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**WATER RESOURCE MANAGEMENT IN UPPER EWASO NG'IRO  
NORTH CATCHMENT**

*Strategies for Actor collaboration* V

**THESIS**

**By: Sarah T.J Orendo B.A.(Hons.) 1993**

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## DECLARATION

This thesis is my original work and has not been presented for a degree in any other university

Signed oL, Date ^ I ^ J j

Sarah Thecla Orendo  
(Candidate)

This thesis has been submitted for examination with my approval as university supervisor

Signed y Zo-©

Dr. Samuel Obiero  
(Supervisor)

August 2000

### *Dedication*

This work is dedicated to my parents: Late Sebastian Orendo and Mama Clemensia Mong'ina Orendo who bore the burden of bringing me up, and to all my friends and relatives for their unfailing support and inspiration

## ACKNOWLEDGMENTS

I sincerely thank GTZ (Small Towns Development Project) for sponsoring my studies at the university and thus making it possible for me to write this piece of work. I am indebted to Laikipia Research Programme for their contribution to logistical and technical support.

I am grateful to the following organisations, officers and individuals who assisted by availing useful information both in print and as key informants during the study: Ministry of Water Development staff, especially Engineer Wainaina, Ministry of Agriculture Livestock Development staff, Engineer. Getanda of Nyeri, Ewaso Ng'iro North Development Authority officers, Hannah of UNEP library, Macharia Advocates, and NETWAS.

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To all those who have assisted in the completion of this work though not mentioned I thank you all!

## ABBREVIATIONS

ASAL Programme	Arid and Semi Arid Lands Programme, Laikipia
ASALs	Arid and Semi Arid Lands
CBS	Central Bureau of Statistics
DDC	District Development Committee
DEC	District Executive Committee
DFRD	District Focus for Rural Development
DWB	District Water Board
EDI	Economic Development Institute
ENNC	Ewaso Ng'iro North Catchment
ENNDA	Ewaso Ng'iro North development Authority
ENNCB	Ewaso Ng'iro North Catchment Board
GOK	Government of Kenya
JICA	Japan International Cooperation Agency
KEFRI	Kenya Forest Research Institute
LAs	Local Authorities
LRP	Laikipia Research Programme
MOALDM	Ministry of Agriculture, Livestock Development and Marketing
MOE	Ministry of Environment
MOENR	Ministry of Environment and Natural Resources
MOLS	Ministry of Lands and Settlement
MOWD	Ministry of Water Development
NEAP	National Environment Action Plan
NGOs	Non Governmental Organisations
NIB	National Irrigation Board
NRM3	Natural Resources Management Modeling and Monitoring
OECD	Organisation for Economic Co-operation and Development
SARDEP	Semi Arid Rural Development Programme
UNDP	United Nations Development Programme
SISDO	Small Holder Irrigation Schemes Development Organisation
UNEP	United Nations Environment Programme

## ABSTRACT

The Ewaso Ng'iro River basin, the largest of the six basins in Kenya suffers from water scarcity. Rainfall is low and unreliable and poorly distributed. The basin consists of both arable and arid lands but arid zone occupies the largest portion. The poor water management both at local and institutional levels are due to uncoordinated activities resulting in conflicts among water users on one hand and water managers on the other. The paper analyses the roles of the different water actors, their areas of collaboration, and possible conflicts. It also addresses the legal aspects of water and their shortcomings.

The study found out that there are very many institutions engaged in water management; and each of these institutions have their respective laws governing their operations. The laws governing their operation are scattered in several Acts of Parliament, giving responsibilities to several actors thereby making it difficult for an actor to perform effectively without the others. In addition, the Institutions perform functions, which are related but they do not collaborate. Apart from the institutional and the legal framework, there are other factors that influence water management namely increasing population, increasing economic activities, land use changes, and household perceptions.

The study concluded that the uncoordinated nature of the various institutions in Upper Ewaso Ng'iro North catchment, their approaches to water management and perceptions cannot ensure sustainable water resource management. The conflicting water related laws worsen the situation.

The study recommends an integrated approach to water resource management by all the agencies dealing with water. Further, specific roles should be defined and allocated to specific actors. For instance, the central government should take up regulatory roles and leave supply to other actors among them the Water Users Associations, the water undertakers and Non Governmental Organisations to name but a few. Since the problem of planning for water is due to institutions and the people, the study recommends a dual approach to planning, namely, supply and demand oriented approaches. This will ensure conservation measures are taken seriously so as to improve efficiency of water use. At the district level, the District Planning Unit should co-ordinate all activities within the district to ensure that efforts are not duplicated by the various agencies. Each agency should operate in one sector and limit its operation in certain designated areas to avoid duplication of efforts.

The laws on water should be harmonized with the Water Act. In addition, land laws should also be reviewed as a prerequisite to solving water management problems in the Upper Ewaso Ng'iro Catchment.

