\_walk.pdf](http://siteresources.worldbank.org/exttoppsisou/resources/1424002-1185304794278/4026035-1185375653056/4028835-1185375678936/1_Transect_walk.pdf), accessed on 17<sup>th</sup> June 2017)

A field observation checklist outlines all the crucial information that the researcher aims to collect during the transect walk, to ensure that no important aspect is missed out. Usually the researcher is accompanied by one or more members of the WRUA who are conversant with the



issues in the sub-basin so that they issues are pointed out as they walk through. The field observation checklist used during this research is attached as Appendix 3.1.6 of this Thesis.

**(vi) Field Photographs**

Field photographs were used to capture important physical features that the researcher observed during the transect walks. Use of photographs helped to corroborate the information gathered through other tools such as household surveys, focus group discussions and key informant interviews. Photographs also help to clarify some aspects of the report, as can be seen in several sections of Chapter Four of this Thesis. Field photographs were taken using a high resolution and high optical zoom digital camera which could still capture distant features with sufficient clarity to enable review.

**(vii) Collection and review of secondary data, records and documents**

Secondary data collected included records of the WRUA's financial transactions, the WRUA's constitution, by-laws, membership lists, SCMPs, and other relevant documents from WRA and WSTF which would enhance the outcomes of the research. Literature for review was collected from the internet, the university library, the WRA and other government agencies websites, from individual researchers etc.

**3.5 Population and Sample Size**

The study population comprised all the members of the Kuywa WRUA, the WRUA Management Committee, the staff from WRA regional office in Kakamega and from the Kitale sub-regional office, and also the relevant WSTF staff. The Kuywa WRUA (KUWRUA) was selected for this study since it has well established and functioning WRUA structures, it has developed a responsive participatory SCMP and is among the WRUAs that have received funds from WRA/WSTF towards implementation of the SCMP proposals. The sampling population for semi-structured questionnaires was all the registered members of the Kuywa WRUA as reflected in the official WRUA membership registers.

The initial sample size (without applying the finite proportion correction factor) can be determined using the following formula (available at <http://www.qualtrics.com>, accessed on 24<sup>th</sup> June 2016):

$$n_0 = \frac{Z^2 p(1-p)}{e^2} \dots\dots\dots \text{Equation 3-1}$$

Where;

$n_0$  is sample size for infinite population;

$Z$  is the Z-score value obtained from the charts;

$p$  is the percentage proportion of the sample; and

$e$  is the confidence interval or margin of error.

The selected confidence level was 95% with a confidence interval (margin of error) of 10%. The selected percentage proportion was 0.5, which gives the maximum possible sample size. The Z-score value was determined from the Z-score charts, which is 1.96 for a 95% confidence level. Applying the finite proportion correction factor, we obtain the actual sample size  $n$ , from the finite population,  $N$ , using the following formula (available at <http://www.qualtrics.com>, accessed on 24<sup>th</sup> June 2016):

$$n = \frac{n_0 N}{n_0 + (N - 1)} \dots\dots\dots \text{Equation 3-2}$$

Kuywa River sub-basin is divided into three zones, i.e. Upper Kuywa (Zone A), Middle Kuywa (Zone B) and Lower Kuywa (Zone C). The total number of registered members for each zone as per the lists provided by WRUA management teams was as shown in Table 3-4, with the full membership lists attached in the annexes to this Thesis.

**Table 3-4:** Number of Registered Members in Kuywa WRUA and the Sample Size

No.	Kuywa Zone	Registered Members	Sample Size
1	Zone A	118	25
2	Zone B	82	23
3	Zone C	104	24
<b>4</b>	<b>Total</b>	<b>304</b>	<b>72</b>

Based on the above formulas, and given the total number of registered WRUA members, the sample size was calculated as follows:

The initial sample size for infinite population,  $n_0$  is determined using Equation 3-1 above, where

$Z$  is the Z-score value obtained from the charts; =1.96

$p$  is the percentage proportion of the sample; =0.5

$e$  is the confidence interval or margin of error; = 0.1

$$n_0 = \frac{1.96^2 \times 0.5(1-0.5)}{0.1^2} \quad n_0 = 96$$

The actual (corrected) sample size  $n$ , is determined using Equation 3-2 above, where;

$N$  is the finite population provided from the field; =304

$$n = \frac{96 \times 304}{96 + 303}$$

Therefore  $n = 73$

Thus, a sample size of 72 members of the Kuywa WRUA was selected, through systematic random sampling method, to which the research questionnaires were administered.

### **3.6 Sampling Methodology**

The Kuywa River sub-basin area has been divided into three zones, A, B and C, each of which is administered by a smaller WRUA and each has developed their own micro-basin management plan. Stratified systematic random sampling method was used to establish a sample size of 24 registered WRUA members from each of the micro-basins, on whom the research questionnaires were administered. With the full lists of WRUA members from each micro-basin, the total number of registered members was each divided by 24 to obtain a recurring interval of selection of sampled members from each list. The start point for each list was selected randomly after which a name was selected after every recurring interval as determined from the total population. The total number of sampled members from each zone was determined as 25 in Zone A, 23 in Zone B and 24 in Zone C, forming a sample size of 72.

### **3.7 Questionnaire Administration Procedures**

The research assistants taking part in primary data collection were first taken through all the questions on the questionnaire so that they are familiar with what is expected, and were also trained on the procedure of administering the questionnaire, including how to make any useful observations during the course of the interviews that would enhance the objectivity of responses from those interviewed. Semi-structured questionnaires were first pretested using a pilot exercise so that any issues of concern are addressed and the questions revised where necessary. The research assistants were selected based on their academic qualifications and the researcher first took each through an interview to determine their competency for the job.

In order to maximize on the efficiency in the information gathering, the interviews were carried out on separate days for each zone. Three research assistants were trained and used for each zone, each being sourced from their zone of residence. Each research assistant was allowed a maximum of four questionnaires per day due to the distance they needed to cover from one respondent to the next. KUWRUA Management Committee members from each zone were available to offer guidance to the data collectors but were themselves exempt from responding to the questionnaires.

### **3.8 Data Cleaning and Entry**

Data from the field was checked for inaccurate, incomplete, or unreasonable data and for compliance against the set standards and rules. Preliminary checking of the questionnaires was carried out by the researcher at the end of each day, once they were returned by the research assistants. This involved reviewing the filled questionnaires and asking for clarifications from the assistants where required. A data entry expert was then employed to key the field data into the computer software program for analysis.

### **3.9 Data Analysis**

Quantitative data collected from the field was analysed using IBM's Statistical Package for the Social Sciences (SPSS) (IBM SPSS Statistics, Version 20.0) and MS Excel, while qualitative data was synthesized and summarized into various major themes for ease of analysis. Some of the formats of presentation of the data before analysis included tables, bar charts, frequency polygons and histograms. The detailed results of the field data analysis by IBM SPSS Statistics Version 20.0 are attached in Appendix 4.1 and 4.2 of this Thesis.

### **3.10 Rating of Kuywa WRUA's implementation of the WDC process**

As part of the evaluation of the Kuywa WRUA's performance in implementation of the WDC process, the researcher undertook to rate the WRUA's implementation of various activities on a scale of 1 to 10, with 1 being 'Very Poor' and 10 being 'Excellent'.

Table 3-5 shows the rating system adopted by the researcher in evaluation of the WRUA's implementation of the WDC process.

**Table 3-5:** Rating system for evaluation of the Kuywa WRUA’s performance

Score	Rating	Score	Rating
1	Very Poor	7	Above Average
2-3	Poor	8	Good
4	Below Average	9	Very Good
5-6	Average	10	Excellent

### **3.11 Ethical Considerations and Confidentiality**

Ethical considerations in research can be defined as the need to ensure that the researcher conforms to the standards of conduct of the authorities in the area of research, and the need to uphold the right to confidentiality and privacy for all individuals and groups that you will engage during the course of the research.

Towards meeting this requirement, the researcher sought authority from all the relevant authorities for conformity and in ensuring that the study was not discontinued in the process. Authority was sought from the University of Nairobi to be allowed to carry out the research. The authority given by the University assisted in seeking consequent permissions.

The researcher wrote to WRA sub-regional office in Kitale, WRA regional office in Kakamega, as well as the WRA headquarters, seeking for permission to carry out research within their areas of jurisdiction. Permission was also sought from WSTF national office to interview their relevant personnel during the course of this research.

Confidentiality was honoured by the researcher through ensuring that participants in the households’ survey were engaged on their own will without deception or promises for rewards. The households’ survey questionnaires also assured the respondents that their responses would be kept confidential and assured them that the information would only be used for research purposes, urging them to be truthful and honest in their responses.

The researcher has, as much as possible, acknowledged all copyrighted intellectual property referred to in this research, and has represented all issues as reported to him during his interviews in all fairness and without personal biases.

## 4. DATA ANALYSIS, PRESENTATION AND INTERPRETATION

### 4.1 Introduction

This chapter focuses on data analysis, interpretation and presentation. To effectively address issues that are concerned with the study, both quantitative analysis and content analysis was used. The purpose of this study was to investigate the effectiveness of Water Resources Users Associations (WRUAs) in implementing Integrated River Basin Management (IRBM). The case study was the Kuywa Water Resources Users Association (KUWRUA) within the Kuywa River sub-basin that traverses Bungoma County of Western Kenya.

The objectives of the study were to identify from amongst the WRUA's funded activities those which are in line with the principles of Integrated River Basin Management, to establish the challenges faced by the WRUA in implementing their funded activities and how they affect the WRUA's efforts towards Integrated River Basin Management, and to draw a conclusion on the extent to which the Water Resources Users Associations are implementing Integrated River Basin Management within their river basins.

### 4.2 Demographic Information of WRUA Members

The researcher sought to establish the demographic data of the WRUA members and looked at their gender, age, education level, monthly income and expenditures and their sources of income. Their responses are highlighted in sub-sections 4.2.1 for gender, 4.2.2 for age, 4.2.3 for household size, and 4.2.4 for education. Raw data used for analysis of the demographic information of WRUA members is attached in Appendix 4.1.1 of this Thesis.

#### 4.2.1 Gender of the WRUA Members

The respondent WRUA members were asked to indicate their gender. Their responses were as shown in Table 4-1.

**Table 4-1:** Gender of the WRUA Members

Category	Frequency	Percentage (%)
Male	40	55.6
Female	32	44.4
<b>Total</b>	<b>72</b>	<b>100.0</b>

From Table 4-1, 55.6% of the WRUA members were males while 44.4% of the WRUA members were females. This implies there were more males respondents than females which might be because more males are interested in WRUA activities and by extension water for farming activities. This conforms to the observation that most decisions in operation and maintenance of water projects have been shown to be made by men as observed in studies by Motsi and Madyiwa (undated).

#### 4.2.2 Age of the WRUA Members

The age distribution of respondents is as shown in Table 4-2. The mean age of respondents was 46 years old.

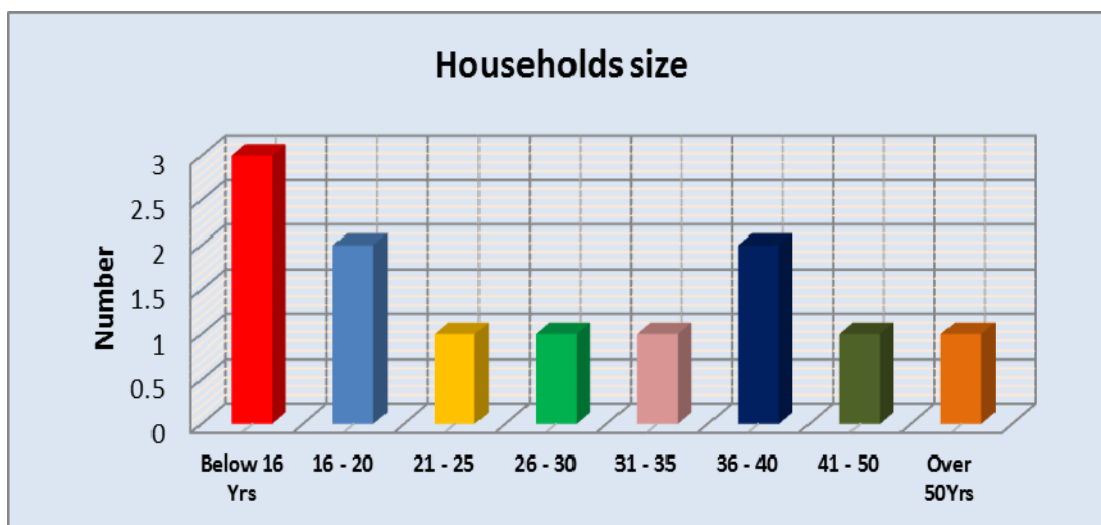
**Table 4-2:** Age Distribution of the WRUA Members

Category	Frequency	Percentage (%)
18 – 29 years	5	7
30 – 39 years	17	24
40 – 49 years	25	35
50 – 59 years	18	25
Over 60 years	7	9
<b>Total</b>	<b>72</b>	<b>100</b>

As indicated in Table 4-2, 35% of the WRUA members who responded to the questionnaires were aged between 40 to 49 years, which represents the majority age group of the sampled population. 25% of the WRUA members were aged between 50 years to 59 years, with only 9% of the WRUA members being 60 years and above. About 24% of the members were aged between 30 to 39 years, with the youngest age group of those sampled (between 18 to 29 years) being only 7% of the total population. This shows that the population sampled was generally of mature age, able to understand the water resources and environmental issues facing them which this study focuses on.

#### 4.2.3 Average households' size disaggregated by age

The WRUA members were asked to state the size of their households in terms of the number of members of the nuclear family only. Their responses are as indicated in Figure 4-1. The average household size was 7 people.



**Figure 4-1:** Average households’ size disaggregated by age

On average, about 3 household members were aged 16 years and below, while 2 members were aged 16 to 20 years as well as 36 to 40 years. The rest of the age groups each had just one household member on average. This disaggregation is well in agreement with the country’s demographic statistics which shows that the youths generally form the highest population in the country.

#### 4.2.4 Education Level of the WRUA Members

The education levels of respondents are shown in Table 4-3.

**Table 4-3:** Education Level of the WRUA Members

Category	Frequency	Percentage (%)
No schooling	1	1.4
Lower Primary	2	2.8
Upper Primary	21	29.2
Secondary	38	52.8
College	5	6.9
University	4	5.6
Other	1	1.4
<b>Total</b>	<b>72</b>	<b>100</b>

From Table 4-3, 52.80% of the WRUA sampled members had attained secondary school education while about 29.2% had attained upper primary school education. Only 6.9% and 5.6% of the WRUA members had attained college and university level education respectively, which

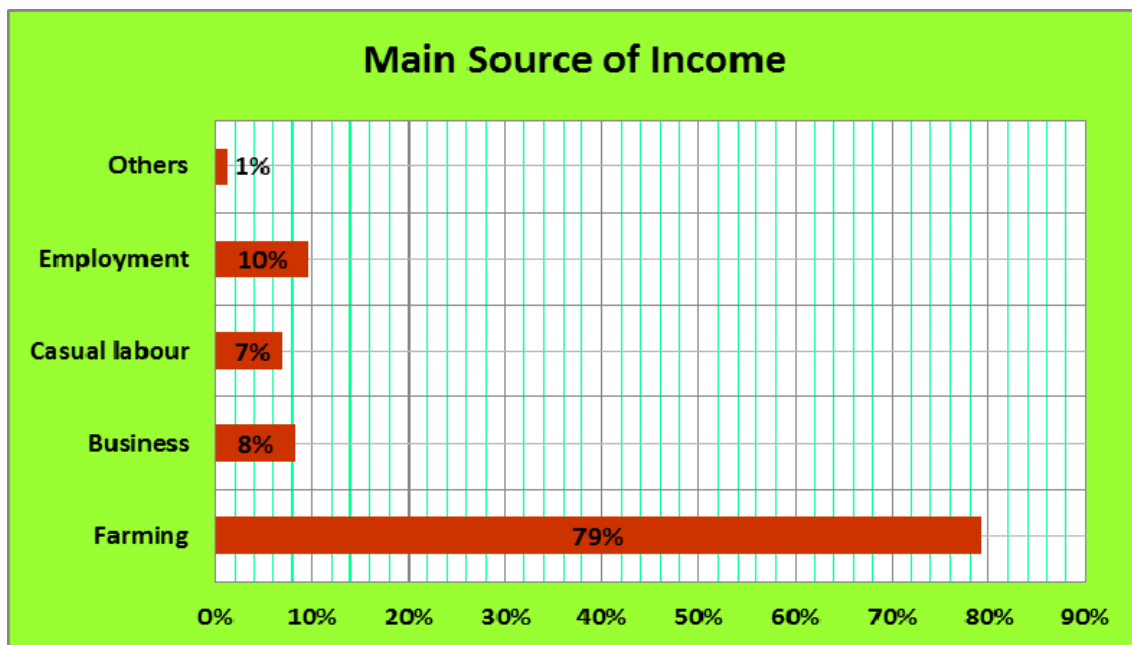


shows relatively low literacy levels amongst the sampled WRUA members. This could indicate the unwillingness by the more educated members of the society to participate in matters of conservation, or could be attributed to the fact that most educated members of the society could have moved out of their rural homes to urban centres in search of employment.

The low literacy levels could have an effect on the WRUA members' levels of constructive participation in WRUA activities.

#### 4.2.5 Main Source of Income for Households

The respondents were asked to indicate their main source of income. Their responses were as indicated in Figure 4-2.



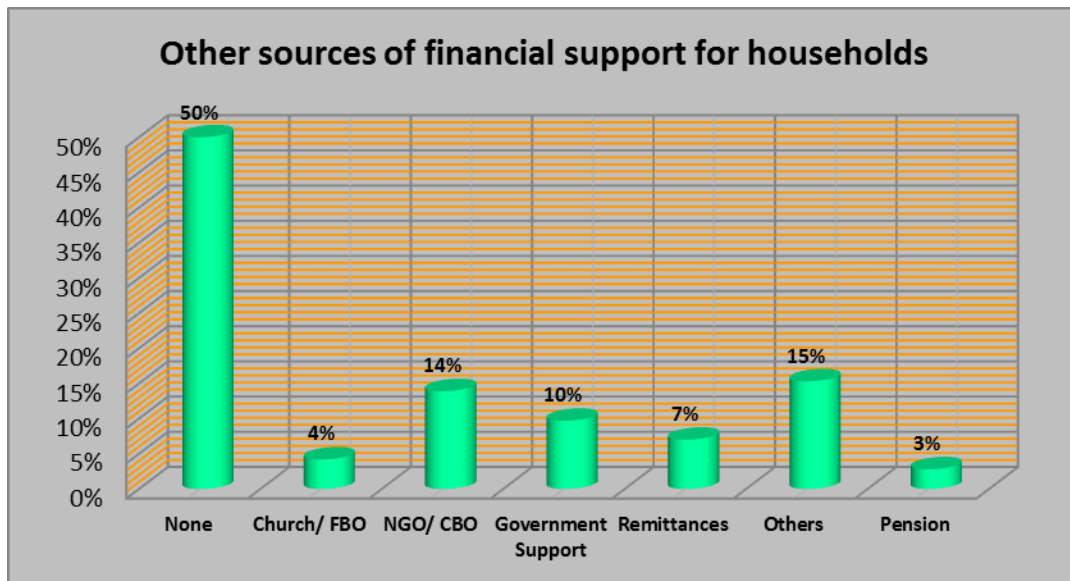
**Figure 4-2:** Main Sources of Income for Households

About 79% of all households interviewed depended on farming as their main source of income. About 10% were in formal employment while 8% were in business. The 79% majority depending on farming could perhaps provide an indication of why the WRUA members were keen to control environmental degradation within their basin area, as well as other issues related to water resources management.

#### 4.2.6 Other Sources of Financial Support

WRUA members were asked to state their other sources of income, apart from their main source as indicated in section 4.2.5. Majority of the responds indicated they had no other source of

income apart from the ones mentioned above. 7% of the sampled members indicated remittances from their relatives, 4% indicated support from church and faith-based organizations (4%), 14% from community based and non-governmental organizations, while about 10% and 3% indicated additional income from government support and pension. This last group could represent the members aged 60 years and above, who depended on the government’s support for elderly and vulnerable groups in the society. Full details are as indicated in Figure 4-3.



**Figure 4-3:** Other Sources of Financial Support for Households

#### 4.2.7 Average Monthly Income for the Households

Average monthly income for the households was found to be Kshs. 20,775.00.

#### 4.2.8 Average Monthly Expenditure for the Households

The average monthly expenditure for the sampled households was found to be Kshs. 15,413. The highest monthly expense was on school fees, at 39% of the monthly total, followed by food at 18%, while the lowest monthly expenditure was on water, which had less than 1% of the total monthly expenditure. With majority of the homes depending on protected springs for their drinking water, this could explain why water is not a major contributor to the households’ monthly expenditure. The breakdown of the households’ monthly expenditure is as shown in Table 4-4.

**Table 4-4:** Average monthly expenditure by households on various items

Category	Frequency	Percentage (%)
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Category	Frequency	Percentage (%)
Education	5,966	39
Health	1,173	8
Food	2,732	18
Cooking Fuel	517	3
Rent	218	1
Transport/ Car Fuel	1,023	7
Water	64	0
Clothing	1,313	9
Others	1,502	10
<b>Total</b>	<b>15,413</b>	<b>100</b>

### 4.3 Household's Awareness on Basin Conservation Issues

This section of the questionnaire sought to obtain information on the households' awareness about environmental issues within their basin area, the environmental services available, households' involvement in environmental conservation efforts, and information on the environmental conservation groups available within the area. Full details on the outcome of this are as outlined in sub-sections 4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.3.5 and 4.3.6, while the raw data used for this analysis is attached as Appendix 4.1.2 of this Thesis.

#### 4.3.1 Perception on the State of the Environment

Respondents were asked to state their perceptions on the state of the environment in the Kuywa River sub-basin. Their responses are as stated in Table 4-5.

**Table 4-5:** Perceptions on the State of Environment

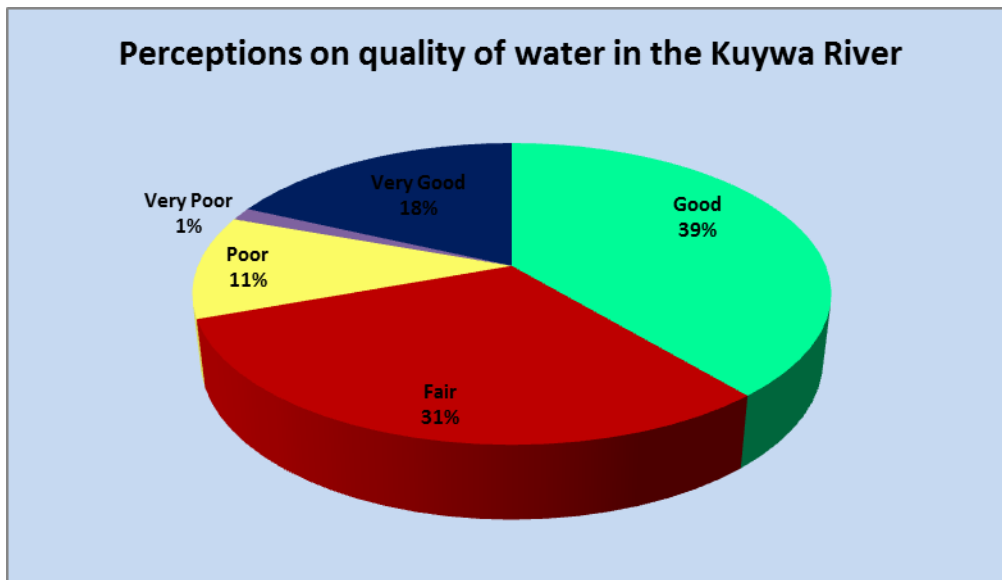
Category	Frequency	Percentage (%)
Very Good	18	25.0
Good	41	56.9
Degraded	12	16.7
Very degraded	1	1.4
<b>Total</b>	<b>72</b>	<b>100</b>

From Table 4-5, 25% of the respondents believe that the state of the environment in the Kuywa River sub-basin is very good, while about 56.9% perceived that it was generally good. 16.7% of

the respondents believe that the environment is degraded, with only about 1.4% reckoning that the state of the environment in the Kuywa River sub-basin was very much degraded. It can be concluded therefore, that the WRUA members generally had a positive feeling about the state of the environment in the Kuywa River sub-basin. This positive attitude could partly be attributed to the sensitization and awareness campaigns carried out by the Kuywa WRUA which could have made the members more conscious about how they report on the state of their environment.

#### 4.3.2 Perceptions on the Quality of the Water in Kuywa River

The respondents were asked their opinion regarding the state of quality of the water in the Kuywa River. Their responses were as summarised in Figure 4-4.



**Figure 4-4:** Perceptions on the quality of the water in the Kuywa River

From Figure 4-4, about 18% of the households believed that the quality of water from the Kuywa River was very good. Majority of the households (39%) believed the water was quality was generally good, 31% believed it was fair while 11% believed the water quality was poor.

Over 50% of the respondents felt that the water quality was either very good or generally good, which is an indicator of the efforts made by the Kuywa WRUA in trying to reinstate the state of water quality in the river.

#### 4.3.3 Environmental Conservation Activities on WRUA Members' Farms

All the respondents interviewed reported carrying out environmental conservation activities on their farms. This shows that the WRUA's efforts to involve all WRUA members in conservation

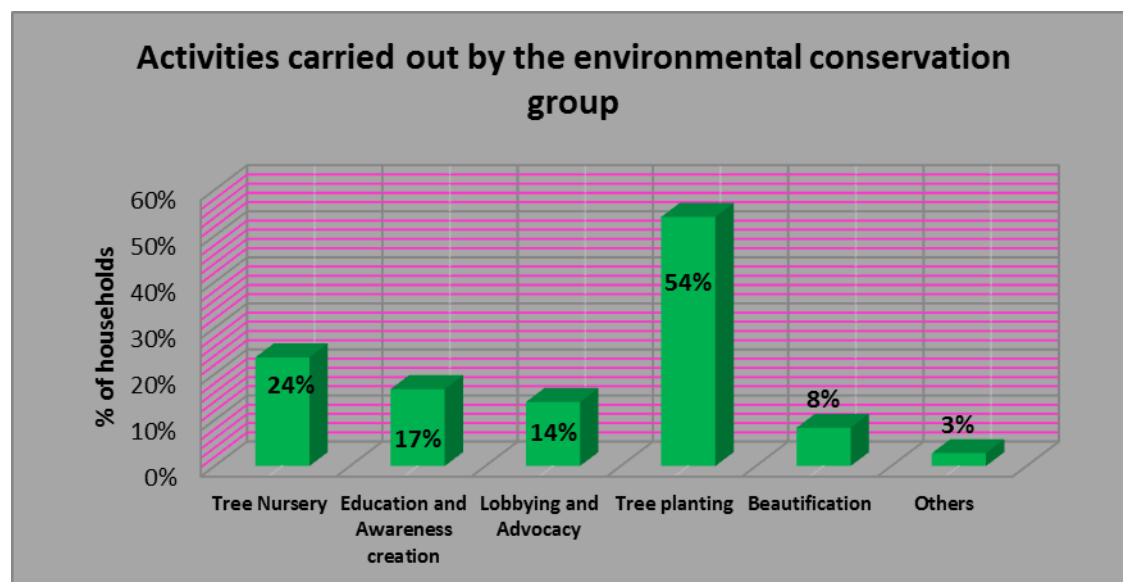
activities were bearing fruit. The various kinds of conservation activities carried out are as shown in Table 4-6.

**Table 4-6:** Environmental Conservation Activities on WRUA Members Farms

Category	Frequency	Percentage (%)
Terracing/contour ploughing	21	29.2
Indigenous trees planting	48	66.6
Rain water harvesting	10	13.8
Conservation of riparian lands	9	12.5
Organic farming	10	13.9
Others (specify)	2	2.8

#### 4.3.4 Membership in Environmental Conservation Groups

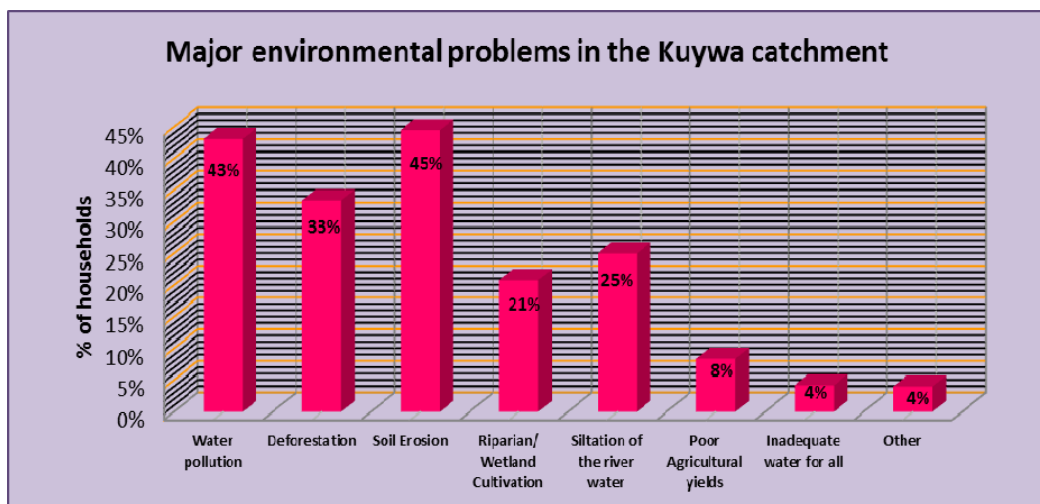
The WRUA members were asked to state whether they belonged to any other environmental conservation group, and which conservation activities they were involved in. Figure 4-5 gives a summary of the findings.



**Figure 4-5:** Activities carried out by environmental conservation groups

#### 4.3.5 Major Environmental Problems Affecting Kuywa River Sub-basin

Members were asked to state what they thought were the major environmental problems affecting the Kuywa River sub-basin. Their thoughts are as indicated in Figure 4-6.

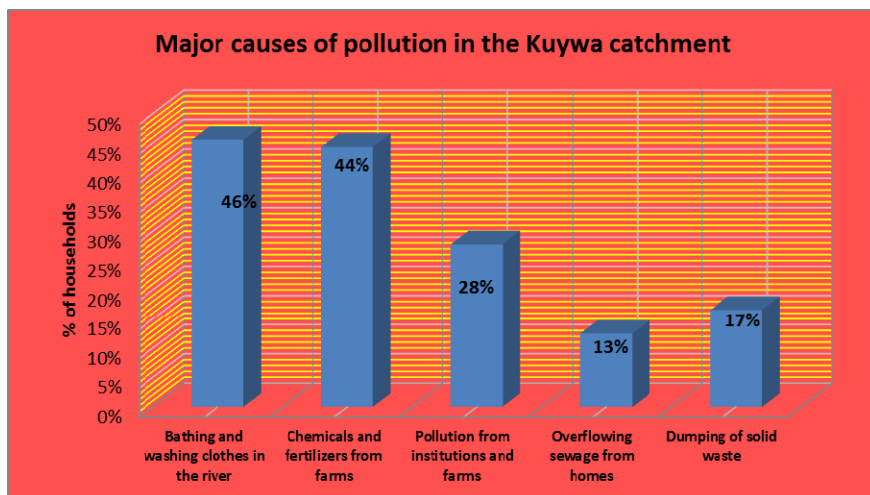


**Figure 4-6:** Major environmental challenges affecting the Kuywa River sub-basin

From Figure 4-6, 43% of the respondents cited water pollution as the major environmental problem affecting Kuywa River sub-basin. 45% of the respondents cited soil erosion, 33% cited deforestation, 25% cited siltation of the river water while 21% cited riparian land /wetland cultivation. Only 4% cited inadequate water for all as a major environmental problem.

#### 4.3.6 Major Causes of Pollution in the Kuywa River

Respondents were asked to indicate what they thought were the major causes of pollution in the Kuywa River sub-basin. Their responses are summarised in Figure 4-7.



**Figure 4-7:** Major causes of pollution in the Kuywa sub-basin

From Figure 4-7, 46% of the households interviewed cited bathing and washing clothes in the river as the major causes of pollution in the Kuywa River. 44% cited pollution from chemicals and fertilizers from farms while 28% cited pollution from institutions and factories. About 13% of the households cited overflowing sewage from homes.

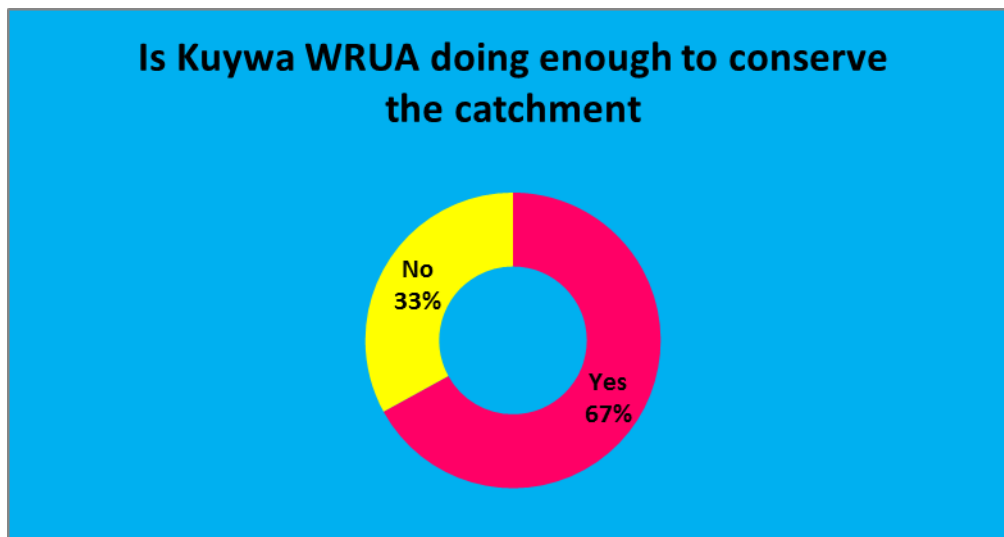
This problem of bathing and washing clothes in the river is indeed quite rampant in the Kuywa River sub-basin, as was witnessed by the researcher during his transect walks across the basin. It can therefore be said that the responses in the questionnaires to the WRUA members corroborate well the physical field observations by the researcher, which is a good indication on the overall outcome of the research.

#### **4.4 Kuywa WRUA’s Activities and their Impact on the Ground**

This section deals with activities carried out by the Kuywa WRUA in their efforts towards water resources management and basin conservation. The researcher’s aim was to gauge the WRUA members’ appreciation of the efforts that the WRUA has put in towards fulfilling their mandate of basin conservation and water resources management. Raw data used for this analysis is attached as Appendix 4.1.3 of this Thesis.

##### **4.4.1 Kuywa WRUA’s Efforts in Basin Conservation**

The WRUA members were asked on whether they thought their WRUA was doing enough to fulfil its mandate of basin conservation and water resources management. The summary of their responses is as indicated in Figure 4-8.



**Figure 4-8:** Perceptions on Kuywa WRUA’s efforts in basin conservation

67% of the respondents believe the Kuywa WRUA has done enough to ensure basin conservation, with about 33% thinking otherwise.

##### **4.4.2 Activities undertaken by Kuywa WRUA towards Basin Conservation**

The researcher sought to know the activities carried out by the WRUA to ensure water resources management and basin conservation. Their responses were as summarised in Table 4-7.

**Table 4-7:** Activities undertaken by Kuywa WRUA towards basin conservation

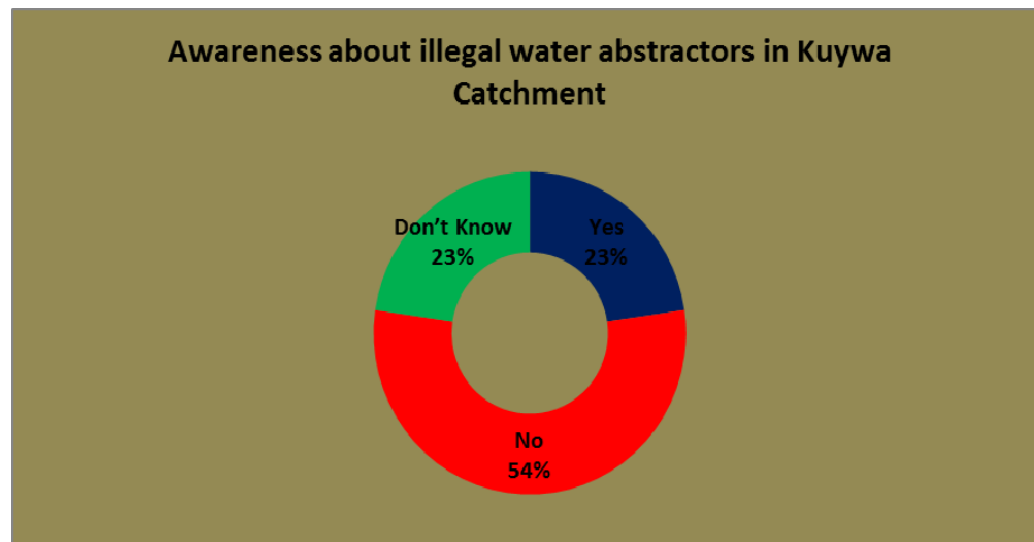
Category	Frequency	Percentage (%)
Planting Indigenous trees	58	80.6
Remove eucalyptus trees on river banks	10	13.9
Building gabions/ terraces	17	23.6
Awareness creation	18	25.0
Water quality surveys	2	2.8
Others (specify)	0	0

Majority (80.6%) of the WRUA members cited planting of indigenous trees as the main activity carried out by the WRUA towards basin conservation, followed by building of terraces and gabions (23.6%) and removal of eucalyptus trees on river banks (13.9%). This corresponded well with the actual conservation activities carried out by the WRUA as per the funding they received from the government, as discussed in the later sections of this Thesis.

#### 4.4.3 Awareness about Illegal Water Abstractors in the Kuywa River

54% of the respondents were not aware of presence of illegal water abstractors in the Kuywa River. 23% said they were aware of illegal water abstractors, while another 23% did not know. Details as indicated in Figure 4-9.

The high percentage of unawareness amongst the WRUA members on this issue of illegal water abstractors could allude to lack of sensitization by the WRUA officials.



**Figure 4-9:** Awareness about Illegal Water Abstractors in the Kuywa River



#### 4.4.4 Kuywa WRUA's Activities to Curb Deforestation

The respondents were asked to mention some of the activities carried out by Kuywa WRUA to curb deforestation. Their responses were as summarised in Table 4-8.

**Table 4-8:** Kuywa WRUA's Activities to Curb Deforestation

Category	Frequency	Percentage (%)
Tree planting	53	73.6
Fencing off forested areas	9	12.5
Awareness creation	26	38.1
Reporting illegal loggers	8	11.1
Other (specify)	0	0

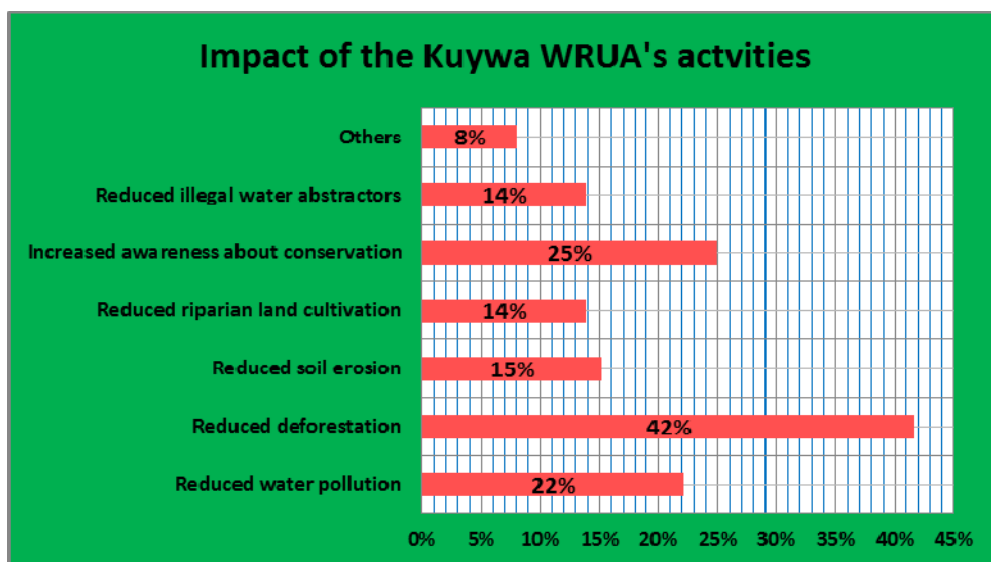
73.6% of the respondents cited tree planting as the WRUA's main intervention measure towards curbing deforestation. This correlates well with the WRUA's flagship project which was the planting of 17km of indigenous trees along the river in an effort to reclaim the riparian land and deter residents from cultivating too close to the river. The WRUA has also established various tree nurseries with the basin, in which they stock mainly indigenous trees and sell to their members and even non-members encouraging them to plant along the river banks as well as within their farms.

#### 4.4.5 Impacts of the Kuywa WRUA's Activities

The respondents were asked to state whether they had noticed any changes in management of water resources and basin conservation since Kuywa WRUA started operating, and to state some of the change they had noticed. The outcome of this survey is as summarized in Figure 4-10.

From the Figure 4-10, all the respondents (100%) indicated that they had noticed a change since the WRUA started its operations. This is due to the fact that the activities the WRUA has carried out, such as planting trees along the riparian land, tree nurseries, spring protection works, cut-off drains, terraces and gabions along the roads, silt traps across the river, etc., were quite visible throughout the sub-basin.

Approximately 42% of the respondents indicated they had noticed reduced deforestation, 25% stated they had noticed increased awareness about environmental conservation, while about 22% had noticed reduction in water pollution. Other changes noted by the respondents included reduction in the number of illegal water abstractors, reduction in riparian land cultivation as well as reduced soil erosion.



**Figure 4-10:** Assessment of Impacts of the WRUA’s Activities on the Basin

#### **4.5 Focus Group Discussion with the WRUA Management**

The researcher held a focus group discussion with members of the Kuywa WRUA management committee aimed at gauging their understanding of the concept of Integrated River Basin Management and its implementation at the local basin level. To bring the participant to the same level, the researcher gave a brief overview about the objectives of this research, being to establish the roles of Water Resources Users Associations (WRUAs) in implementing the principles of Integrated River Basin Management at the local level.

The researcher posed various questions to the CMC members on the concept of Integrated River Basin Management at the sub-basin level, and sought answers from the various available members to gauge how each of them understood the concept.

Thereafter the researcher directed the discussion towards reviewing the various projects undertaken by the WRUA as part of their mandate for water resources management and basin conservation. In order to specifically gauge the WRUA’s level of success in implementation of the concept of Integrated River Basin Management, it was important first to review their Sub-Catchment Management Plan (SCMP), which sets out the environmental and water resource management challenges that the sub-basin is experiencing, and the activities to be carried out towards mitigating the identified challenges.

It was also important to ensure that the WRUA’s level of success is gauged not based on every planned activity as outlined in their SCMP, but only on those activities for which they managed to secure funding for implementation. Thus, the researcher restricted himself to the activities that

the WRUA had obtained funds to carry out, to establish whether they were actually carried out as initially planned, using the funds that were available and set aside for the same.

#### **4.5.1 Review of WKCDD and FMP's Funding**

The Kuywa WRUA received funds from the Western Kenya Community Driven Development and Flood Mitigation Project (WKCDD and FMP), which were used for funding the development of the Sub-Catchment Management Plan (SCMP).

A review of the Kuywa SCMP in line with the WDC modules reveals that the SCMP had a number of gaps that were not addressed as required by the WDC modules. The following are some of the emerging issues from the review of the WKCDD and FMP's funding:

- (i) The SCMP does not address issues of water demand, water balance and water allocation plan. The amount of water available in the sub-basin is also not determined/indicated;
- (ii) Water use monitoring plan within the basin is not elaborate. Aspects such as use of water meter at abstraction points not mentioned, and also discharge measurement for canal and furrow systems not well explained;
- (iii) Monitoring permits-the two coffee factories have no valid authorization to abstract water from the river since their permit has expired;
- (iv) The SCMP failed to expand on Rights Based Approach (RBA) issues. Gender disparity is however mentioned, though the percentage of women is unknown;
- (v) The SCMP does not identify, analyze and list the key stakeholders based on their interaction with the community;
- (vi) The SCMP does not adequately address the issues of water use charges; neither does it properly articulate the importance of compliance, nor provides a compliance plan;
- (vii) The SCMP does not adequately address the issue of the reserve of the area, what quantity and quality are needed for the environment and basic human consumption, etc;
- (viii) The SCMP does not classify and analyze special basin areas within its jurisdiction. There is the mention of the wetlands which have been encroached upon, although these wetlands have not been mapped out; and
- (ix) The SCMP has not come out strongly on issues of institutional development and collaboration, although the Kuywa WRUA has a separate constitution and by-laws which govern its operations.

#### **4.5.2 Review of WSTF's Level II Funding**

The WRUA chairman availed the signed Level II funding contract between Kuywa WRUA and WRA Regional Office in Kakamega, WRA national office in Nairobi, and the Water Services

Trust Fund (WSTF). From this signed agreement a list of the funded activities which were in line with the principles of IRBM at the local level was established.

The Contract was signed on the 13<sup>th</sup> October 2011, and the works were to be completed by 30<sup>th</sup> October 2012. Key activities funded under this contract included the following:

- (i) Spring protection works;
- (ii) Construction of cut-off drains on sloped farms;
- (iii) Abstraction survey;
- (iv) Basin protection; and
- (v) Training and sensitization.

The total amount of money received was Kshs. 1,767,645.00.

#### 4.5.2.1 Overview of the Funded Activities

The sections below provide a brief overview of the activities carried out by the WRUA through funding from WSTF, and their status as at the time of this review.



**Photo Plate 1: A protected spring in the sub-basin**

Some of the springs however showed turbidity levels higher than recommended, just by visual inspection.

#### (i) Spring Protection Works

With the funding received from WSTF, the WRUA undertook spring protection works for a total 7 No. springs. The initial number proposed during application for funding was 5 No. but was increased to 7 No. during project implementation. This has contributed greatly to availability of clean potable water for the households, and also reduced dependence on the Kuywa River's water which is unfit for direct human consumption.

#### (ii) Construction of cut-off drains on sloped farms

The WRUA management had done several cut-off drains along sections of roads and foot paths which were hitherto prone to soil erosion. The funding proposal showed they had initially budgeted for construction of 3km of cut-off drains, although in the end, only about 1km of cut-off drains was done. The cut-off drains were mostly constructed with reinforced concrete although some were simply terraces dug across the floods pathways to divert the flow of storm water. This helped to reduce soil erosion along these roads.



**Photo Plate 2: Erosion protection along the roads**

### **(iii) Sub-basin protection**

In terms of basin protection the WRUA had undertaken a pilot indigenous tree planting exercise along the Kuywa River which was quite successful. About 17.0 km of indigenous trees were planted along the river from the bridge at Kuywa junction upstream of the river. Through sensitization and with involvement of the local administration, all the communities living along the river and cultivating up to the river were moved at least 10 meters away from the river banks to pave

way for the planting of indigenous trees.

This not only protects the riparian ecosystem but it also prevents excessive human cultivation activities close to the river which leads to erosion and increased sediment deposit into the river water. The WRUA also established 2 No. tree nurseries planting approved river friendly trees which the WRUA plants as part of their reforestation exercise and also for income generation. The trees have helped to stabilise soils along the river banks, which were hitherto being washed down during heavy flooding thus widening the river.

The WRUA has continued with sensitization of their members against planting eucalyptus trees along the rivers, although this practice was still prevalent in the Kuywa River sub-basin.



**Photo Plate 3: Planting of indigenous trees along the riparian lands along the Kuywa River**



**Photo Plate 4: Tree nurseries carried out by one of the members of the Kuywa WRUA**

**(iv) Silt trap (Weir) on River Kibisi**



**Photo Plate 5: Silt trap constructed across Kibisi River**

This was also funded by WSTF money and the intention was to construct a weir across the river that would reduce the flow velocities in the river to ensure as much as possible of the silt from the Kibisi River is trapped before it reaches the Kuywa River. However, with no major maintenance undertaken on the weir since its construction, the silt has since build up almost to the weir crest hence hampering the effectiveness of the weir as a silt trap.

**(v) Abstraction Survey**

The proposed abstraction survey was not carried out as initially budgeted for. Instead the community did 2 No. additional spring protection works. Abstraction survey was later carried out under funding from the German Society for International Cooperation (GIZ), brought on board by WRA. GIZ also developed a Water Allocation Plan (WAP) for WRA but both their Abstraction Survey and WAP reports were not accepted by WRA. The WRUA is yet to obtain final copies of the abstraction survey report and water allocation plan from WRA.

**(vi) Community Sensitization**

This was done using chiefs' and assistant chiefs' barazas.

**4.5.2.2 Outcomes of this Level II funding**

The WRUA management believe that the funding received from the WSTF achieved the objective it was intended for. The following were mentioned by the WRUA management committee as the positive outcomes of the WSTF initial funding:

- (i) The Kuywa River is now less polluted than it was at the start;
- (ii) Effluent from coffee factories was no



**Photo Plate 6: Poultry farming by one of the WRUA members as part of their livelihoods programmes**

- longer being released into the river while still in its raw form. Each coffee factory is now required to construct effluent treatment ponds for treating their effluent water to acceptable standards before discharging into the river;
- (iii) Planting of eucalyptus trees along the river had reduced significantly over time, although the challenge still remains. The WRUA management reported that non-WRUA members especially were very obstinate and defiant;
  - (iv) Indigenous trees planted along the river have helped in protecting the river banks from erosion and in restoring the riparian ecosystem;
  - (v) Indigenous trees also use less water from the river, thus helping in water conservation;
  - (vi) Livelihoods programme carried out by the WRUA members have greatly improved their economic living standards;
  - (vii) Afforestation efforts were bearing fruit. The WRUA has established 2 No. tree nurseries where indigenous trees are cropped for planting. Afforestation has been mainly concentrated along river banks, as well as in some few homes and in schools;
  - (viii) Tree nurseries were also their sources of income generation;
  - (ix) Terraces along the roads and paths have not only reduced soil erosion but also helped in ensuring more water percolation thus aiding the underground water recharge;
  - (x) More members of the WRUA were now more sensitized about conservation issues;
  - (xi) Contour ploughing was now being practiced by farmers on sloping land parcels;
  - (xii) More springs have been protected and more people have been sensitized to wash at the springs and not in the river;
  - (xiii) To curb the problem of people washing in the rivers, the WRUA management committee has divided the entire basin into sections and allocated each member a section to man, where those who disobey are reported to the local administration;
  - (xiv) Watering animals directly in the river has also been discouraged;
  - (xv) Uncontrolled irrigation upstream which used to divert and waste a lot of water has also been outlawed with everyone who wants to irrigate having to obtain a permit. Small scale pumping from the river for irrigation was also outlawed;
  - (xvi) The WRUA management reported to have carried out a polluter survey and had developed an inventory of polluters. Potential polluters especially at market centres have also been mapped out; and

(xvii) Erosion has been reduced substantially although the some potential erosion areas are yet to be addressed due to lack of funds.

#### **4.5.2.3 Challenges faced by the WRUA**

- (i) Lack of funding: there has not been any more funds availed to the WRUA since 2013, which has adversely affected the WRUA's efforts in basin protection and most of their projects have died off;
- (ii) WRUA management committee carry out their work on voluntary basis, with no allowances. This demoralizes them;
- (iii) Defiance and little cooperation from both WRUA members and non-members towards the proposed basin management plans. For instance Eucalyptus tree planting along the river is still rampant despite the WRUA's sensitization programmes;
- (iv) Political interference, with the political leaders taking credit for projects that were not initiated by them. The WRUA CMC noted that CDF boards usually come on board when the projects are close to completion, and they want the projects branded as CDF-funded;
- (v) Land owners on whose land the protected springs are located have also caused problems in some cases, wanting to be compensated for the land, even though the springs were serving the communities for free before they were protected;
- (vi) Challenges of fund-raising, with many proposals preparation, which costs money but many of which yield nothing in the end;
- (vii) Challenges of funds collection from the WRUA members through monthly/annual contributions. Many members have failed to pay for their annual shares contributions;
- (viii) Failed promises to the members also demoralizes them leading to low participation – e.g. some grevillea tree seedlings that were promised to be issued to the members but were never delivered.



**Photo Plate 7: Eucalyptus tree planting along the Kuywa River still prevalent**



#### 4.5.2.4 WRUA Management Committee’s Assessment of their SCMP

The researcher asked the WRUA management committee to rate themselves on their performance in development of their Sub-Catchment Management Plan. The issues for consideration by the WRUAs in SCMP development have been outlined in the WDC document. The rating was done on a score of 1 to 10, with 1 being ‘Very Poor’ and 10 being ‘Excellent’. The outcome of their rating is as indicated in Table 4-9. The full rating system for this evaluation is as shown in Section 3.10 of this Thesis.

**Table 4-9:** WRUA management committee rating of their SCMP development process.

Issues	Rate		Rate
Problem identification and prioritization	9	Stakeholder identification and analysis	9
Mapping of point source and non-point source polluters	8	Water resource infrastructure development	7
Mapping of illegal abstractors	7	Water use monitoring	6
Soil erosion control	7	Conflict management	8
Basin conservation	8	Water abstraction data collection	5
Wetlands/riparian land conservation	7	Financial management	8
Institutional development and collaboration	5	Awareness creation on conservation issues	5
Basin’s water resources mapping	8	Water user compliance plan	6
Rights based approach (RBA) issues	5	Water balance and water allocation	6
Water resource and basin monitoring	5	Over-abstraction monitoring and reporting	9
Deforestation control	8	Water demand management	6

From the above ratings it can be seen that the WRUA Management Committee rated themselves quite highly with respect to issues such as problem identification and prioritization, stakeholder participation and analysis and basin’s water resources mapping. Other areas where they rated themselves fairly highly was on mapping of point source and non-point source polluters, basin conservation, over-abstraction monitoring and reporting, awareness creation on conservation issues, financial management and conflict management.

On some of the issues where they rated poorly, this can be attributed to their lack of technical expertise in those areas, e.g. water resource and basin monitoring, water use monitoring,

institutional development and collaboration, water user compliance plan and water abstraction data collection.

A review of the Kuywa Sub-Catchment Management Plan shows that the WRUA had rated themselves reasonably fairly in view of the strengths and weaknesses of the SCMP as analyzed in Section 4.5.1.1 of this Thesis. There was however, a divergence on the issue of stakeholder identification and analysis where the WRUA CMC members rated themselves quite highly compared to the researcher’s own rating.

#### 4.5.3 Review of WKCDD and FMP’s 2nd Funding

The WRUA received the 2<sup>nd</sup> funding from the World Bank through the Western Kenya Community Driven Development and Flood Mitigation Project (WKCDD and FMP), towards the Kuywa Water Basin Conservation Micro-Project. The total amount of funding was Kshs. 2,000,000.00.

The project sought to address the following problems:

- (i) Environmental degradation;
- (ii) Water-borne/related diseases; and
- (iii) Deforestation.

The activities funded were as follows:

- (i) Spring protection;
- (ii) Gulley control; and
- (iii) Planting water friendly trees.

The project started on 1<sup>st</sup> April 2013 and ended on 30<sup>th</sup> June 2013.

Table 4-10 shows the performance of the WKCDD and FMP’s funded project as per the appraisal carried out by WKCDD and FMP’s monitoring and evaluation team.

**Table 4-10: Project Appraisal Form and Scores**

No.	Indicator	Weighting	Score
1	Promoting Adoption of Appropriate land use practices in targeted micro-basins	22	20
2	Undertaking/implementing specific soil and water conservation activities in the targeted areas	22	20
3	Reducing Sediment load in rivers in the targeted micro-basins	22	20
4	Preparation and approval of Micro-Basin Action Plans (MCAPs)	22	21

No.	Indicator	Weighting	Score
5	Promoting activity-specific income generation in targeted areas	12	8
<b>6</b>	<b>Total score</b>	<b>100</b>	<b>89</b>

#### **4.5.4 Proposal for Additional Funding from WKCDD and FMP**

The WRUA applied to the World Bank (through WKCDD and FMP) for an additional Kshs. 5,000,000.00 in 2014, for funding river bank protection works but their application was not successful. This funding was meant to complete the planting of indigenous trees along the river bank, which had been started by the funds received from WSTF. A further application for funding from the Constituency Development Fund (CDF) also failed.

#### **4.6 Key Informant Interview with WRA Regional and National Office**

The researcher carried out a key informant interview with a senior official from the WRA National office in charge of community development to obtain her perspective about the status of implementation of Integrated River Basin Management through the WDC process. She noted that WRA has made great strides in carrying out its mandate as the body charged with implementing Integrated River Basin Management across all basins in Kenya, with the help of WRUAs at the sub-basin level. The Authority had managed to streamline and fully operationalize Integrated Water Resources Management (IWRM) in line with international recommendations. The Authority had also revised the WDC manual to include three more chapters in order to deal with emerging issues, and to incorporate lessons learnt through the eight years of implementation of the WDC process.

##### **4.6.1 Challenges faced by WRA in implementing the WDC through WRUAs**

Some of the challenges faced, as pointed out by the WRA official, included the following:

- (i) Limited funding: the WDC process depended heavily on donor funding, with only a small portion of the funds being provided by the Kenyan government. Initially the donors provided funding with no stringent controls over where it would be used. However, with the advent of devolution the donors were now becoming specific on where they wanted their funds used. Some donors have specified that they only want their funds utilised within certain Counties, for instance within the Arid and Semi-arid lands (ASAL) areas etc. This means that some counties have gone without funding for a long since no donors have come forward seeking to fund WRUA activities within their location;

- (ii) Political interference: the local, regional, or even national politics have tended to have an effect on the operations of the WRUAs and their activities;
- (iii) Inaccessibility of some regions due to their remoteness has meant that some areas have not received sufficient coverage by WRUA operations. Recent cases of insecurity in some areas especially in the Northern frontiers have also provided challenges;
- (iv) Climate issues e.g. floods which have caused some areas to be cut off, or damaged some of the infrastructures developed by the WRUAs;
- (v) Policy challenges: Funding from the central government to WRUAs activities has been minimal due to skewed policies which have tended to prioritize other water sector issues such as water supply at the expense of water resources management;
- (vi) Conflict in legislation and overlapping mandates among government institutions: lack of clear-cut mandates amongst various government institutions operating within the water sector, for example, between NEMA, National Land Commissions, Kenya Water Towers Agency, County Governments and WRA has led to conflicts;
- (vii) Language barriers in some cases, especially when it comes to training the WRUAs on the WDC process;
- (viii) Lack of capacity amongst the WRUAs: High illiteracy levels in some areas has meant that even the best of the available WRUA members are still not able to be sufficiently trained to champion the interests of the WRUA;
- (ix) Poor work done by some consultants: Some of the activities required to be carried out, such as abstraction surveys, are highly specialised and require expertise not found amongst the WRUA members, thus requiring them to hire consultants. While some consultants have come in and done excellent jobs as per their terms of reference, others have returned shoddy and poor outcomes that ended up being rejected by WRA; and
- (x) Poor handling of consultancy jobs: The funds required for carrying out consultancy jobs are usually deposited in the WRUAs accounts thus placing them under charge of the WRUA management committees. Due to lack of technical knowhow, the management committees have been duped into paying the consultants for services rendered even before the outcomes of their consultancies are verified by the WRUA members or by WRA. In case their reports are later rejected by WRA for being shoddy then the funds will already have been wasted.

#### **4.6.2 Weaknesses in the WDC process**

- (i) The WDC does not provide for funding for the formation on WRUAs. It only provides for funding for SCMP development assuming that the WRUAs are already established and in operation. This has left WRA with the burden of funding the formation of WRUAs, an activity that is quite costly as well;
- (ii) The WDC provides that only 15% of the WSTF funds will go to WRA for funding technical support and oversight over the WRUA activities. This according to WRA is quite a small amount compared to the amount of work required to offer technical support and oversight to the WRUAs;
- (iii) While the WDC manual itself is very detailed and adequate for the intended purpose, sometimes the WDC trainers, who are either WRA staff or hired consultants contracted to offer training to the WRUAs and guide them through the SCMP development, could themselves be inadequately prepared and not fully familiar with the manual. WRA has tried to mitigate for this through regular refresher courses for its old staff, while the new staff are also thoroughly trained in the WDC process before they are allowed to offer training to the WRUAs; and
- (iv) The WRUAs as established under the Water Act 2016 are voluntary organizations of individuals who have an interest in water resources within a sub-basin. Thus most of their participation in the WRUA's activities, while it costs time and money, is usually voluntary without any compensation from the government. This has led to low participation by some members in the WRUAs activities, while some have dropped out completely to concentrate on other income generating activities to fend for their families.

#### **4.6.3 Lessons learnt by WRA in implementing the WDC through WRUAs**

In WRA's view the WRUAs have been quite effective in carrying out their mandate as outlined in the WDC document, although with a few exceptions in different parts of the country. A review of the WRUAs as impact across the country will reveal that WRUAs have done tremendously well in fulfilling their objectives as outlined in the WDC document (WRA, 2008).

WRA has in the year 2014-2015 revised the WDC Manual Volume II to include three additional chapters (modules) to incorporate some of the lessons learnt from the implementation of the earlier version of the manual. The three new chapters are:

- (i) **Livelihoods enhancement:** This chapter seeks to address the problem of reducing participation of WRUA members in WRUAs activities due to the perceived lack of benefit therein. The livelihoods chapter provides for funding and training of the WRUA members

in income generating activities such as tree nurseries, poultry keeping, bee keeping, greenhouse horticulture and fish keeping. The WRUAs are required to identify some income generating activities which they wish to engage in and to include their costs in the budgets which are presented to WSTF or to other donors for funding;

- (ii) Climate change adaptation: This chapter seeks to promote training of the WRUAs towards adaptation to climate change. The objective is to build resilience of the communities towards the effects of climate change through building their adaptive capacity, embracing drought resilience crops, etc.; and
- (iii) Flood and Drought mitigation: This chapter seeks to better prepare the communities towards dealing with floods and droughts. This is done through encouraging the communities to build their homes on higher grounds, to build storage facilities, and to develop some simple early warning systems which can be easily adopted by the communities.

#### **4.6.4 Challenges faced by WRUAs in implementing their SCMPs**

- (i) Participation of members in the WRUAs activities: Some of the WRUA members are unwilling to participate in the WRUAs activities due to perceived lack of benefit therein. Some have even sabotaged the activities of the WRUAs by insisting on cultivation on the riparian lands, watering their animals directly in the rivers, etc.;
- (ii) Gender imbalance and marginalisation of the women: Women participation in WRUA activities is minimal, yet women are key members in the utilisation of the natural resources in the sub-basins. Even in WRUA management committees the two thirds gender rule has been ignored in some WRUAs, while in some others the women's voices generally ignored;
- (iii) Challenges in citing the projects: Sometimes the WRUA leadership gets biased in siting the projects, concentrating them on one side of the sub-basin based on the influence the leaders have on the WRUA; and
- (iv) Political interference: local politicians including MCAs and MPs have had meddled in the activities of the WRUAs to try and gain political mileage. Cases of MCAs and MPs claiming credit for projects that they never participated during initiation and implementation are rife. Sometimes MPs have sponsored a small portion of the projects through CDF money and then went ahead to claim ownership of the entire projects.

#### **4.6.5 How to increase WRUAs' effectiveness in implementation of their SCMPs**

- (i) Capacity building of the WRUAs' leadership through continuous training on aspects such as book keeping, conflicts resolution, financial management etc., will enhance their effectiveness;
- (ii) Building capacity of the WRUA leaders for fundraising: WSTF's funding is becoming more and more limited, and therefore the WRUAs need to be sensitized on other ways of raising money. Committees should be formed just to deal with continuous fundraising, through writing proposals and looking around for possible funding opportunities; and
- (iii) Involvement of the WRUA members in the activities carried out by the Consultants in order to ensure ownership of the outcomes, for effective implementation of the recommendations. Under normal circumstances the consultants reports are usually presented to the stakeholders during the verification workshops where the outcomes and recommendations are read to the members to ratify and approve. This helps to a certain extent, but if the WRUA members were closely involved from the start of the exercise it could have helped the communities to better own the outcome of those exercises.

#### **4.6.6 Kenya's legislative and institutional framework for the WDC process**

In WRA's opinion, there is sufficient legislative and institutional framework already in place to facilitate Integrated River Basin Management at the sub-basin level. However, the challenge has been that of coordination, with many government institutions each carrying out their work and implementing programmes all geared towards water and natural resources management, without a central command centre that coordinates all these institutions' activities. Government bodies such as Kenya Forestry Service, Kenya Wildlife Service, National Environment Management Authority, National Lands Commission, WRA, Kenya Water Towers Agency, National Drought Management Authority etc., all have a mandate towards conservation of the natural ecosystems in Kenya. However, each of these entities seems to be working independently without proper coordination from a central location. The result has been duplication of efforts and conflicts arising from overlapping mandates.

#### **4.6.7 Coordination amongst WRUAs working within the same basin**

As already discussed in Chapter Two of this Thesis, one of the challenges facing WRA in its efforts towards catchment conservation has been lack of coordination amongst the various WRUAs working within a larger river basin. The recently introduced concept of basin forums by WRA, if properly operationalized will be crucial in providing the much needed coordination

amongst water users within each basin in the country. This concept has already been incorporated in the recently revised Basin Area Water Resources Management Strategies for each of the six basin areas across the country (Source: Key Informant Interview with WRA’s Community Development Officer, WRA National Office, May 2016).

#### 4.6.8 Role of WRA in supporting WRUAs in implementation of the WDC

The WDC booklet (WRA and WSTF, 2009) has highlighted the roles of WRA, sub-regional, regional and national offices in the implementation of the WDC process. The researcher sought to review the roles of WRA in supporting WRUAs towards implementation of the WDC process, and rated WRA’s performance of these roles on a scale of 1 to 10. The criterion for arriving at the various scores was based on the guidelines as provided in the WDC document, and the researcher’s own judgement based on the information reviewed during the field research. For instance, the score for the capacity building of WRUA CMC members was based on assessment of the number of trainings undertaken, and how well the members had understood their respective roles. The score for WRA’s financial support to the WRUA during implementation of its SCMP was based, amongst other aspects, on the number of proposals prepared by the WRUA, and approved by WRA for funding but which are yet to be funded due to limited available funding.

The outcome of this evaluation is summarised in Table 4-11.

**Table 4-11:** Role of WRA in supporting WRUAs in implementation of the WDC

No.	Roles of WRA in Support of WRUAs	How WRA has performed its roles in supporting the WRUAs	Score Out of 10
<b>Roles of WRA Sub-regional Office</b>			
1	Assistance in development of the WRUAs and SCMPs	<ul style="list-style-type: none"> <li>WRA in conjunction with WSTF have developed the WDC document which guides the development of WRUAs at each sub-basin level</li> </ul>	8
2	Capacity building of WRUA CMC members to perform their roles effectively	<ul style="list-style-type: none"> <li>Capacity building trainings were carried regularly although low literacy levels among the committee members hamper the capacity building efforts</li> <li>WRA facilitates the WRUA CMC members to undertake exchange programmes for learning and bench-marking</li> </ul>	8
3	Technical support to WRUAs during the implementation of their SCMPs	<ul style="list-style-type: none"> <li>WRA has employed fully trained field officers who work with the WRUAs in each sub-region to provide technical support and backstopping. WRA capacity is however limited in view of the number</li> </ul>	7



No.	Roles of WRA in Support of WRUAs	How WRA has performed its roles in supporting the WRUAs	Score Out of 10
		of WRUAs that each sub-region is required to oversee.	
4	Financial support to the WRUAs during the implementation of their SCMPs	<ul style="list-style-type: none"> <li>In WRA's own admission, financial limitations were the biggest hindrance to their efforts towards integrated water resource's management through the WRUAs at the sub-basin level. With limited funding both from the national government and the donors, this has considerably hampered their efforts towards facilitating formation of WRUAs, development of SCMPs and technical support to WRUAs in implementation of funded activities.</li> </ul>	5
5	Monitoring an evaluation of WRUAs activities	<ul style="list-style-type: none"> <li>WRA regularly monitors the activities of WUAs and prepares M and E reports;</li> <li>WRUAs also prepare their own M and E reports which they submit to RMA for review.</li> </ul>	7
6	Support the WRUAs in development of proposals for seeking funding from WSTF	<ul style="list-style-type: none"> <li>WRA has performed out this role effectively with the help of its field officers.</li> </ul>	8
7	Support WRUAs in developing TORs and other contractual matters pertaining to the recruitment of SOs	<ul style="list-style-type: none"> <li>WRA has performed out this role effectively with the help of its field officers.</li> </ul>	8
<b>Roles of WRA Regional Office</b>			
8	Undertake desk and field appraisals of WDC applications and forward to WRA National Office	<ul style="list-style-type: none"> <li>WRA has performed out this role effectively with the help of its field officers</li> </ul>	8
9	Support quality improvements in SCMP development and implementation	<ul style="list-style-type: none"> <li>Use of SOs in development of SCMPs has ensured that their quality is assured. The challenge has been how to ensure the WRUA CMC members are fully involved during the SCMP development process.</li> </ul>	8
10	Coordination of efforts by WRUAs within one sub-basin	<ul style="list-style-type: none"> <li>WRA has not had a strong framework for coordination of all the activities of WRUAs working with one sub-basin. It has however recently introduced a concept of basin forums</li> </ul>	5

No.	Roles of WRA in Support of WRUAs	How WRA has performed its roles in supporting the WRUAs	Score Out of 10
		where all the WRUAs operating within the same basin meet once a year to discuss issues affecting the basin, and to exchange ideas on workable conservation mechanisms.	
11	Pre-qualify and induct SOs	<ul style="list-style-type: none"> <li>WRA carries out this role effectively through its trained field officers.</li> </ul>	8
<b>Roles of WRA National Office</b>			
12	Coordinate the WDC applications to WSTF	<ul style="list-style-type: none"> <li>This role has been carried out effectively through WRA's established structures from sub-regional, regional to national office.</li> </ul>	8
13	Mobilize resources for WDC process	<ul style="list-style-type: none"> <li>WRA has not performed strongly in mobilization of funds towards implementation of WDC process. This could be due to the fact that WRA's mandate is very wide and most of its resources get utilised in other more pressing issues.</li> </ul>	6
14	Review procedures and strengthen quality of the WDC process	<ul style="list-style-type: none"> <li>Monitoring and evaluation both at the regional and national level has ensured that lessons learnt are incorporated towards strengthening the WDC.</li> </ul>	8
15	Audit compliance to WDC systems	<ul style="list-style-type: none"> <li>WRA carries out this role effectively through its internal audit systems.</li> </ul>	9

From evaluation in Table 4.11, the WRA has achieved an average score of 7.4, which is an “above average” score based on the rating system outlined in Section 3.10 of this Thesis. The WRA needs to improve in aspects such as provision of financial support to the WRUAs during the implementation of their SCMPs, coordination of efforts by WRUAs within one sub-basin and mobilization of resources for WDC process.

#### **4.7 Key Informant Interview with Water Services Trust Fund**

The researcher carried out a Key Informant Interview with the Manager in charge of Water Resources Investment at Water Services Trust Fund (WSTF). The objective of the interview was to obtain WSTF's perspective on the effectiveness of the WRUAs in general, in carrying out their mandate especially with respect to the funding received from WSTF. The interview also aimed at verifying the information gathered from the research in the field through households' survey, focus group discussions and key informant interviews.

The outcome of the interview is as outlined in the following sub-sections.

#### **4.7.1 Overview of the WSTF funding process for WRUAs**

WSTF's funding for the WRUAs is usually released in four levels, as follows:

- (i) Level 1 funding with a ceiling of Kshs. 1.5 million which is used for holding two workshops, i.e. (i) capacity building workshop to sensitise more community members to join the association and participate in SCMP development, and (ii) SCMP development workshop.
- (ii) Level 2 funding ceiling is Kshs. 5 million for funding activities in the SCMP which can fit within the Kshs. 5 million.
- (iii) Level 3 funding ceiling is Kshs 10 million for funding SCMP activities after successfully completing level 2 funding.
- (iv) Level 4 funding ceiling is Kshs. 30 million (3 tranches of 10 million each).

The maximum amount of funds that can be given to a WRUA is Kshs. 50 million. For every amount of funds that are released to the WRUAs, 15% of that money goes to WRA for facilitating their supervisory function during the implementation of the projects.

Donor funding for the WRUAs is currently very limited, with only 3 financiers at the moment. These three are as follows (Source: Key Informant Interview with WSTF's Water Resources Investment Manager, May 2016):

- (i) Governments of Finland and Sweden doing joint financing.
- (ii) Medium Term ASAL (arid semi-arid lands) Programme funding in 6 counties only.
- (iii) IFAD, financing community forest associations in Mt. Kenya and Aberdare area, also working in 6 counties only.

A total of 18 Counties of the 47 are currently funded.

#### **4.7.2 Effectiveness of the SCMPs in ensuring Integrated River Basin Management**

In WSTF's opinion, the SCMPs as developed by the WRUAs are quite effective in ensuring sustainable water resources management and basin conservation. The SCMPs are usually developed through a highly participatory process so that all issues affecting the sub-basin are identified and prioritised. If the SCMPs can be fully implemented they can definitely ensure sustainable water and natural resources management. The challenge is usually the limited funding.

#### **4.7.3 Efficiency of the WRUAs in utilizing the funds received**

In WSTF's opinion, most WRUAs across the country have been efficient in their utilization of the allocated funds. The money is usually given starting with smaller amounts as the WRUAs are

gauged to see their accountability. The funds keep increasing in amount as the WRUAs grow and develop better structures for financial management and accountability. Those WRUAs who mismanage their initial tranche of funds will most likely miss out on future allocations. There have been a few audit queries here and there but not on large scale.

#### **4.7.4 Capacity building trainings provided by WSTF to the WRUA leadership**

The key informant interview found out that WSTF carries out capacity building trainings for WRUA management committees in Financial Management and Procurement to ensure they are well equipped to do proper accounting. The WRUAs are also allowed to include in their budget some amount for training under Chapter Ten for Institutional Development.

#### **4.7.5 Weaknesses noted in the WDC process**

- (i) Some WRUAs have complained that the WDC process is long. The WSTF officer reported cases of funds being returned to the donors at the end of the window period, yet there were many WRUAs in need of the funds to implement their SCMPs;
- (ii) Financing mechanism: The 15% funding is usually released to the WRA headquarters, and there are delays before reaching the sub-regional offices. Sometimes it completely fails to reach the sub-regions, yet they are the ones who need it most; and
- (iii) Women who are the major stakeholders in water issues are usually marginalised by cultural issues, where they are not allowed to contribute to matters of the WRUAs. The two thirds gender rule is also just followed on paper but the women's voice is mostly ignored.

#### **4.7.6 Suggested improvements in the WDC process**

- (i) Further improvements required on the ceilings for each level to ensure that more money is absorbed by WRUAs to finance the pertinent issues affecting the sub-basins;
- (ii) Further improvements are required on the WDC process to ensure funds are issued faster. Donor funding usually comes with deadlines, and sometimes the lengthy processes of applying for the funding has seen some donor funds returned once the deadlines are surpassed without having been used. Monies should be released in bigger tranches so that they are utilised within the allocated timelines;
- (iii) Sensitise people to change their attitude towards conservation activities. Most government actors, including policy makers, don't seem to be fully informed about the importance of Water and Natural Resources Management. There seems to be more emphasis on water

supply at the expense of water resources management, yet water supply depends heavily on water resources management.

#### **4.7.7 How the WRUAs can improve their efficiency in utilization of their funds**

More capacity building training is required on financial management. Usually what is provided for under WDC is too short, just about three days. A new concept of training using academic institutions to assist the WRA personnel in offering trainings to WRUAs management committees is required, a Public Private Partnership to empower the private sector to support WRA in capacity building trainings for WRUAs.

#### **4.7.8 WRUAs’ ability to balance between various competing interests**

The final question that the researcher had was whether the WRUAs were able to strike a balance between various competing issues such as carrying out livelihoods activities, ensuring Rights Based approach, awareness creation, conflict resolution and actual basin conservation activities, which should be their core mandate. However, according WSTF, this has been mainly achieved by WSTF’s stringent review of the budgets submitted by the WRUAs, which ensures that there is a balance so that not all the funds allocated are directed to other issues other than basin conservation.

#### **4.7.9 Role of WSTF in supporting WRUAs towards implementation of WDC process**

The researcher sought to understand the role of WSTF in supporting WRUAs towards implementation of Integrated Water Resources Management, and how they faired in carrying out this role. The main roles of WSTF have also been outlined in the WDC booklet (WRA and WSTF, 2009). A summary of this review is as indicated in Table 4-12. The researcher also evaluated the WSTF’s performance in supporting WRUAs towards implementation of the WDC process, on a scale of 1 to 10, according to the rating system indicated in Section 3.10 of this Thesis.

**Table 4-12:** Role of WSTF in supporting WRUAs towards implementation of WDC process

No.	Roles of WSTF in Support of WRUAs	How WSTF has performed its roles in supporting WRUAs	Score out of 10
1	Mobilise resources for WDC	WSTF’s main source of funding for the WDC process is from foreign donors, and not government budgetary allocations. This has hampered effective implementation of the WDC process in many sub-basins since donor	6

No.	Roles of WSTF in Support of WRUAs	How WSTF has performed its roles in supporting WRUAs	Score out of 10
		funding is limited and/or comes with pre-conditions.	
2	Appraisal and approval of project proposals	WSTF appraises and approves proposals submitted by WRUAs seeking funding. While the number of qualified proposals is usually many, the proposals that are actually approved for funding are quite few due to limited funds.	7
3	Monitor implementation of funded projects	WSTF does this effectively through its field officers, done in conjunction with WRA field officers.	8
4	Audit compliance to WDC systems.	This has been carried out effectively through WRA's internal audit systems.	9

Based on the evaluation in Table 4.12, the WSTF has achieved an average score of 7.5, which is an “above average” score based on the rating system outlined in Section 3.10 of this Thesis. The WSTF needs to improve in aspects such as mobilisation of resources for the WDC process. There is also need to revise the project proposal’s appraisal and approval procedures so that the process is faster to avoid cases of funds being returned unutilised to the donors once the funding window period elapses.

#### **4.8 Spatial Analysis Tools for Sub-basin Monitoring**

The researcher employed various spatial analysis tools for monitoring spatial and temporal changes in the Kuywa River sub-basin for the time period during which the WRUA has been in existence and operational.

Use of historical imagery from Google Earth revealed a marginal return of tree cover along the river at several sections of the river. Not much change was seen in terms of vegetation cover over the sub-basin for the period from April 2001 to date. An analysis of spatial-temporal changes in the basin using Google Earth Imagery has been attached as Appendix 4.2 of this Thesis. However, use of ArcGIS for a more detailed analysis of the spatial features of the sub-basin was not possible due to limited time series data available from WRA.

## **5. ANALYSIS OF THE FINDINGS**

### **5.1 Principles of Integrated River Basin Management**

From the literature review in Chapter Two of this Thesis, the key (cross-cutting) principles of Integrated River Basin Management can be summarized as follows:

- (i) Strategic river basin planning;
- (ii) Integration of functions and coordination;
- (iii) Scale;
- (iv) Stakeholders involvement;
- (v) Prioritizing and Timing of Actions Plans;
- (vi) Institutional arrangements and Capacity building;
- (vii) Accountability; and
- (viii) Monitoring and reporting.

Strategic River Basin Planning starts with the formation of an appropriate river basin organization with clear roles and duties (Hooper, 2005). Once the RBO is established it shall be guided by the following internationally accepted rules of strategic river basin planning (Pegram et al, 2013):

- (i) Develop a comprehensive understanding of the entire system;
- (ii) Develop appropriate river basin management plans to guide the vision;
- (iii) Plan and act, even without full knowledge;
- (iv) Prioritize issues for current attention, and adopt a phased approach for long-term goals;
- (v) Enable adaptation to changing circumstances;
- (vi) Develop relevant and consistent thematic plans;
- (vii) Address issues at the appropriate scale;
- (viii) Engage stakeholders with a view to strengthening institutional relationships;
- (ix) Focus on implementation of the basin plan throughout; and
- (x) Select the planning approach and methods to suit the basin.

In the Kenyan context, it can be rightfully presumed that the water resources users associations are the legally established river basin organizations mandated with the role of strategic river basin planning at the local level. In order to effectively carry out their mandate, and in line with the requirements of IRBM, the WRUAs have developed their own river basin management plans, the sub-catchment management plans.

In line with this understanding, the researcher sought to establish how well the WRUAs, as Kenya's vehicles for Integrated River Basin Management, have carried out this mandate. The researcher reviewed the WRUA's alignment with internationally accepted principles of IRBM, such as Strategic River Basin Planning; Integration of Functions and Coordination; Institutional Arrangements and Capacity Building; Scale; Stakeholders Involvement; Prioritization and Timing of Actions Plans; Accountability; and Monitoring and Reporting.

## **5.2 Kuywa WRUA's Implementation of IRBM**

The Kuywa WRUA's SCMP has been developed based on the WDC process, which guides the formation of WRUAs and the development of SCMPs for the WRUA's implementation. It is also clear from the literature review in Chapter Two of this Thesis, that the WDC process is quite consistent with the internationally accepted principles of IRBM, and that in implementing the WDC process in Kenya, the WRUAs are basically implementing the principles of IRBM.

A brief overview of the principles of Integrated River Basin Management, and how the Kuywa WRUA has implemented these principles through their SCMP, is discussed in the following sub-sections.

### **(i) Strategic River Basin Planning**

Integrated River Basin Management cannot be successful without Strategic River Basin Planning. This starts with the formation of an appropriate river basin organization with clear roles and duties (Hooper, 2005), followed by the development of a comprehensive river basin management plan. The Kuywa WRUA, as the RBO mandated with implementation of IRBM within the Kuywa River sub-basin, has done well to develop its sub-catchment management plan as a starting point in IRBM implementation. A review of the WRUA's SCMP in line with the rules of Strategic River Basin Management (Pegram et al, 2013) is briefly outlined in Table 5-1.

Table 5-1 also shows the researcher's rating of the WRUA's compliance with the rules of strategic river basin planning, based on the rating system outlined in Section 3.10 of this Thesis.

While these ratings are exclusively based on the researcher's own judgment, they are guided by the researcher's understanding of the "Ten Golden Rules of Strategic River Basin Planning" (Pegram et al, 2013), vis-à-vis his detailed review of the Kuywa WRUA's SCMP to establish to what extent it complies with the rules as expounded by the authors. The ratings are aimed at providing a quantified assessment of the WRUA's performance of its roles and thus helping to build up the research towards a measurable conclusion.



**Table 5-1: Kuywa WRUA's Compliance with the Rules of Strategic River Basin Planning**

No.	Rules for Strategic River Basin Planning	Kuywa WRUAs Compliance With The Rules for Strategic River Basin Planning	Rating
1	Develop a comprehensive understanding of the entire system	The WRUA undertook a comprehensive study of the Kuywa River sub-basin during the development of its SCMP, which helped to map out the major water and other natural resources and identify the major challenges facing the sub-basin. Thus the WRUA has sufficiently complied with this rule.	8
2	Select the planning approach and methods to suit the basin	The Kuywa WRUA's SCMP was developed based on the basin conditions unique to the Kuywa River sub-basin.	8
3	Develop appropriate river basin management plans to guide the vision	The Kuywa WRUA's SCMP lays down the plan for managing the sub-basin, and guides the WRUA on which steps to take towards that vision. The WRUA has therefore complied sufficiently with this rule.	9
4	Plan and act, even without full knowledge	The WRUA was able to develop a SCMP and to start off the conservation activities without full knowledge of all the conservations issues within the sub-basin and their inter-relations. Some aspects of the sub-basin such as abstraction survey and pollution survey were carried out later, but the planning and basin conservation process had already started.	8
5	Prioritize issues for current attention, and adopt a phased approach for the long-term goals	Kuywa SCMP outlines the short-term, medium-term as well as long-term goals for the WRUA. The WRUA had also prioritized some of the issues that require immediate attention, for which they sought funding.	8
6	Enable adaptation to changing circumstances	Kuywa SCMP is based on the WDC process which is itself evolving with time to adapt to the changing circumstances. The new version of the WDC has incorporated emerging issues such as livelihoods, climate change and drought and flood mitigation.	7
7	Develop relevant and consistent thematic plans	Kuywa SCMP has been developed along basic river basin management themes such water resource allocation, water quality management, soil erosion control, riparian and	8

No.	Rules for Strategic River Basin Planning	Kuywa WRUAs Compliance With The Rules for Strategic River Basin Planning	Rating
		wetlands ecosystem conservation etc. With these in mind the planning team was able to develop appropriate planning approaches and institutional considerations relevant to each.	
8	Address issues at the appropriate scale	The Kuywa WRUA is operational at the sub-basin level which is the lowest level in the WRA organizational hierarchy. Thus the WRUA is best suited to address issues at the local level since its leadership and membership is a draw from the local level.	9
9	Focus on implementation of the basin plan throughout	The Kuywa WRUA has developed their SCMP which guides its activities to avoid any tendency to drift away to irrelevant businesses and distractions.	8
10	Engage stakeholders	The WDC process of SCMP development is highly participatory. This ensures that all relevant stakeholders are consulted and engaged in order to seek for solutions that are acceptable to all.	7
<b>11</b>	<b>Average Score</b>		<b>8.0</b>

**(ii) Assessment of Kuywa WRUA’s Compliance with other Principles of IRBM**

An assessment of the Kuywa WRUA’s roles was carried out to establish to what extent these roles are consistent with the principles of Integrated River Basin Management, which is the implementation of IWRM at the river basin level. The researcher has reviewed the organizational and operational structure of the Kuywa WRUA as an example of a River Basin Organization whose mandate is to implement IWRM at the sub-basin level, and has sought to appreciate how the WRUA’s organizational structure, its roles and operations are consistent with the principles of IRBM as discussed in Chapter Two of this Thesis.

The rating for each item reviewed is based on the researcher’s assessment of the WRUA’s performance in complying with the internationally accepted principles of IRBM. It is therefore a subjective tool adopted by the researcher as part of a detailed quantified assessment of the WRUA’s roles and operations, to help build up the research towards a measureable conclusion.

Table 5-2 shows the assessment of the WRUA’s compliance with other principles of IRBM.

**Table 5-2:** Assessing Kuywa WRUA’s compliance with the principles of IRBM

No.	Principles of IRBM	Kuywa WRUA’s Compliance with Principles of IRBM	Rating
1	Integration of Functions and Coordination	Kuywa WRUA is just one of the various WRUAs under the Lake Victoria North Basin Area, all managed by the WRA Regional office in Kakamega. The Regional office coordinates all the WRUA activities in the basin area by ensuring that all WRUAs are engaged in conservation activities as per their mandate. The WRA regional offices are in turn coordinated by the WRA national office in Nairobi.	7
2	Institutional Arrangements and Capacity Building	The Kuywa River sub-basin is just one of the various sub-basins within the larger Nzoia river basin, which is itself a sub-sub-basin of the larger Lake Victoria North Basin Area. The Kuywa River sub-basin is administered by the Kuywa WRUA, which reports to the WRA regional office in charge of the Lake Victoria North Basin Area, based in Kakamega. An overview of the institutional framework governing the water sector in Kenya is shown in Figure 2.1 of this Thesis. The Kuywa WRUA is organized into a Central Management Committee with sub-committees in charge of finance, etc.	8
3	Scale	The Kuywa WRUA operates at the local level, and has its objectives as being water resources management and basin conservation issues at the local level, and has the mandate to set its objectives and activities to meet the issues and challenges relevant to its locality.	9
4	Stakeholders Involvement	The Kuywa WRUA has well established mechanisms for stakeholder participation in decision-making on all issues affecting the basin. This has helped to ensure that conflicts are resolved on a negotiated platform rather than through legal channels, thus ensuring that issues of basin conservation and water resources management are always prioritized over sectorial interests.	8
5	Prioritization and Timing of Actions Plans	The Kuywa WRUA’s SCMP has a prioritized action plan showing the activities planned and their time-frames. The proposed action plans have also been classified into short-term (2-3 years), medium-term (4-5 years) and long-term (6-10 years).	8

No.	Principles of IRBM	Kuywa WRUA's Compliance with Principles of IRBM	Rating
6	Accountability	The Kuywa WRUA's activities are monitored both by the WRA regional office to whom they report, and by the agencies that fund its projects and activities, such as the WSTF. This ensures that the WRUA's activities and action plans are strictly aligned with their mandate as set out in the Water Act 2016.	8
7	Monitoring and Reporting	The Kuywa WRUA is answerable to the WRA sub-regional office in Kitale, as well as the WRA regional office in Kakamega. The WRUA Prepares and submits annual reports. As a pre-requisite for the funding, the WRUA is required to ensure that it prepares and submits reports to the funding agencies detailing the funds received and how they were utilized.	8
<b>8</b>	<b>Average Score</b>		<b>8.0</b>

### 5.3 Summary of the findings

Table 5-3 provides as summary of the findings from the evaluation of the funded activities as prioritized in the Kuywa WRUA's SCMP.

**Table 5-3: Summary of Findings from the Research**

No.	Research Objectives	Research Tools Employed	Research Findings
1.	To identify from amongst the WRUA’s funded activities those which are in line with the principles of Integrated River Basin Management;	<ol style="list-style-type: none"> <li>1. Literature review; and</li> <li>2. Focus group discussion guide for WRUA Management Committee.</li> </ol>	<p>The funded activities from WSTF’s Level II funding (Kshs. 1,767,645.00) were as follows:</p> <ol style="list-style-type: none"> <li>(i) Spring protection;</li> <li>(ii) Cut-off drains on sloped farms;</li> <li>(iii) Abstraction survey;</li> <li>(iv) Basin protection; and</li> <li>(v) Training and sensitization.</li> </ol> <p>The funded activities from WKCDD and FMP’s funding (Kshs. 2,000,000.00) were as follows:</p> <ol style="list-style-type: none"> <li>(i) Spring protection;</li> <li>(ii) Gully control; and</li> <li>(iii) Planting water friendly trees.</li> </ol>
2.	To establish the extent to which the WRUA’s activities implemented have had a positive effect on the sub-basin.	<ol style="list-style-type: none"> <li>1. Transect walk checklist;</li> <li>2. Field photographs;</li> <li>3. Spatial analysis tools (Google earth, etc.);</li> <li>4. Semi-structured household survey questionnaires for WRUA members;</li> <li>5. Focus group discussion guide for WRUA Management</li> </ol>	<p><b>(i) Impacts of the spring protection works</b></p> <ul style="list-style-type: none"> <li>• Availability of clean potable water from the springs has improved health standards for the residents;</li> <li>• Less dependence on the water from the river as people turn to springs;</li> <li>• Watering animals directly in the river has also reduced; and</li> <li>• More people have been sensitized to wash their clothes at the springs and not in the river.</li> </ul> <p><b>(ii) Impacts of cut-off drains</b></p> <ul style="list-style-type: none"> <li>• Reduced erosion on roads; and</li> <li>• Terraces along the roads and paths have helped in underground water recharge though more water percolation.</li> </ul> <p><b>(iii) Impacts of basin protection works</b></p>

No.	Research Objectives	Research Tools Employed	Research Findings
		<p>Committee;</p> <p>6. Key informant interview guide for WRA Regional Office; and</p> <p>7. Key informant interview guide with WRA National Office.</p>	<ul style="list-style-type: none"> <li>• Indigenous trees planting along the riparian land has reduced human encroachment on riparian lands;</li> <li>• Reduced in cultivation close to the river has led to reduced soil erosion;</li> <li>• Reduced sediment load in the river water;</li> <li>• Reduced costs of water treatment by public water supplies that depend on the Kuywa River; and</li> <li>• Indigenous trees also use less water from the river, resulting in water conservation.</li> </ul> <p><b>(iv) Abstraction survey</b></p> <ul style="list-style-type: none"> <li>• Uncontrolled irrigation upstream has been outlawed, leading to increased flows downstream; and</li> <li>• Permits now required for everyone who wants to carry out irrigation.</li> </ul> <p><b>(v) Impacts of training and sensitization</b></p> <ul style="list-style-type: none"> <li>• The Kuywa River is now less polluted than it was at the start;</li> <li>• Reduction in planting of eucalyptus trees along the rivers; and</li> <li>• More members of the WRUA were now more sensitized about conservation issues.</li> </ul> <p><b>(vi) Polluter Survey</b></p> <ul style="list-style-type: none"> <li>• Point source and non-point source polluters were mapped out and sensitized against pollution; and</li> <li>• Coffee factories now treat their effluent water before discharging into the river.</li> </ul> <p><b>(vii) Livelihoods Programs</b></p> <ul style="list-style-type: none"> <li>• Tree nurseries and chicken rearing has improved the economic living standards; and</li> </ul>

No.	Research Objectives	Research Tools Employed	Research Findings
			<ul style="list-style-type: none"> <li>Afforestation along the river banks has taken root.</li> </ul>
3.	To establish the challenges faced by the WRUA in implementing their funded activities and how they affect the WRUA's efforts towards Integrated River Basin Management.	<ol style="list-style-type: none"> <li>Semi-structured household survey questionnaires for WRUA members;</li> <li>Focus group discussion guide for WRUA Management Committee;</li> <li>Key informant interview guide for WRA Regional Office; and</li> <li>Key informant interview guide with WRA National Office.</li> </ol>	<p><b>(i) Challenges Faced by the WRUA in Implementing its activities</b></p> <ul style="list-style-type: none"> <li>Lack of funding: the WRUA hasn't received any funds since 2013;</li> <li>Lack of compensation for WRUA CMC members for their work with the WRUA;</li> <li>Lack of cooperation from both WRUA members and non-members towards the proposed basin conservation activities;</li> <li>Political interference, political leaders taking credit for projects they did not initiate;</li> <li>Land owners wanting to be compensated for the land on which the protected springs are located, yet initially they had no problem community members using the unprotected springs;</li> <li>Costs of running the WRUAs, e.g. many proposals being prepared and costing money, but yielding nothing in the end;</li> <li>Challenges of funds collection from the WRUA members through annual contributions, with many defaulting; and</li> <li>Failed promises to the WRUA members due to limited financing also demoralizes them leading to low participation.</li> </ul>
4.	To draw a conclusion on the extent to which the WRUAs are implementing IRBM within their river basins, and make recommendations.	<ol style="list-style-type: none"> <li>Data entry and analysis tools.</li> </ol>	<ul style="list-style-type: none"> <li>The overall conclusions from this research are summarised in Chapter Six of this Thesis.</li> </ul>

#### 5.4 Assessing the WRUA's Performance in Implementation of the WDC Process

A summary of the WRUA's performance in implementation of the various issues related to Integrated River Basin Management at the sub-basin level is as shown in Table 5-4.

**Table 5-4:** Assessing the WRUA's performance in implementation of the WDC Process

No.	Review Items	Score	Total
<b>General issues related to the WRUA, SCMP and WRUA CMC</b>			
1.	Role that stakeholders played in the development of the SCMP	7	10
2.	Role that stakeholders play in implementation of the SCMP	6	10
3.	Does the WRUA have an inventory of the water polluters?	9	10
4.	Does the WRUA have an inventory of illegal water abstractors?	7	10
5.	WRUA CMC's appreciation of Integrated River Basin Management	5	10
6.	WRUA CMC's appreciation of Integrated Water Resources Management	8	10
<b>7.</b>	<b>Average Score</b>	<b>7.0</b>	<b>10</b>
No.	WRUA's performance in implementation of funded activities:	Score	Total
1.	Spring protection works	9	10
2.	Basin protection (planting indigenous trees along river banks)	8	10
3.	Livelihoods activities	8	10
4.	Tree nurseries	9	10
5.	Construction of cut-off drains on sloped farms	8	10
6.	Carried out abstraction survey	7	10
7.	Water quality protection (silt trap on river Kibisi)	8	10
8.	Water pollution control (tackling water polluters)	8	10
9.	Implementing specific soil and water conservation activities	8	10
10.	Preparation micro-basin action plans (MCAPs)	9	10
11.	Training and sensitization	9	10
<b>12.</b>	<b>Average Score</b>	<b>8.3</b>	<b>10</b>
No.	Improvements in the state of the environment since the WRUA started implementing the funded activities	Score	Total



No.	Review Items	Score	Total
1.	Reduction in number of point-source polluters	9	10
2.	Reduction in illegal abstraction/uncontrolled irrigation upstream	8	10
3.	Appropriate land use practices	7	10
4.	Reduction in sediment load in rivers	6	10
5.	Erosion control (terraces and gabions on roads)	6	10
6.	Reduced planting of eucalyptus trees along the river	7	10
7.	Afforestation efforts along river banks	6	10
8.	Riparian land/ wetlands reclamation/protection	7	10
9.	Reduced dependence on river water for domestic use	9	10
10.	Reduction in watering of animals in the river	7	10
<b>11.</b>	<b>Average Score</b>	<b>7.2</b>	<b>10</b>
No.	WRUA's ability to deal with challenges	Score	Total
1.	Challenges of lack of funding (WRUA's fund-raising abilities)	6	10
2.	Involvement of all CMC members in WRUA's activities	7	10
3.	Involvement of community stakeholders in the WRUA's activities	7	10
4.	Involvement of all WRUA members in the WRUA's activities	8	10
5.	Involvement of women in the WRUA's leadership and its core activities	9	10
6.	Level of commitment from all management committee members despite lack of compensation for their time and efforts	7	10
7.	Dealing with political interference	8	10
8.	Resolution of conflicts	8	10
<b>9.</b>	<b>Average Score</b>	<b>7.5</b>	<b>10</b>
No.	Assessing the WRUA's SCMP's compliance with the WDC modules	Score	Total
1.	Problem identification and prioritization	8	10
2.	Mapping of point source and non-point source polluters	7	10
3.	Mapping of illegal abstractors	7	10
4.	Soil erosion control	6	10

No.	Review Items	Score	Total
5.	Basin conservation	7	10
6.	Wetlands/riparian land conservation	7	10
7.	Water use monitoring plan	4	10
8.	Awareness creation on conservation issues	7	10
9.	Water user compliance plan	4	10
10.	Rights based approach (RBA) issues	5	10
11.	Water resource and basin monitoring	7	10
12.	Stakeholder participation and analysis	5	10
13.	Over-abstraction monitoring and reporting	5	10
14.	Water resource infrastructure development	5	10
15.	Conflict management	7	10
16.	Water abstraction data collection	6	10
17.	Financial management	7	10
18.	Deforestation control	7	10
19.	Institutional development and collaboration	6	10
20.	Water demand and water balance	4	10
21.	Water allocation plan	4	10
22.	Basin's water resources mapping	7	10
23.	Water demand management	6	10
<b>24.</b>	<b>Average Score</b>	<b>6.0</b>	<b>10</b>
No.	Assessing the WRUA's roles in line with the principles of Integrated River Basin Management	Score	Total
1.	Strategic River Basin Planning	8	10
2.	Integration of Functions	6	10
3.	Coordination	6	10
4.	Institutional Arrangements	6	10
5.	Capacity Building	6	10

No.	Review Items	Score	Total
6.	Scale	7	10
7.	Stakeholders Involvement	7	10
8.	Prioritization	7	10
9.	Timing of Actions Plans	5	10
10.	Accountability	8	10
11.	Monitoring and Reporting	7	10
<b>12.</b>	<b>Average Score</b>	<b>6.5</b>	<b>10</b>
No.	Assessing the Roles of WRA in supporting WRUAs towards implementing the WDC process	Score	Total
1.	Assistance in development of the WRUAs and SCMPs	9	10
2.	Capacity building of WRUA CMC members to be effective	8	10
3.	Technical support to WRUAs during implementation of their SCMPs	9	10
4.	Financial support to WRUAs during implementation of their SCMPs	6	10
5.	Monitoring and evaluation of WRUAs activities	9	10
6.	Support the WRUAs in development of proposals for funding	9	10
7.	Support WRUAs in developing TORs and other contractual matters pertaining to the recruitment of SOs	9	10
8.	Support quality improvements in SCMP development and implementation	8	10
9.	Undertake desk and field appraisals of WDC applications and forward to WRA National Office	8	10
10.	Coordination of efforts by WRUAs within one sub-basin	5	10
11.	Pre-qualify and induct SOs	8	10
12.	Coordinate the WDC applications to WSTF	8	10
13.	Mobilize resources for the WDC process	6	10
14.	Review procedures and strengthen quality of the WDC process	8	10
15.	Audit compliance to WDC systems	9	10
<b>16.</b>	<b>Average Score</b>	<b>7.9</b>	<b>10</b>
No.	Assessing the Roles of WSTF in supporting WRUAs towards	Score	Total

No.	Review Items	Score	Total
	<b>implementing the WDC process</b>		
1.	Mobilise resources for WDC	6	10
2.	Appraisal and approval of project proposals	7	10
3.	Monitor implementation of funded projects	9	10
4.	Audit compliance to WDC systems.	9	10
<b>5.</b>	<b>Average Score</b>	<b>7.8</b>	<b>10</b>
No.	Summary	Score	Total
1.	General issues related to the WRUA, SCMP and WRUA CMC	7.0	10
2.	WRUA's performance in implementation of funded activities	8.3	10
3.	Improvements in the state of the environment since the WRUA started implementing the funded activities	7.2	10
4.	WRUA's ability to deal with challenges	7.5	10
5.	Assessing the WRUA's SCMP's compliance with the WDC modules	6.0	10
6.	Assessing the WRUA's roles in line with the principles of Integrated River Basin Management	6.5	10
7.	Assessing the roles of WRA in supporting WRUAs towards implementing the WDC process	7.9	10
8.	Assessing the roles of WSTF in supporting WRUAs towards implementing the WDC process	7.8	10
<b>9.</b>	<b>Average Score</b>	<b>7.3</b>	<b>10</b>

## 6. CONCLUSIONS AND RECOMMENDATIONS

### 6.1 Conclusions

Based on the research carried out on the Kuywa WRUA, it can be concluded that the WRUAs are having a major impact on the conservation of their sub-basins. However, lack of technical capacity and limited funding were some of the many challenges faced by WRUAs in implementation of their SCMPs.

Further, from the research carried out, it can be concluded that the WRUAs' roles are generally in line with the principles of Integrated River Basin Management. Key principles of Integrated River Basin Management such as Strategic Basin Planning, Scale, Participation, Prioritization, Timing, Accountability, Monitoring and Reporting and Adaptation to Changing Circumstances, were all evident in the roles of the WRUAs as represented in this research on the Kuywa WRUA.

The following conclusions can also be deduced from the findings of this research:

- (i) The WRUAs are still struggling with capacity especially with respect to human resources. Some of the leaders are not well educated and therefore their capacity to drive the vision of the WRUAs is limited;
- (ii) The WRUAs have developed their SCMPs with well outlined plans but they lack funding. For the Kuywa WRUA for instance, the last time they received funding was in 2013, and since then they have written and submitted many proposals for funding but all have failed;
- (iii) The WRUAs are led by elected officials who serve on voluntary basis, and much of the time and effort they put into the WRUAs activities is not compensated for. This leads to low morale and motivation;
- (iv) The WRUAs' mandate also includes looking out for environmental offenders such as illegal abstractors, point-source polluters, etc. However, their ability to enforce this mandate is limited since they do not have prosecutorial powers;
- (v) Government's investment in water resources management has been weaker compared to its investment in water supply and irrigation development. This might not be as a result of weaker policies on water resources management but just a case of lack of prioritisation;
- (vi) Various government institutions dealing with water and natural resources management are currently not coordinated. Each of these entities is implementing their policies independently without proper coordination with others in the same sector. The result has been duplication of efforts and conflicts arising from overlapping mandates;

- (vii) The research also established that lack of coordination amongst WRUAs within the same basin was a major hindrance to achieving a basin-wide approach to Integrated River Basin Management; and
- (viii) Conflicts in mandates between various governments institutions, for instance between NEMA and WRA (WRA 2013), stills persist, further hampering the country's efforts towards integrated water and natural resources management.

## **6.2 Recommendations**

The following are the recommendations on the way forward:

- (i) Capacity building trainings, especially for the WRUA central management committees and the technical committees, play a key role in ensuring the WRUAs are able to deliver on their mandate. The WDC process should provide for enhanced trainings in aspects such as financial management, procurement, and monitoring and evaluation. Exchange programmes for benchmarking and learning, which are already provided for in the WDC manual, should be enhanced and financed so that the WRUA leadership can gain valuable lessons from their successful peers;
- (ii) Limited funding for implementation of the SCMPs remains the biggest threat to the success of the WRUAs as vehicles for Integrated River Basin Management. Both the national government as well as the County governments must prioritize the conservation of water and natural resources so that sufficient funds are allocated towards the same in their annual budgets. Government must strongly participate in mobilization of funds from donors and development partners, for water and natural resources management, just as it has done for water supply and irrigation development, and must not leave that task to WSTF alone;
- (iii) The WDC process needs to be reviewed to hasten the process of application for and receipt of funds from WSTF by the WRUAs. Currently the process is quite slow, leading to low uptake of available donor funding, which is usually released under a specified limited window period;
- (iv) The WDC manual has been revised to include a chapter on livelihoods, which provides for funding and training of the WRUA members in income generating activities, to address the problem of reducing participation of WRUA members in WRUAs activities due to the perceived lack of benefit therein. There is however, still need to come up with mechanisms for compensating the WRUAs leadership teams especially the members of the Central Management Committees and the technical committees for their expertise and time input

into the operations of the WRUA. This will not only ensure that the WRUAs activities but will also attract more qualified personnel to participate in the WRUAs activities thereby enhancing the technical capacity of WRUAs to deal with issues affecting the sub-basin;

- (v) Compliance enforcement remains a big challenge to the quest for Integrated River Basin Management due to the WRUAs' their lack of mandate to apprehend offenders, and WRA's limited human resources capacity to enforce its water resources management rules. There is need for a new regulatory framework which accords the WRUAs more powers to apprehend offenders in their efforts to enforce compliance. WRA's capacity also needs to be enhanced so that they provide better oversight to the WRUAs towards enforcing compliance.
- (vi) There is need to institute an inter-ministerial council for coordination of the various Government organizations dealing with water and natural resources management. This should be a multi-agency council consisting of representatives from all the government institutions dealing with natural resources management, who will be charged with harmonising the operations of various institutions to eliminate duplication of efforts and conflicts arising from overlapping mandates. The inter-ministerial council should come up with an ordered, harmonised documentation of all government legislations dealing with natural resources management, to establish which law takes precedence in case of conflict;
- (vii) Alternatively the already existing Water Sector Working Group (WSWG) needs to be expanded with a bigger mandate to ensure effective coordination of all players in the water sector across the various government departments.

### **6.3 Further Research**

This research limited itself to assessing the WRUA's funded activities only, since it would have been unreasonable to gauge the WRUA's performance on aspects which they planned to implement but lacked funding. Yet the range of funded activities differs from one WRUA to another based on their prioritisation. Thus there is still need to carry out a more comprehensive research of the WRUAs' mandates based how well they implement their entire Sub-Catchment Management Plan. This would provide an even better understanding of how well the WRUAs' roles and their activities are in line with the principles of Integrated River Basin Management.

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## Appendices

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### Appendix 3.1: Field Data Collection Tools

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### Appendix 3.1.1: Semi-structured Questionnaire for Households Survey

**PART A: Socio-economic characteristics of the study area:**

This section asks for background information to help determine the socio-economic status of respondents. Your answers will be kept completely confidential.

1. Name of the Respondent: .....

2. Gender:	3. Relationship to Household Head	4. Age (years): How old are you?	5. Marital Status	6. Occupation: What is your occupation?	7. Education: What is your highest level of education completed?	8. Household size: How many members of your household are in each of these age groups?
1. Male	1. Head		1. Single	1. Farming	1. No schooling	Below 16 years
2. Female	2. Spouse		2. Married	2. Trading	2. Lower Primary	16 – 20 years
	3. Son/Daughter		3. Separated	3. Artisan	3. Upper Primary	21 – 25 years
	4. Brother/Sister		4. Widow/er	4. Casual	4. Secondary	26 – 30 years
	5. Grandchild		5. Divorced	5. Salaried	5. College	31 – 35 years
	6. Father/Mother			6. Unemployed	6. University	36 – 40 years
	7. Other relative			7. Student	7. Other	41 – 50 years
	8. Non-relative			8. Other		Over 50 years

9.	What is your main source of income? (Please tick only ONCE to show the main source of income)	Farming	1.
		Casual Labour	2.
		Business	3.
		Rental Income	4.
		Employment	5.
		Remittances	6.
		Other (Please specify)	7.
10.	Any other sources of financial support for the family? (please tick all relevant ones)	None	1.
		Church/Faith Based Organization	2.
		Pension	3.
		NGOs/CBO	4.
		Remittances	5.
		Government Support	6.
		Others (Please specify)	7.
11.	What is your total income including external financial support per month?	<b>Source of Income</b>	<b>Amount (Kshs)</b>
		Main Income	
		Other sources	
		<b>Total Income</b>	
12.	Expenditure per month (Note: If the respondent gives amount for the year then divide by 12)	<b>Item</b>	<b>Amount (Kshs)</b>
		Education	
		Health	
		Food	
		Cooking Fuel	
		Rent	
		Transport/Car Fuel	
		Water	
		Clothing	
		Others	

**PART B: Awareness, identification of environmental services, and institutions:**

This section provides information on environmental awareness, the environmental services available and information on the institutions available within the area. Your answers will be kept completely confidential.

1.	What is your general perception of the state of the environment in the Kuywa River sub-basin?	Very good	1.
		Good	2.
		Degraded	3.
		Very Degraded	4.
2.	What is your general perception of the current quality of the water in the Kuywa River?	Very good	1.
		Good	2.
		Fair	3.
		Poor	4.
		Very Poor	5.
3.	What is your general perception of the current availability of the water in the Kuywa River?	Very Reliable	1.
		Reliable	2.
		Unreliable	3.
		Very Unreliable	4.
4.	Do you carry out any environmental conservation activities on your farm? Yes/No If yes, which environmental conservation activities do you carry out?	Terracing/contour ploughing	1.
		Indigenous trees planting	2.
		Rain water harvesting	3.
		Conservation of riparian lands	4.
		Organic farming	5.
		Others (specify)	6.
5.	If no, why?	Shortage of finance	1.
		Shortage of land	2.
		Not profitable	3.
		Lack of awareness	4.
		Insecure land tenure	5.
		Other (specify)	6.
6.	If Yes, which goods or services do you get? (Multiple answers allowed)	Water for domestic use	1.
		Fuel wood	2.
		Raw materials for commercial use	3.



		Raw material for domestic use	4.
		Fishing	5.
		Grazing lands	6.
		Food crops (specify)	7.
7.	Are you a member of any environmental conservation group? Yes/No If Yes, which activities do you carry out?	Tree nursery	1.
		Education and awareness creation	2.
		Lobbying and advocacy	3.
		Tree planting	4.
		Beautification	5.
		Other (specify)	6.
8.	Are you aware of the Kuywa WRUA? Yes/No If Yes, how were you involved in its formation?	Participated fully in its development	1.
		Attended consultation meeting (s)	2.
		Was a respondent to a questionnaire	3.
		Participated in the validation	4.
		Not involved in any way	5.
		Other (specify)	6.
9.	What do you think are the major environmental problems affecting the Kuywa sub-basin?	Water pollution	1.
		Deforestation	2.
		Soil erosion	3.
		Riparian/wetlands cultivation	4.
		Siltation of the river water	5.
		Poor agricultural yields	6.
		Inadequate water for all	7.
		Other (specify)	8.
10.	What do you think are the major causes of pollution of the Kuywa River?	Bathing and washing clothes in the	1.
		Overflowing sewage from homes	2.
		Dumping of solid waste e.g. paper	3.
		Chemicals and fertilizers from farms	4.
		Pollution from institutions and	5.
		Other (specify)	6.
11.	Do you think the Kuywa WRUA is doing enough to conserve the catchment? Yes/No	If No, why do you think so?	1.
			2.
			3.
			4.
			5.

**PART C: KUWRUA’s Activities and their Impact on the Ground**

This section seeks to understand the Kuywa Water Resources Association’s activities and their impact, whether they have been felt on the ground or not. Kindly provide truthful responses.

1.	Are you aware of any activity that Kuywa WRUA has undertaken to ensure water resources management and catchment conservation?  Yes/No	If Yes, which activities?	
		Planting indigenous trees	1.
		Remove eucalyptus trees on river	2.
		Building gabions/terraces	3.
		Awareness creation	4.
		Water quality surveys	5.
		Other (specify)	6.
2.	Are there illegal water abstractors in your area? 1. Yes 2. No. 3. Don’t Know	If Yes, what has Kuywa WRUA done to reduce this trend?	1.
			2.
			3.
			4.
3.	Has Kuywa WRUA undertaken any activities to curb deforestation? 1. Yes 2. No. 3. Don’t Know	If Yes, which activities?	
		Tree planting	1.
		Fencing off forested areas	2.
		Awareness creation	3.
		Reporting illegal loggers	4.
Other (specify)	5.		
4.	Has KUWRUA undertaken any activities to reducing gully erosion? 1. Yes 2. No. 3. Don’t Know	If Yes, which activities?	
			1.
			2.
			3.
			4.
			5.
	6.		
5.	Have you noticed any changes in management of water resources and catchment conservation since KUWRUA started operating? 1. Yes 2. No. 3. Don’t Know	If Yes, which are the changes?	
		Reduced illegal water abstraction	1.
		Reduced water pollution	2.
		Reduced deforestation	3.
		Reduced soil erosion	4.
		Increased awareness about	5.
		Reduced riparian land cultivation	6.
		Reduced encroachment on wetlands	7.
Other (specify)	8.		

## Appendix 3.1.2: Focus Group Discussion Guide for WRUA Management Committee

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**Name of Moderator**..... **Date** .....

**Name of Person Taking Notes** ..... **Place** .....

1. How was the KUWRUA formed? How long has the KUWRUA been in existence?
2. How was the Management Committee chosen? How did you arrive at the list of stakeholders to be involved?
3. What role did the Management committee play in development of the SCMP?
4. What role does the local community and stakeholders play in implementation of the SCMP?
5. What challenges have you encountered in your effort to ensure community involvement in the WRUA's activities?
6. What were the three priority problems in your SCMP? How have they been addressed so far?
7. Do you have an inventory of the water polluters in Kuywa River? Please provide a copy. What activities has KUWRUA undertaken to control water pollution?
8. Is rapid deforestation a major problem in the sub-basin? How is KUWRUA addressing it?
9. Is gully erosion a major problem in the sub-basin? What are some of the causes of gully erosion? Are there any measures that the KUWRUA has taken to control gully erosion?
10. Is illegal water abstraction a major challenge in the Kuywa River? Do you have an inventory of all illegal water abstractors? What activities have you undertaken to address this problem?
11. What specific activities in your SCMP have so far been funded by WSTF, and for how long? Has there been an improvement since you started receiving funding for those activities?
12. Which problems have failed to improve despite the WRUA spending money addressing them?
13. Does the KUWRUA have any other sources of funds apart from WSTF? If yes, which ones?

14. How can you rate (1 to 10) the implementation of the SCMP in the year 2013-2014?
15. What challenges have you faced in implementation of the SCMP? How did you address them?
16. Do you think the SCMP as currently developed is adequate to address all environmental challenges in the sub-basin? What suggestions do you have on how it can be improved?
17. What do you understand by Integrated River Basin Management? What activities has the WRUA undertaken in line with this concept of IRBM?
18. What do you understand by Integrated Water Resources Management? What activities has the WRUA undertaken in line with this concept of IWRM?
19. From the following issues within your mandate, which areas do you think you have performed well and where have you performed poorly? Please rate them on a scale of 1 to 10.

<b>Issues</b>	<b>Rate</b>		<b>Rate</b>
Problem identification and prioritization		Over-abstraction monitoring and reporting	
Mapping of point source and non-point source polluters		Water resource infrastructure development	
Mapping of illegal abstractors		River pollution control	
Soil erosion control		Conflict management	
Catchment conservation		Water abstraction data collection	
Wetlands/riparian land conservation		Financial management	
Water use monitoring		Deforestation control	
Awareness creation on conservation issues		Institutional development and collaboration	
Water user compliance plan		Water abstraction data	
Rights based approach (RBA) issues		Water balance and water allocation	
Water resource and catchment monitoring		Catchment's water resources mapping	
Stakeholder participation and analysis		Water demand management	

### Appendix 3.1.3: Key Informant Interview Guide for WRA Regional Office

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**Name of Respondent** ..... **Date** .....

**Job Title** ..... **Place of Interview** .....

1. Are you aware of any activities that KUWRUA has undertaken towards reduction of water pollution in the Kuywa River? How was the RO involved in carrying out the activities?
2. Do you think the KUWRUA SCMP as developed is effective in ensuring sustainable water resources management and catchment conservation?
3. Has the KUWRUA been effective in carrying out their mandate of water resource management and catchment conservation? On a scale of 1 to 10, how do you rate them?
4. How efficient has the KUWRUA been in utilizing the funds they receive?
5. Is there a monitoring, evaluation and reporting system put in place where the WRUAs prepare reports and submit to WRA? How frequent are these reports?
6. Have there been major conflicts in the management committee? Have these conflicts hampered their performance in any way?
7. What do you think are the major problems affecting the Kuywa River sub-basin?

Issues	Rate		Rate
Riparian cultivation		Encroachment on wetlands	
Siltation of the river		Catchment degradation	
Over-abstraction		Point source pollution	
Lack of awareness about conservation		Non-point source pollution	
Deforestation		Solid waste pollution	
Illegal water abstraction		Introduction of eucalyptus trees	
Soil erosion		Inappropriate use of agro-chemicals	

8. From the following issues within the WRUA's mandate, which areas do you think they have performed well and where have they performed poorly? Please rate them on a scale of 1 to 10.

Issues	Rate		Rate
Problem identification/prioritization		Over-abstraction monitoring	
Mapping of polluters		Water infrastructure development	
Mapping of illegal abstractors		River pollution control	
Soil erosion control		Conflict management	

<b>Issues</b>	<b>Rate</b>		<b>Rate</b>
Catchment conservation		Water abstraction data collection	
Wetlands/riparian land conservation		Financial management	
Water use monitoring		Deforestation control	
Awareness creation on conservation		Water resource monitoring	
Water user compliance plan		Water abstraction data	
Rights based approach issues		Water balance and water allocation	
Institutional development and collaboration		Water resources mapping	
Stakeholder participation and analysis		Water demand management	

9. What role does WRA RO play in the development of Sub-Catchment Management Plans?
10. What role does WRA RO play in the implementation of Sub-Catchment Management Plans?
11. Are there any weaknesses you have noticed in the WDC process of WRUA formation and SCMP development? Kindly enumerate the weaknesses if any.
12. What major challenges have you witnessed in the implementation of the SCMPs in your Region?
13. Looking at all the WRUAs in your Region, do their management committees have the technical capacity to oversee catchment conservation and water resources management activities, including administering the funds thereof?
14. Are there capacity building trainings for the WRUA management committee members? How frequent? Have these trainings helped to improve their performance in the committees?
15. What are your suggestions on how to increase the WRUA's efficiency in the implementation of the SCMPs?
16. Are conflicts in the WRUA management committees a major impediment to SCMP implementation and catchment conservation efforts in this region?
17. How much is the success rate (scale 1 to 10) in terms of funds utilization by the WRUAs towards catchment conservation and water resources management?
18. Are the WRUAs able to strike a balance between the various competing issues such as carrying out income generating activities, ensuring Rights Based approach, awareness creation, conflict resolution and actual catchment conservation activities?
19. Have the WRUAs as established under the WDC guidelines been effective in catchment conservation and water resources management? What are the lessons learnt by WRA in establishing and working with WRUAs towards effective Integrated Water Resources Management?
20. What could be done in order to ensure effective coordination of the various WRUAs working within a single river basin, in order bring about Integrated Water Resources Management across the entire river basin?

**Appendix 3.1.4: Key Informant Interview Guide for the WRA National Office**

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**Name of Respondent** ..... **Date** .....

**Job Title** ..... **Place of Interview** .....

1. In WRA’s evaluation how is the country doing in its efforts towards Integrated Water Resources Management (IWRM)? Please rate on a scale of 1 to 10.
2. What are the major challenges faced by the Country in attaining its objectives in water resources management and conservation of its key water catchment areas?
3. Are there any weaknesses you have noted in the WDC process of WRUA formation and SCMP development? Kindly enumerate the weaknesses if any.
4. Have the WRUAs as established under the WDC guidelines been effective in catchment conservation and water resources management? What are the lessons learnt by WRA in establishing and working with WRUAs towards effective Integrated Water Resources Management?
5. What major challenges have you faced while supervising the implementation of SCMPs by the WRUAs?
6. What are the challenges faced by WRUAs in implementing their SCMPs?
7. What are your suggestions on how to increase the WRUAs’ effectiveness in the implementation of their SCMPs?
8. Are there gaps in Kenya’s overall legislative and institutional framework that have led to ineffective and uncoordinated water resources management?
9. What could be done in order to ensure effective coordination of the various WRUAs working within various sub-basins to bring about Integrated Water Resources Management across the entire river basin?

### Appendix 3.1.5: Key Informant Interview Guide for the WSTF Officials

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**Name of Respondent** ..... **Date** .....

**Job Title** ..... **Place of Interview** .....

1. What role does WSTF play in the development of Sub-Catchment Management Plans?
2. What role does WSTF play in the implementation of Sub-Catchment Management Plans?
3. Do you think the SCMPs as developed and implemented are effective in ensuring sustainable water resources management and catchment conservation in the country?
4. How efficient are the WRUA's in utilizing the funds received towards catchment conservation and water resources management? Please rate them on scale of 1 to 10.
5. How do you rate the effectiveness of Kuywa WRUA specifically, in carrying out their mandate so far (on a scale of 1 to 10)? On what basis did you come up with that score?
6. Has there been any mismanagement of funds received by the Kuywa WRUA? If yes, what measures did the WSTF put in place to ensure such does not happen again?
7. Are there any capacity building trainings that WSTF provides to the WRUA management committees countrywide on financial management? If Yes, Have these trainings helped to improve the committees' performance?
8. Are there any weaknesses you have noticed in the WDC process of WRUA formation and SCMP development? If Yes, Kindly enumerate the weaknesses.
9. What are your proposals on how the WDC can be improved in order to meet the objective of water resources management by the WRUAs?
10. What are your suggestions on how the WRUAs can improve their efficiency in utilization of their funds to implement their SCMPs?
11. Are the WRUAs able to strike a balance between the various competing issues such as carrying out income generating activities, ensuring Rights Based approach, awareness creation, conflict resolution and actual catchment conservation activities?



*Appendix 3.1.6: Field Observation Checklist for Transect Walks*

**Appendix 3.1.6: Field Observation Checklist for Transect Walks**

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<b>No.</b>	<b>Issues for observation</b>	<b>Remarks</b>
1.	Catchment degradation	
2.	Deforestation	
3.	Encroachment on wetlands / riparian lands	
4.	Flooding	
5.	Human and wildlife conflicts (menace from monkeys)	
6.	Illegal water abstraction	
7.	Inappropriate use of agro- chemicals	
8.	Inefficient irrigation methods	
9.	Introduction of eucalyptus trees	
10.	Lack of awareness about conservation	
11.	Over-abstraction	
12.	Over-grazing of livestock	
13.	Pollution from coffee and sugar factories	
14.	Pollution from washing clothes/ bathing/watering animals in the river	
15.	Riparian land / wetlands cultivation	
16.	Solid waste dumping near water courses	
17.	Siltation of the river	
18.	Soil erosion	
19.	Wastewater pollution from households and institutions	

## Appendix 4.1: Raw Data from IBM SPSS Statistics 20.0 for Analysis

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Appendix No.	Appendix Description
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Appendix 4.2	Temporal Analysis of Google Earth Imagery

## Appendix 4.1.1: Raw Data on Socio-economic characteristics of the study area

### FREQUENCIES VARIABLES

Notes							
Output Created				18-FEB-2016 13:03:04			
Comments							
Input	Data		C:\Users\Maureen\Desktop\KUYWA PROJECT\KUYWA OVERALL				
	Active Dataset		DataSet1				
	Filter		<none>				
	Weight		<none>				
	Split File		<none>				
	No. of Rows in Working Data File		72				
Missing Value Handling	Definition of Missing		User-defined missing values are treated as missing.				
	Cases Used		Statistics are based on all cases with valid data.				
Notes							
Resources		Processor Time		00:00:00.22			
		Elapsed Time		00:00:00.21			
Statistics							
		Gender Respondent	Re/ship To Household Head	Age	Marital Status	Occupation	Education
N	Valid	72	72	71	71	72	71
	Missing	0	0	1	1	0	1
Statistics							
		AgeBelow 16	Age16to20	Age21to25	Age26to30	Age31to35	Age36to40
N	Valid	65	58	52	48	38	35
	Missing	7	14	20	24	34	37
Statistics							
		Age41to50	AgeOver50	Main Source of Income 1	Main Source of Income 2	Financial Support 1	
N	Valid	45	48	72	4	70	
	Missing	27	24	0	68	2	

Statistics							
		Financial support 2	Total Income Main	Total Income Other	Total Income	Expenses Education	
N	Valid	4	68	67	68	62	
	Missing	68	4	5	4	10	
Statistics							
		Expenses Health	Expense s Food	Expenses Cooking Fuel	Expense s Rent	Expenses Transport	Expenses Water
N	Valid	62	62	62	62	62	62
	Missing	10	10	10	10	10	10
Statistics							
		Expenses Clothing	Expenses Others	Expenses Total	State of Environment	Quality of Water	
N	Valid	61	61	62	72	72	
	Missing	11	11	10	0	0	
Statistics							
		Availability of Water	Carry Environment Conservation	If Yes Activities	If Yes Activities2	If No Why	
N	Valid	72	72	64	36	8	
	Missing	0	0	8	36	64	
Statistics							
		If Yes Goods Gotten 1	If Yes Goods Gotten 2	Member Environmental Conservation	If Yes Activities Carried Out 1	If Yes Activities Carried Out 2	
N	Valid	64	36	71	56	30	
	Missing	8	36	1	16	42	

Statistics						
		Kuywa WRUA	If Yes Involved Formation	Environmental Problems 1	Environmental Problems 2	Environmental Problems 3
N	Valid	72	63	72	32	26
	Missing	0	9	0	40	46

Statistics						
		Causes of Pollution 1	Causes of Pollution 2	Causes of Pollution 3	Doing Enough to Conserve	If No, Why

N	Valid	72	34	22	65	0
	Missing	0	38	50	7	72
<b>Statistics</b>						
		Activity WRUA Resource	If Yes Resource Management Activity 1	If Yes Resource Management Activity 2	Illegal Water Abstractors	If Yes What has been done
N	Valid	70	66	39	66	0
	Missing	2	6	33	6	72
<b>Statistics</b>						
		Activity Curb deforestation	If Yes Activities to Curb Deforestation 1	If Yes Activities to Curb Deforestation 2	Activities to reduce gully erosion	Which Activities
N	Valid	69	66	30	68	72
	Missing	3	6	42	4	0
<b>Statistics</b>						
			Changes Management Water Resources	If Yes Which Changes	If Yes Which Changes 2	
N	Valid		69	65	32	
	Missing		3	7	40	

### Frequency Table

		Frequency	Percent	Valid Percent	Cumulative Percent
<b>Gender Respondent</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	40	55.6	55.6	55.6
	Female	32	44.4	44.4	100.0
	Total	72	100.0	100.0	
<b>Relationship To Household Head</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Head	36	50.0	50.0	50.0
	Spouse	28	38.9	38.9	88.9
	Son/ Daughter	3	4.2	4.2	93.1
	Grand Child	1	1.4	1.4	94.4
	Father/ Mother	3	4.2	4.2	98.6
	22.00	1	1.4	1.4	100.0
	Total	72	100.0	100.0	

		Frequency	Percent	Valid Percent	Cumulative Percent
<b>Age</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	17.00	1	1.4	1.4	1.4
	25.00	2	2.8	2.8	4.2
	28.00	3	4.2	4.2	8.5
	30.00	5	6.9	7.0	15.5
	31.00	1	1.4	1.4	16.9
	32.00	1	1.4	1.4	18.3
	33.00	1	1.4	1.4	19.7
	35.00	3	4.2	4.2	23.9
	36.00	1	1.4	1.4	25.4
	37.00	2	2.8	2.8	28.2
	38.00	2	2.8	2.8	31.0
	40.00	1	1.4	1.4	32.4
	41.00	1	1.4	1.4	33.8
	42.00	4	5.6	5.6	39.4
	44.00	4	5.6	5.6	45.1
	45.00	4	5.6	5.6	50.7
	46.00	4	5.6	5.6	56.3
	48.00	3	4.2	4.2	60.6
	49.00	3	4.2	4.2	64.8
	50.00	1	1.4	1.4	66.2
	51.00	1	1.4	1.4	67.6
	52.00	3	4.2	4.2	71.8
	54.00	2	2.8	2.8	74.6
	55.00	2	2.8	2.8	77.5
	56.00	1	1.4	1.4	78.9
57.00	1	1.4	1.4	80.3	
58.00	4	5.6	5.6	85.9	
59.00	3	4.2	4.2	90.1	
60.00	1	1.4	1.4	91.5	
62.00	1	1.4	1.4	93.0	
65.00	1	1.4	1.4	94.4	
66.00	1	1.4	1.4	95.8	
68.00	1	1.4	1.4	97.2	
72.00	1	1.4	1.4	98.6	
75.00	1	1.4	1.4	100.0	
<b>Age</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Total	71	98.6	100.0	

		Frequency	Percent	Valid Percent	Cumulative Percent
Missing	System	1	1.4		
Total		72	100.0		
Marital Status					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Married	64	88.9	90.1	90.1
	Separated	2	2.8	2.8	93.0
	Widower	5	6.9	7.0	100.0
	Total	71	98.6	100.0	
Missing	System	1	1.4		
Total		72	100.0		
Occupation					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Farming	54	75.0	75.0	75.0
	Trading	7	9.7	9.7	84.7
	Artisan	1	1.4	1.4	86.1
	Casual	1	1.4	1.4	87.5
	Salaried	6	8.3	8.3	95.8
	Unemployed	1	1.4	1.4	97.2
	Student	1	1.4	1.4	98.6
	11.00	1	1.4	1.4	100.0
	Total	72	100.0	100.0	
Education					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No schooling	1	1.4	1.4	1.4
	Lower primary	2	2.8	2.8	4.2
	Upper primary	21	29.2	29.6	33.8
	Secondary	38	52.8	53.5	87.3
	College	5	6.9	7.0	94.4
	University	4	5.6	5.6	100.0
	Total	71	98.6	100.0	
Missing	System	1	1.4		
Total		72	100.0		
Age Below 16					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	4	5.6	6.2	6.2
	1.00	17	23.6	26.2	32.3
	2.00	13	18.1	20.0	52.3
	3.00	8	11.1	12.3	64.6

		Frequency	Percent	Valid Percent	Cumulative Percent
	4.00	9	12.5	13.8	78.5
	5.00	9	12.5	13.8	92.3
	6.00	3	4.2	4.6	96.9
	7.00	1	1.4	1.5	98.5
	10.00	1	1.4	1.5	100.0
	Total	65	90.3	100.0	
Missing	System	7	9.7		
Total		72	100.0		
<b>Age 16 to 20</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	8	11.1	13.8	13.8
	1.00	17	23.6	29.3	43.1
	2.00	22	30.6	37.9	81.0
	3.00	8	11.1	13.8	94.8
	4.00	2	2.8	3.4	98.3
	6.00	1	1.4	1.7	100.0
	Total	58	80.6	100.0	
Missing	System	14	19.4		
Total		72	100.0		
<b>Age 21 to 25</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	13	18.1	25.0	25.0
	1.00	17	23.6	32.7	57.7
	2.00	17	23.6	32.7	90.4
	3.00	1	1.4	1.9	92.3
	4.00	2	2.8	3.8	96.2
	5.00	2	2.8	3.8	100.0
	Total	52	72.2	100.0	
Missing	System	20	27.8		
Total		72	100.0		
<b>Age 26 to 30</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	14	19.4	29.2	29.2
	1.00	20	27.8	41.7	70.8
	2.00	10	13.9	20.8	91.7
	3.00	3	4.2	6.3	97.9
	4.00	1	1.4	2.1	100.0
	Total	48	66.7	100.0	
Missing	System	24	33.3		
Total		72	100.0		



		Frequency	Percent	Valid Percent	Cumulative Percent
<b>Age 31 to 35</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	21	29.2	55.3	55.3
	1.00	8	11.1	21.1	76.3
	2.00	9	12.5	23.7	100.0
	Total	38	52.8	100.0	
Missing	System	34	47.2		
Total		72	100.0		
<b>Age 36 to 40</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	15	20.8	42.9	42.9
	1.00	16	22.2	45.7	88.6
	2.00	2	2.8	5.7	94.3
	4.00	1	1.4	2.9	97.1
	6.00	1	1.4	2.9	100.0
	Total	35	48.6	100.0	
Missing	System	37	51.4		
Total		72	100.0		
<b>Age 41 to 50</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	10	13.9	22.2	22.2
	1.00	30	41.7	66.7	88.9
	2.00	4	5.6	8.9	97.8
	3.00	1	1.4	2.2	100.0
	Total	45	62.5	100.0	
Missing	System	27	37.5		
Total		72	100.0		
<b>Age Over 50</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	15	20.8	31.3	31.3
	1.00	24	33.3	50.0	81.3
	2.00	8	11.1	16.7	97.9
	3.00	1	1.4	2.1	100.0
	Total	48	66.7	100.0	
Missing	System	24	33.3		
Total		72	100.0		
<b>Main Source of Income 1</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Farming	57	79.2	79.2	79.2

		Frequency	Percent	Valid Percent	Cumulative Percent
	Casual labour	4	5.6	5.6	84.7
	Business	5	6.9	6.9	91.7
	Employment	5	6.9	6.9	98.6
	Others	1	1.4	1.4	100.0
	Total	72	100.0	100.0	
<b>Main Source of Income 2</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Casual labour	1	1.4	25.0	25.0
	Business	1	1.4	25.0	50.0
	Employment	2	2.8	50.0	100.0
	Total	4	5.6	100.0	
Missing	System	68	94.4		
Total		72	100.0		
<b>Financial Support 1</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	36	50.0	51.4	51.4
	Church/FBO	3	4.2	4.3	55.7
	Pension	2	2.8	2.9	58.6
	NGOs/CBO	8	11.1	11.4	70.0
	Remittances	3	4.2	4.3	74.3
	Government support	7	9.7	10.0	84.3
	Others	11	15.3	15.7	100.0
	Total	70	97.2	100.0	
Missing	System	2	2.8		
Total		72	100.0		
<b>Financial Support 2</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NGOs/CBO	2	2.8	50.0	50.0
	Remittances	2	2.8	50.0	100.0
	Total	4	5.6	100.0	
Missing	System	68	94.4		
Total		72	100.0		
<b>Total Income Main</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	5	6.9	7.4	7.4
	1000.00	1	1.4	1.5	8.8
	3000.00	3	4.2	4.4	13.2

		Frequency	Percent	Valid Percent	Cumulative Percent
	3500.00	1	1.4	1.5	14.7
	3600.00	1	1.4	1.5	16.2
	4000.00	1	1.4	1.5	17.6
	5000.00	4	5.6	5.9	23.5
	6000.00	6	8.3	8.8	32.4
	7000.00	1	1.4	1.5	33.8
	7500.00	1	1.4	1.5	35.3
	8000.00	1	1.4	1.5	36.8
	8500.00	1	1.4	1.5	38.2
	9000.00	2	2.8	2.9	41.2
	10000.00	8	11.1	11.8	52.9
	11000.00	2	2.8	2.9	55.9
	12000.00	1	1.4	1.5	57.4
	12300.00	1	1.4	1.5	58.8
	13000.00	1	1.4	1.5	60.3
	15000.00	3	4.2	4.4	64.7
	15500.00	1	1.4	1.5	66.2
	15600.00	1	1.4	1.5	67.6
	20000.00	4	5.6	5.9	73.5
	24000.00	1	1.4	1.5	75.0
	30000.00	4	5.6	5.9	80.9
	36000.00	1	1.4	1.5	82.4
	40000.00	2	2.8	2.9	85.3
	50000.00	3	4.2	4.4	89.7
	52000.00	1	1.4	1.5	91.2
	60000.00	3	4.2	4.4	95.6
	64000.00	1	1.4	1.5	97.1
	72000.00	1	1.4	1.5	98.5
	80000.00	1	1.4	1.5	100.0
	Total	68	94.4	100.0	
Missing	System	4	5.6		
Total		72	100.0		
<b>Total Income Other</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	46	63.9	68.7	68.7
	500.00	1	1.4	1.5	70.1
	1000.00	2	2.8	3.0	73.1
	1500.00	2	2.8	3.0	76.1
	1700.00	1	1.4	1.5	77.6
	2000.00	1	1.4	1.5	79.1

		Frequency	Percent	Valid Percent	Cumulative Percent
	3000.00	1	1.4	1.5	80.6
	3360.00	1	1.4	1.5	82.1
	4000.00	1	1.4	1.5	83.6
	4500.00	2	2.8	3.0	86.6
	5000.00	4	5.6	6.0	92.5
	5400.00	1	1.4	1.5	94.0
	6000.00	1	1.4	1.5	95.5
	13000.00	1	1.4	1.5	97.0
	15000.00	1	1.4	1.5	98.5
	20000.00	1	1.4	1.5	100.0
	Total	67	93.1	100.0	
Missing	System	5	6.9		
Total		72	100.0		
<b>Total Income</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	5	6.9	7.4	7.4
	1600.00	1	1.4	1.5	8.8
	3000.00	1	1.4	1.5	10.3
	4000.00	2	2.8	2.9	13.2
	5000.00	4	5.6	5.9	19.1
	5500.00	1	1.4	1.5	20.6
	6000.00	4	5.6	5.9	26.5
	7000.00	1	1.4	1.5	27.9
	7500.00	1	1.4	1.5	29.4
	7700.00	1	1.4	1.5	30.9
	8000.00	1	1.4	1.5	32.4
	8500.00	1	1.4	1.5	33.8
	9000.00	2	2.8	2.9	36.8
	9360.00	1	1.4	1.5	38.2
	10000.00	5	6.9	7.4	45.6
	11000.00	1	1.4	1.5	47.1
	12000.00	1	1.4	1.5	48.5
	13000.00	1	1.4	1.5	50.0
	14500.00	1	1.4	1.5	51.5
	15000.00	4	5.6	5.9	57.4
15500.00	1	1.4	1.5	58.8	
15600.00	1	1.4	1.5	60.3	
17000.00	1	1.4	1.5	61.8	
17300.00	1	1.4	1.5	63.2	
20000.00	3	4.2	4.4	67.6	

		Frequency	Percent	Valid Percent	Cumulative Percent
	24000.00	1	1.4	1.5	69.1
	25000.00	1	1.4	1.5	70.6
	28000.00	1	1.4	1.5	72.1
	30000.00	3	4.2	4.4	76.5
	36000.00	1	1.4	1.5	77.9
	40000.00	2	2.8	2.9	80.9
	41400.00	1	1.4	1.5	82.4
	50000.00	2	2.8	2.9	85.3
	51000.00	1	1.4	1.5	86.8
	52000.00	1	1.4	1.5	88.2
<b>Total Income</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	60000.00	2	2.8	2.9	91.2
	64000.00	2	2.8	2.9	94.1
	65000.00	1	1.4	1.5	95.6
	72000.00	1	1.4	1.5	97.1
	80000.00	1	1.4	1.5	98.5
	100000.00	1	1.4	1.5	100.0
	Total	68	94.4	100.0	
Missing	System	4	5.6		
Total		72	100.0		
<b>Expenses on Education</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	9	12.5	14.5	14.5
	500.00	1	1.4	1.6	16.1
	700.00	1	1.4	1.6	17.7
	1000.00	3	4.2	4.8	22.6
	1200.00	1	1.4	1.6	24.2
	1500.00	1	1.4	1.6	25.8
	2000.00	10	13.9	16.1	41.9
	2500.00	2	2.8	3.2	45.2
	3000.00	4	5.6	6.5	51.6
	4000.00	4	5.6	6.5	58.1
	4500.00	1	1.4	1.6	59.7
	5000.00	2	2.8	3.2	62.9
	6000.00	7	9.7	11.3	74.2
	6500.00	1	1.4	1.6	75.8
	7000.00	1	1.4	1.6	77.4
	8000.00	2	2.8	3.2	80.6
	10000.00	5	6.9	8.1	88.7

		Frequency	Percent	Valid Percent	Cumulative Percent
	11000.00	1	1.4	1.6	90.3
	15000.00	1	1.4	1.6	91.9
	18000.00	1	1.4	1.6	93.5
	20000.00	1	1.4	1.6	95.2
	30000.00	2	2.8	3.2	98.4
	50000.00	1	1.4	1.6	100.0
	Total	62	86.1	100.0	
Missing	System	10	13.9		
Total		72	100.0		
<b>Expenses on Health</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	15	20.8	24.2	24.2
	100.00	2	2.8	3.2	27.4
	200.00	1	1.4	1.6	29.0
	300.00	1	1.4	1.6	30.6
	500.00	8	11.1	12.9	43.5
	800.00	1	1.4	1.6	45.2
	1000.00	17	23.6	27.4	72.6
	1200.00	1	1.4	1.6	74.2
	1500.00	6	8.3	9.7	83.9
	2000.00	6	8.3	9.7	93.5
	3000.00	1	1.4	1.6	95.2
	5000.00	2	2.8	3.2	98.4
	15000.00	1	1.4	1.6	100.0
	Total	62	86.1	100.0	
Missing	System	10	13.9		
Total		72	100.0		
<b>Expenses on Food</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	11	15.3	17.7	17.7
	200.00	2	2.8	3.2	21.0
	300.00	1	1.4	1.6	22.6
	500.00	5	6.9	8.1	30.6
	600.00	1	1.4	1.6	32.3
	900.00	1	1.4	1.6	33.9
	1000.00	6	8.3	9.7	43.5
	1200.00	1	1.4	1.6	45.2
	1500.00	1	1.4	1.6	46.8
	2000.00	4	5.6	6.5	53.2
	3000.00	10	13.9	16.1	69.4

		Frequency	Percent	Valid Percent	Cumulative Percent
	4000.00	5	6.9	8.1	77.4
	4500.00	4	5.6	6.5	83.9
	5000.00	4	5.6	6.5	90.3
	6000.00	3	4.2	4.8	95.2
	9000.00	1	1.4	1.6	96.8
	12000.00	1	1.4	1.6	98.4
	21000.00	1	1.4	1.6	100.0
	Total	62	86.1	100.0	
Missing	System	10	13.9		
Total		72	100.0		
<b>Expenses on Cooking Fuel</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	30	41.7	48.4	48.4
	50.00	1	1.4	1.6	50.0
	100.00	3	4.2	4.8	54.8
	150.00	3	4.2	4.8	59.7
	200.00	5	6.9	8.1	67.7
	300.00	5	6.9	8.1	75.8
	400.00	1	1.4	1.6	77.4
	450.00	1	1.4	1.6	79.0
	500.00	2	2.8	3.2	82.3
	700.00	1	1.4	1.6	83.9
	800.00	1	1.4	1.6	85.5
	900.00	1	1.4	1.6	87.1
	1000.00	1	1.4	1.6	88.7
	2000.00	3	4.2	4.8	93.5
	3000.00	1	1.4	1.6	95.2
	4000.00	1	1.4	1.6	96.8
	5000.00	1	1.4	1.6	98.4
	5500.00	1	1.4	1.6	100.0
	Total	62	86.1	100.0	
Missing	System	10	13.9		
Total		72	100.0		
<b>Expenses on Rent</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	58	80.6	93.5	93.5
	1500.00	1	1.4	1.6	95.2
	2000.00	2	2.8	3.2	98.4
	8000.00	1	1.4	1.6	100.0
	Total	62	86.1	100.0	

		Frequency	Percent	Valid Percent	Cumulative Percent
Missing	System	10	13.9		
Total		72	100.0		
Expenses on Transport					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	32	44.4	51.6	51.6
	200.00	2	2.8	3.2	54.8
	300.00	1	1.4	1.6	56.5
	400.00	3	4.2	4.8	61.3
	500.00	6	8.3	9.7	71.0
	600.00	1	1.4	1.6	72.6
	700.00	1	1.4	1.6	74.2
	1000.00	2	2.8	3.2	77.4
	1500.00	3	4.2	4.8	82.3
	2000.00	1	1.4	1.6	83.9
	2500.00	1	1.4	1.6	85.5
	2700.00	1	1.4	1.6	87.1
	3000.00	2	2.8	3.2	90.3
	4000.00	1	1.4	1.6	91.9
	4500.00	1	1.4	1.6	93.5
	5000.00	1	1.4	1.6	95.2
	6000.00	2	2.8	3.2	98.4
	12000.00	1	1.4	1.6	100.0
Total		62	86.1	100.0	
Missing	System	10	13.9		
Total		72	100.0		
Expenses on Water					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	54	75.0	87.1	87.1
	100.00	3	4.2	4.8	91.9
	200.00	2	2.8	3.2	95.2
	240.00	1	1.4	1.6	96.8
	1000.00	1	1.4	1.6	98.4
	2000.00	1	1.4	1.6	100.0
	Total		62	86.1	100.0
Missing	System	10	13.9		
Total		72	100.0		
Expenses on Clothing					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	17	23.6	27.9	27.9
	100.00	1	1.4	1.6	29.5



		Frequency	Percent	Valid Percent	Cumulative Percent
	200.00	2	2.8	3.3	32.8
	300.00	1	1.4	1.6	34.4
	500.00	6	8.3	9.8	44.3
	600.00	1	1.4	1.6	45.9
	700.00	2	2.8	3.3	49.2
	800.00	3	4.2	4.9	54.1
	900.00	3	4.2	4.9	59.0
	1000.00	7	9.7	11.5	70.5
	1200.00	1	1.4	1.6	72.1
	1500.00	2	2.8	3.3	75.4
	2000.00	5	6.9	8.2	83.6
	2500.00	1	1.4	1.6	85.2
	3000.00	3	4.2	4.9	90.2
	3500.00	1	1.4	1.6	91.8
	4000.00	1	1.4	1.6	93.4
	5000.00	2	2.8	3.3	96.7
	7000.00	1	1.4	1.6	98.4
	12000.00	1	1.4	1.6	100.0
	Total	61	84.7	100.0	
Missing	System	11	15.3		
Total		72	100.0		
<b>Expenses on Others</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	42	58.3	68.9	68.9
	50.00	1	1.4	1.6	70.5
	60.00	1	1.4	1.6	72.1
	100.00	1	1.4	1.6	73.8
	200.00	2	2.8	3.3	77.0
	300.00	1	1.4	1.6	78.7
	400.00	1	1.4	1.6	80.3
	500.00	1	1.4	1.6	82.0
	700.00	1	1.4	1.6	83.6
	900.00	1	1.4	1.6	85.2
	1500.00	1	1.4	1.6	86.9
	1900.00	1	1.4	1.6	88.5
	3900.00	2	2.8	3.3	91.8
	5500.00	1	1.4	1.6	93.4
	6500.00	1	1.4	1.6	95.1
	20000.00	2	2.8	3.3	98.4
	25000.00	1	1.4	1.6	100.0

		Frequency	Percent	Valid Percent	Cumulative Percent
	Total	61	84.7	100.0	
Missing	System	11	15.3		
Total		72	100.0		
Expenses Total					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.00	5	6.9	8.1	8.1
	1500.00	1	1.4	1.6	9.7
	1600.00	1	1.4	1.6	11.3
	2000.00	2	2.8	3.2	14.5
	3000.00	1	1.4	1.6	16.1
	3500.00	1	1.4	1.6	17.7
	3800.00	1	1.4	1.6	19.4
	4000.00	1	1.4	1.6	21.0
	4050.00	1	1.4	1.6	22.6
	4400.00	1	1.4	1.6	24.2
	4500.00	2	2.8	3.2	27.4
	4700.00	1	1.4	1.6	29.0
	5000.00	2	2.8	3.2	32.3
	5400.00	1	1.4	1.6	33.9
	6000.00	3	4.2	4.8	38.7
	6300.00	1	1.4	1.6	40.3
	7000.00	2	2.8	3.2	43.5
	7750.00	1	1.4	1.6	45.2
	7800.00	1	1.4	1.6	46.8
	8000.00	1	1.4	1.6	48.4
	8800.00	1	1.4	1.6	50.0
	9000.00	2	2.8	3.2	53.2
	10000.00	1	1.4	1.6	54.8
	11500.00	1	1.4	1.6	56.5
	11700.00	1	1.4	1.6	58.1
	13000.00	1	1.4	1.6	59.7
	13800.00	1	1.4	1.6	61.3
14000.00	1	1.4	1.6	62.9	
14500.00	1	1.4	1.6	64.5	
15500.00	2	2.8	3.2	67.7	
16200.00	1	1.4	1.6	69.4	
16500.00	1	1.4	1.6	71.0	
17300.00	1	1.4	1.6	72.6	
19000.00	1	1.4	1.6	74.2	
19650.00	1	1.4	1.6	75.8	

		Frequency	Percent	Valid Percent	Cumulative Percent
<b>Expenses Total</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	19900.00	1	1.4	1.6	77.4
	23500.00	1	1.4	1.6	79.0
	25900.00	1	1.4	1.6	80.6
	26150.00	1	1.4	1.6	82.3
	26600.00	1	1.4	1.6	83.9
	33000.00	1	1.4	1.6	85.5
	36200.00	1	1.4	1.6	87.1
	36500.00	1	1.4	1.6	88.7
	37600.00	1	1.4	1.6	90.3
	40000.00	1	1.4	1.6	91.9
	46000.00	1	1.4	1.6	93.5
	51000.00	1	1.4	1.6	95.2
	58500.00	1	1.4	1.6	96.8
	64000.00	1	1.4	1.6	98.4
	75000.00	1	1.4	1.6	100.0
Total	62	86.1	100.0		
Missing	System	10	13.9		
Total		72	100.0		

**Appendix 4.1.2: Raw Data on Household's Awareness on Environmental Conservation Issues**

<b>Perceptions on State of Environment</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Good	18	25.0	25.0	25.0
	Good	41	56.9	56.9	81.9
	Degraded	12	16.7	16.7	98.6
	Very degraded	1	1.4	1.4	100.0
	Total	72	100.0	100.0	
<b>Perceptions on Quality of Water in Kuywa River</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very good	13	18.1	18.1	18.1
	Good	28	38.9	38.9	56.9
	Fair	22	30.6	30.6	87.5
	Poor	8	11.1	11.1	98.6
	Very poor	1	1.4	1.4	100.0
	Total	72	100.0	100.0	
<b>Availability of Water</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Reliable	33	45.8	45.8	45.8
	Reliable	37	51.4	51.4	97.2
	Unreliable	2	2.8	2.8	100.0
	Total	72	100.0	100.0	
<b>Carry Out Environmental Conservation?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	63	87.5	87.5	87.5
	No	9	12.5	12.5	100.0
	Total	72	100.0	100.0	
<b>If Yes Activities?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Terracing/ contour ploughing	21	29.2	32.8	32.8
	Indigenous trees planting	32	44.4	50.0	82.8
	Rain Water Harvesting	5	6.9	7.8	90.6
	Conservation of Riparian lands	1	1.4	1.6	92.2
	Organic farming	3	4.2	4.7	96.9
	Others	2	2.8	3.1	100.0

	Total	64	88.9	100.0	
Missing	System	8	11.1		
Total		72	100.0		
<b>If Yes Activities 2</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Indigenous trees planting	16	22.2	44.4	44.4
	Rain Water Harvesting	5	6.9	13.9	58.3
	Conservation of Riparian lands	8	11.1	22.2	80.6
	Organic farming	7	9.7	19.4	100.0
	Total	36	50.0	100.0	
Missing	System	36	50.0		
Total		72	100.0		
<b>If No Why?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Shortage of finance	2	2.8	25.0	25.0
	Shortage of land	3	4.2	37.5	62.5
	Lack of Awareness	3	4.2	37.5	100.0
	Total	8	11.1	100.0	
Missing	System	64	88.9		
Total		72	100.0		
<b>If Yes Goods Gotten</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Water for domestic use	20	27.8	31.3	31.3
	Fuel wood	32	44.4	50.0	81.3
	Raw materials for commercial use	1	1.4	1.6	82.8
	Raw materials for domestic use	8	11.1	12.5	95.3
	Fishing	1	1.4	1.6	96.9
	Food Crops	2	2.8	3.1	100.0
	Total	64	88.9	100.0	
Missing	System	8	11.1		
Total		72	100.0		
<b>If Yes Goods Gotten 2</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Fuel wood	12	16.7	33.3	33.3

	Raw materials for commercial use	2	2.8	5.6	38.9
	Raw materials for domestic use	20	27.8	55.6	94.4
	Fishing	1	1.4	2.8	97.2
	Grazing lands	1	1.4	2.8	100.0
	Total	36	50.0	100.0	
Missing	System	36	50.0		
Total		72	100.0		
<b>Member Environmental Conservation Group?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	56	77.8	78.9	78.9
	No	15	20.8	21.1	100.0
	Total	71	98.6	100.0	
Missing	System	1	1.4		
Total		72	100.0		
<b>If Yes Activities Carried Out</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Tree Nursery	17	23.6	30.4	30.4
	Education and Awareness creation	9	12.5	16.1	46.4
	Lobbying and Advocacy	4	5.6	7.1	53.6
	Tree planting	25	34.7	44.6	98.2
	Other	1	1.4	1.8	100.0
	Total	56	77.8	100.0	
Missing	System	16	22.2		
Total		72	100.0		
<b>If Yes Activities Carried Out 2</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Education and Awareness creation	3	4.2	10.0	10.0
	Lobbying and Advocacy	6	8.3	20.0	30.0
	Tree planting	14	19.4	46.7	76.7
	Beautification	6	8.3	20.0	96.7
	Other	1	1.4	3.3	100.0
	Total	30	41.7	100.0	
Missing	System	42	58.3		
Total		72	100.0		
<b>Are You Aware of Kuywa WRUA?</b>					

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	64	88.9	88.9	88.9
	No	8	11.1	11.1	100.0
	Total	72	100.0	100.0	
<b>If Yes, Where You Involved in its Formation?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Participated fully in its development	20	27.8	31.7	31.7
	Attended consultation meeting	28	38.9	44.4	76.2
	Was a respondent to a questionnaire	3	4.2	4.8	81.0
	Participated in validation meeting	3	4.2	4.8	85.7
	Not involved in any way	7	9.7	11.1	96.8
	Other	2	2.8	3.2	100.0
	Total	63	87.5	100.0	
Missing	System	9	12.5		
Total		72	100.0		
<b>Environmental Problems Affecting the Kuywa Sub-basin 1</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Water pollution	30	41.7	41.7	41.7
	Deforestation	12	16.7	16.7	58.3
	Soil erosion	17	23.6	23.6	81.9
	Riparian/ wetland cultivation	4	5.6	5.6	87.5
	Siltation of the river water	4	5.6	5.6	93.1
	Poor agricultural yields	3	4.2	4.2	97.2
	Inadequate water for all	1	1.4	1.4	98.6
	Other	1	1.4	1.4	100.0
	Total	72	100.0	100.0	
<b>Environmental Problems Affecting the Kuywa Sub-basin 2</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Water pollution	1	1.4	3.1	3.1
	Deforestation	11	15.3	34.4	37.5
	Soil erosion	4	5.6	12.5	50.0
	Riparian/ wetland cultivation	6	8.3	18.8	68.8
	Siltation of the river water	7	9.7	21.9	90.6

	Poor agricultural yields	2	2.8	6.3	96.9
	Inadequate water for all	1	1.4	3.1	100.0
	Total	32	44.4	100.0	
Missing	System	40	55.6		
Total		72	100.0		
<b>Environmental Problems Affecting the Kuywa Sub-basin 3</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Deforestation	1	1.4	3.8	3.8
	Soil erosion	11	15.3	42.3	46.2
	Riparian/ wetland cultivation	5	6.9	19.2	65.4
	Siltation of the river water	7	9.7	26.9	92.3
	Poor agricultural yields	1	1.4	3.8	96.2
	Inadequate water for all	1	1.4	3.8	100.0
	Total	26	36.1	100.0	
Missing	System	46	63.9		
Total		72	100.0		
<b>Causes of Pollution of River Kuywa 1</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bathing and washing clothes in the river	32	44.4	44.4	44.4
	Overflowing sewage from homes	5	6.9	6.9	51.4
	Dumping of solid waste	7	9.7	9.7	61.1
	Chemicals and fertilizers from farms	15	20.8	20.8	81.9
	Pollution from institutions and factories	13	18.1	18.1	100.0
	Total	72	100.0	100.0	
<b>Causes of Pollution of River Kuywa 2</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bathing and washing clothes in the river	1	1.4	2.9	2.9
	Overflowing sewage from homes	4	5.6	11.8	14.7
	Dumping of solid waste	5	6.9	14.7	29.4
	Chemicals and fertilizers from farms	17	23.6	50.0	79.4



	Pollution from institutions and factories	7	9.7	20.6	100.0
	Total	34	47.2	100.0	
Missing	System	38	52.8		
Total		72	100.0		
<b>Causes of Pollution of River Kuywa 3</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bathing and washing clothes in the river	1	1.4	4.5	4.5
	Overflowing sewage from homes	1	1.4	4.5	9.1
	Dumping of solid waste	7	9.7	31.8	40.9
	Chemicals and fertilizers from farms	3	4.2	13.6	54.5
	Pollution from institutions and factories	10	13.9	45.5	100.0
	Total	22	30.6	100.0	
Missing	System	50	69.4		
Total		72	100.0		
<b>Is Kuywa WRUA Doing Enough to Conserve the Sub-basin?</b>					
		<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
Valid	Yes	48	66.7	73.8	73.8
	No	17	23.6	26.2	100.0
	Total	65	90.3	100.0	
Missing	System	7	9.7		
Total		72	100.0		
<b>If No Why</b>					
		Frequency		Percent	
Missing	System	72		100.0	

### Appendix 4.1.3: Raw Data on KUWRUA's Activities and their impact on the ground

<b>Aware of any Kuywa WRUA's Activities to Conserve the Sub-basin?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	66	91.7	94.3	94.3
	No	4	5.6	5.7	100.0
	Total	70	97.2	100.0	
Missing	System	2	2.8		
Total		72	100.0		
<b>If Yes, Which Activity?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Planting Indigenous trees	58	80.6	87.9	87.9
	Building gabions/terraces	1	1.4	1.5	89.4
	Awareness creation	5	6.9	7.6	97.0
	Water quality surveys	2	2.8	3.0	100.0
	Total	66	91.7	100.0	
Missing	System	6	8.3		
Total		72	100.0		
<b>If Yes, Which Activity 2?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Remove eucalyptus trees on river banks	10	13.9	25.6	25.6
	Building gabions/terraces	16	22.2	41.0	66.7
	Awareness creation	13	18.1	33.3	100.0
	Total	39	54.2	100.0	
Missing	System	33	45.8		
Total		72	100.0		
<b>Aware of Illegal Water Abstractors?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	12	16.7	18.2	18.2
	No	44	61.1	66.7	84.8
	Don't Know	10	13.9	15.2	100.0
	Total	66	91.7	100.0	
Missing	System	6	8.3		
Total		72	100.0		

<b>Aware of any Kuywa WRUA's Activity to Curb Deforestation?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	66	91.7	95.7	95.7
	No	3	4.2	4.3	100.0
	Total	69	95.8	100.0	
Missing	System	3	4.2		
Total		72	100.0		
<b>If Yes, Activities to Curb Deforestation 1</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Tree Planting	51	70.8	77.3	77.3
	Fencing off forested areas	3	4.2	4.5	81.8
	Awareness creation	9	12.5	13.6	95.5
	Reporting illegal loggers	3	4.2	4.5	100.0
	Total	66	91.7	100.0	
Missing	System	6	8.3		
Total		72	100.0		
<b>If Yes, Activities to Curb Deforestation 2</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Tree Planting	2	2.8	6.7	6.7
	Fencing off forested areas	6	8.3	20.0	26.7
	Awareness creation	17	23.6	56.7	83.3
	Reporting illegal loggers	5	6.9	16.7	100.0
	Total	30	41.7	100.0	
Missing	System	42	58.3		
Total		72	100.0		
<b>Aware of any Kuywa WRUA's Activities to reduce gully erosion?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	43	59.7	63.2	63.2
	No	11	15.3	16.2	79.4
	Don't Know	14	19.4	20.6	100.0
	Total	68	94.4	100.0	
Missing	System	4	5.6		
Total		72	100.0		
<b>If Yes, Which Activities?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		38	52.8	52.8	52.8
	Building of gabions	1	1.4	1.4	54.2
	Building of gabions	1	1.4	1.4	55.6
	Check dams	1	1.4	1.4	56.9

	Constructed cut-off drains	1	1.4	1.4	58.3
	Constructed gabions	1	1.4	1.4	59.7
	Construction of drains	1	1.4	1.4	61.1
	Cut-off drains	1	1.4	1.4	62.5
	Gabions	1	1.4	1.4	63.9
	Gabions	14	19.4	19.4	83.3
	Gabions	1	1.4	1.4	84.7
	Plant trees	2	2.8	2.8	87.5
	Planted trees	1	1.4	1.4	88.9
	Planting grass	1	1.4	1.4	90.3
	Sensitization	1	1.4	1.4	91.7
	Terraces	2	2.8	2.8	94.4
	Terraces	4	5.6	5.6	100.0
	Total	72	100.0	100.0	
<b>Any Changes in Management of Water Resources since WRUA started Operating?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	65	90.3	94.2	94.2
	No	2	2.8	2.9	97.1
	Don't Know	2	2.8	2.9	100.0
	Total	69	95.8	100.0	
Missing	System	3	4.2		
Total		72	100.0		
<b>If Yes, Which Changes?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Reduced illegal water abstraction	10	13.9	15.4	15.4
	Reduced water pollution	11	15.3	16.9	32.3
	Reduced deforestation	26	36.1	40.0	72.3
	Reduced soil erosion	6	8.3	9.2	81.5
	Increased Awareness about conservation	2	2.8	3.1	84.6
	Reduced riparian land cultivation	8	11.1	12.3	96.9
	Others	2	2.8	3.1	100.0
	Total	65	90.3	100.0	
Missing	System	7	9.7		
Total		72	100.0		
<b>If Yes, Which Changes 2?</b>					

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Reduced water pollution	5	6.9	15.6	15.6
	Reduced deforestation	4	5.6	12.5	28.1
	Reduced soil erosion	5	6.9	15.6	43.8
	Increased Awareness about conservation	16	22.2	50.0	93.8
	Reduced riparian land cultivation	2	2.8	6.3	100.0
	Total	32	44.4	100.0	
Missing	System	40	55.6		
Total		72	100.0		

## Appendix 4.1.4: Summary of Raw Data on Households Survey

DESCRIPTIVES VARIABLES=GenderRespondent RelationshipToHouseholdHead Age MaritalStatus Occupation Education AgeBelow16 Age16to20 Age21to25 Age26to30 Age31to35 Age36to40 Age41to50 AgeOver50 MainSourceofIncome1 MainSourceofIncome2 FinancialSupport1 Financialsupport2 TotalIncomeMain TotalIncomeOther TotalIncome ExpensesEducation ExpensesHealth ExpensesFood ExpensesCookingFuel ExpensesRent ExpensesTransport ExpensesWater ExpensesClothing ExpensesOthers ExpensesTotal StateofEnvironment QualityofWater AvailabilityofWater CarryEnvironmentConservation IfYesActivities IfYesActivities2 IfNoWhy IfYesGoodsGotten IfYesGoodsGotten2 MemberEnvironConservation IfYesActivitiesCarriedOut IfYesActivitiesCarriedOut2 KuywaWRUA IfYesInvolvedFormation EnvironProbs1 EnvironProbs2 EnvironProbs3 Causesofpollution1 CausesofPollution2 CausesofPollution3 DoingEnoughToConserve NoWhy ActivityWRUAResource IfYesResourceMgtActivity IfYesResourceMgtActivity2 IllegalWaterAbstractors IfYesWhathasbeendone ActivityCurbdeforestation IfYesActivitiestoCurbDeforestation1 IfYesActivitiestoCurbDeforestation2 Activitiestoreducegullyerosion ChangesManagementWaterResources IfYesWhichChanges IfYesWhichChanges2  
STATISTICS=MEAN STDDEV MIN MAX.

### Descriptives

Notes		
Output Created		18-FEB-2016 13:03:25
Comments		
Input	Data	C:\Users\Maureen\Desktop\KUYWA PROJECT\KUYWA OVERALL
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	All non-missing data are used.
Notes		

Syntax	DESCRIPTIVES VARIABLES=GenderRespondent RelationshipToHouseholdHead Age MaritalStatus Occupation Education AgeBelow16 Age16to20 Age21to25 Age26to30 Age31to35 Age36to40 Age41to50 AgeOver50 MainSourceofIncome1 MainSourceofIncome2 FinancialSupport1 Financialsupport2 TotalIncomeMain TotalIncomeOther TotalIncome ExpensesEducation ExpensesHealth ExpensesFood ExpensesCookingFuel ExpensesRent ExpensesTransport ExpensesWater ExpensesClothing ExpensesOthers ExpensesTotal StateofEnvironment QualityofWater AvailabilityofWater CarryoutEnvironmentConservation IfYesActivities IfYesActivities2 IfNoWhy IfYesGoodsGotten IfYesGoodsGotten2 MemberEnvironmentalConservation IfYesActivitiesCarriedOut IfYesActivitiesCarriedOut2 KuywaWRUA IfYesInvolvedFormation EnvironProbs1 EnvironProbs2 EnvironProbs3 Causesofpollution1 CausesofPollution2 CausesofPollution3 DoingEnoughtoConserve NoWhy ActivityWRUAResource IfYesResourceMgtActivity IfYesResourceMgtActivity2 IllegalWaterAbstractors IfYesWhathasbeendone ActivityCurbdeforestation IfYesActivitiestoCurbDeforestation1 IfYesActivitiestoCurbDeforestation2 Activitiestoreducegullyerosion ChangesManagementWaterResources IfYesWhichChanges IfYesWhichChanges2 STATISTICS=MEAN STDDEV MIN MAX.
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**Notes**

Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.04

<b>Descriptive Statistics</b>					
	N	Minimum	Maximum	Mean	Std. Deviation
Gender Respondent	72	1.00	2.00	1.4444	.50039
Re/ship To Household Head	72	1.00	22.00	2.0278	2.64294
Age	71	17.00	75.00	45.5352	12.21455
Marital Status	71	2.00	4.00	2.1690	.53415
Occupation	72	1.00	11.00	1.7917	1.80716
Education	71	1.00	6.00	3.7887	.89308

Age Below 16	65	.00	10.00	2.8154	1.98347
Age 16 to20	58	.00	6.00	1.7069	1.15483
Age 21 to 25	52	.00	5.00	1.3846	1.22320
Age 26 to 30	48	.00	4.00	1.1042	.97281
Age 31 to 35	38	.00	2.00	.6842	.84166
Age 36 to 40	35	.00	6.00	.8571	1.21614
Age 41 to 50	45	.00	3.00	.9111	.63325
Age Over 50	48	.00	3.00	.8958	.75059
Main Source of Income 1	72	1.00	7.00	1.5556	1.28796
Main Source of Income 2	4	2.00	5.00	3.7500	1.50000
Financial Support 1	70	1.00	7.00	3.0571	2.42502
Financial Support 2	4	4.00	5.00	4.5000	.57735
Total Income Main	68	.00	80000.00	18816.1765	19825.47442
Total Income Other	67	.00	20000.00	1611.3433	3642.40384
Total Income	68	.00	100000.00	22153.8235	22596.87952
Expenses Education	62	.00	50000.00	5966.1290	8458.73190
Expenses Health	62	.00	15000.00	1172.5806	2054.51676
Expenses Food	62	.00	21000.00	2732.2581	3364.31486
Expenses Cooking Fuel	62	.00	5500.00	516.9355	1146.87543
Expenses Rent	62	.00	8000.00	217.7419	1081.21428
Expenses Transport	62	.00	12000.00	1022.5806	2063.37455
Expenses Water	62	.00	2000.00	63.5484	283.91927
Expenses Clothing	61	.00	12000.00	1313.1148	1998.45569
Expenses Others	61	.00	25000.00	1501.8033	4827.17292
Expenses Total	62	.00	75000.00	15412.9032	16692.03191
State of Environment	72	1.00	4.00	1.9444	.68974
Quality of Water	72	1.00	5.00	2.3889	.95763
Availability of Water	72	1.00	3.00	1.5694	.55224
<b>Descriptive Statistics</b>					
	N	Minimum	Maximum	Mean	Std. Deviation
Carry Environment Conservation	72	1.00	2.00	1.1250	.33304
If Yes Activities	64	1.00	6.00	2.0469	1.18763
IfYesActivities2	36	2.00	5.00	3.1667	1.20712
If No Why	8	1.00	4.00	2.5000	1.30931
If Yes Goods Gotten	64	1.00	7.00	2.1562	1.32400
If Yes Goods Gotten 2	36	2.00	6.00	3.3611	1.07312
Member Environmental Conservation Group	71	1.00	2.00	1.2113	.41111



If Yes Activities Carried Out	56	1.00	6.00	2.7321	1.39468
If Yes Activities Carried Out 2	30	2.00	6.00	3.8667	.97320
Kuywa WRUA	72	1.00	2.00	1.1111	.31648
If Yes Involved Formation	63	1.00	6.00	2.2857	1.41909
Environmental Problems 1	72	1.00	8.00	2.4167	1.65937
Environmental Problems 2	32	1.00	7.00	3.5312	1.54470
Environmental Problems 3	26	2.00	7.00	3.9615	1.18257
Causes of Pollution 1	72	1.00	5.00	2.6111	1.63203
Causes of Pollution 2	34	1.00	5.00	3.7353	1.02422
Causes of Pollution 3	22	1.00	5.00	3.9091	1.19160
Doing Enough to Conserve	65	1.00	2.00	1.2615	.44289
If No Why	0				
Activity WRUA Resource	70	1.00	2.00	1.0571	.23379
If Yes Which Activity	66	1.00	5.00	1.3788	1.04903
If Yes Which Activity2	39	2.00	4.00	3.0769	.77407
Illegal Water Abstractors	66	1.00	3.00	1.9697	.58097
If Yes What has been done	0				
Activity Curb deforestation	69	1.00	2.00	1.0435	.20543
If Yes Activities to Curb Deforestation 1	66	1.00	4.00	1.4545	.89755
If Yes Activities to Curb Deforestation 2	30	1.00	4.00	2.8333	.79148
Activities to reduce gully erosion	68	1.00	3.00	1.5735	.81618
Changes Management Water Resources	69	1.00	3.00	1.0870	.37334
If Yes Which Changes	65	1.00	8.00	3.2000	1.69742
<b>Descriptive Statistics</b>					
	N	Minimum	Maximum	Mean	Std. Deviation
If Yes Which Changes 2	32	2.00	6.00	4.1875	1.22967
Valid N (listwise)	0				

## Appendix 4.2: Temporal Analysis of Google Earth Imagery



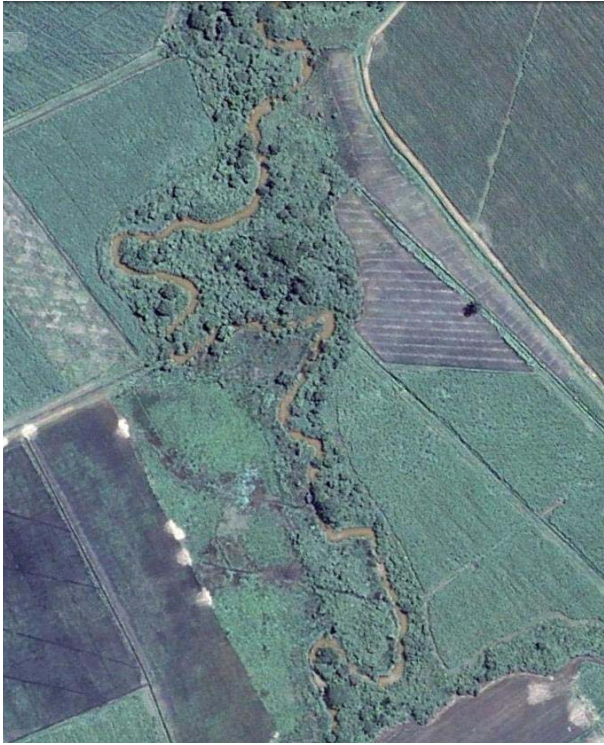
Upper Kuywa April 2001, cultivation close to the river



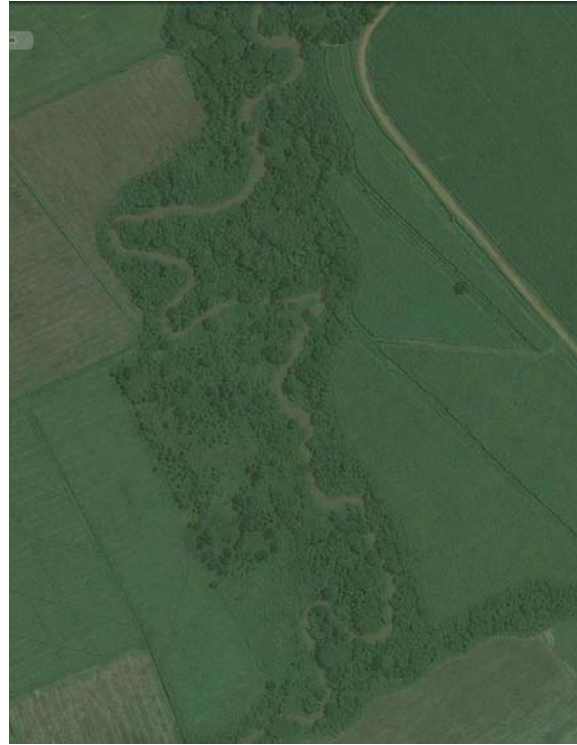
January 2011, after launch of sub-basin protection project



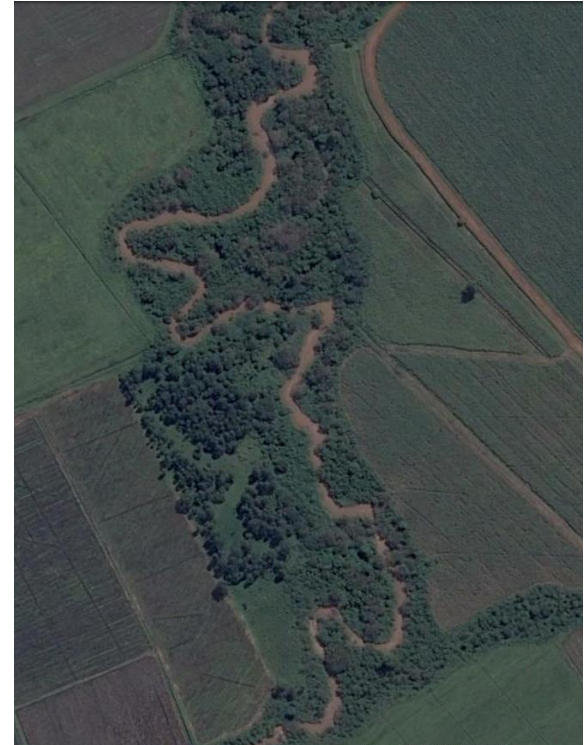
September 2014, enhanced afforestation along the River



Lower Kuywa, April 2001



Lower Kuywa, May 2010



Lower Kuywa, May 2014



Middle Kuywa, April 2001



Middle Kuywa, February 2011 – Increased human settlements.



Middle Kuywa, January 2014 – Increased land fragmentation.