It is by focussing on institutions managing water that Kenya will see clearly the political and policy implications of sound water management and thus enhance its vision on poverty eradication.

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## CHAPTER ONE

### 1.1 INTRODUCTION

Water is said to be the most plentiful of all resources within the earth, its total amount being estimated at  $1.4 \times 10^9$  cubic Km. However, more than 97% is found in the oceans and there is only a small proportion of fresh water (Baumgartner and Reichel, 1975). Out of the fresh water less than 1% is available for human use in streams, lakes, rivers, swamps and ground water. This 1% is considered adequate as stated by the UN conference in 1977:

**Globally, there may be enough water to meet forthcoming needs but frustratingly, it tends to be available in the wrong places at the wrong time in the wrong quantity. In one way or another all societies are affected however rich however poor (Baumgartner et .al, 1975)**

Despite the water resources being plentiful, the problems of water shortages are increasing. Africa's situation and indeed this is true for Kenya is worse than the other continents given that most of the continent falls within the sahel and the desert regions as opposed to equatorial wet regions. In Kenya, the arid and semi-arid lands (ASALs) make up 80% of the country's land surface. This situation is coupled with the fact that Kenya's population doubles every ten years and one of the countries with the highest population growth rates. The current population growth rate is estimated at between 2.5- 2.9% per year (GoK, 1996). This is a

decline given that the intercensal growth rates for 1979 and 1989 was 3.9% and 3.4% respectively. Though this is welcome sign of demographic transition in Kenya, migration will continue to be a major factor. Population increases in most ASAL areas is due to immigration from the high potential areas where population growth rates are high, i.e. 7-8% per annum. This has led to migrations from the densely populated areas to the relatively less densely populated areas. The less densely populated areas happen to be the ASALs, which carry more than 25% of the total human population and slightly more than half of the livestock population. ASAL areas are increasingly becoming important not only due to their livestock production but their increasing accommodation of the ever-increasing migrant population.

The study area, which is the Upper Ewaso Ng'iro North Basin falls within a highland-lowland system that cuts across a relatively high potential and an ASAL area. Increasingly, over the years, due to population explosion people especially from neighbouring relatively high potential areas of Meru, Nakuru, Murang'a, Nyandarua, Kiambu and Nyeri district have migrated to Laikipia. According to the 1989 census Laikipia District had 218,957 people excluding Nanyuki Township. In 1999, the population was 345,460. This represents an increase by 57.8%, over a period of ten years. The intercensal growth rate was 4.6% (between 1979 and 1989). By the year 2001 and 2002, the district is



expected to have a population of 378,447 and over 395,856, respectively (District Development Plan, 1996). This has caused and will continue causing pressure not only on land but also water resources where the water cycle is definitely interfered with.

Interference to the water cycle in the form of unsustainable water exploitation by the increasing population is likely to destabilise the cycle. A change in water storage quantity results due to the difference between the inputs and the outputs of water (Liniger, 1995). Precipitation for instance is an input while evapotranspiration and runoff is an output. Human utilisation of water means potential for misuse. River basins in particular are subject to misuse owing to the upstream and downstream systems, with human activities upstream having an impact on activities downstream. Management of water becomes very essential to ensure equitable allocation for all users so as resolve conflicts arising out of the differing water demands.

The management of water resources is the responsibility of water institutions be they water users themselves or deciding actors. They are expected to preserve, conserve, and protect available water resources and allocate it in a sustainable, rational and economical way (Republic of Kenya, 1990). However, the institutions do not seem to be performing well because the problems of water

scarcity caused by degradation of quantity and quality still persist. This is in spite of the fact that there is a legislative framework in the form of Acts of Parliament that are supposed to guide and enforce the activities of water management. According to Wiesmann (1997), institutional agencies have not helped Sub Saharan Africa to overcome development crisis. This could be due to the weak institutions coupled with a weak legal framework to manage resources.

It has often been said that institutions' management activities are not in harmony and lack proper co-ordination .The general disharmony results into conflicts and duplication of efforts among institutions. It is for instance possible to find two institutions in the same locality engaged in a similar project but none is aware of the other leading to semi-optimal use of efforts/resources. Institutions' activities could also be concentrated in one area of a catchment at the expense of another. This situation necessitates collaboration which will ensure that scarce resources are allocated more efficiently and equitably. Currently, there is no existing collaborating agency and if it is present its impact has not been felt. The institutions will be looked at in the four levels: national level, regional level, district and, local level institutions.

The legislative framework could be wanting. The Water Act (Cap 372), which is the main Act dealing with water resource management was last reviewed in 1972. It is expected to promote efficient, sustainable and beneficial use of water. This is outdated and lacks clarity. Further, the statutes that are related directly or indirectly to water management are many and contradictory thereby prone to manipulation by water users and law enforcers. The Water Act for instance is supposed to be deterrent enough to water defaulters through penalties charged. In addition enforcement of the regulations should be up to date.

Despite the existence of institutions and legal framework to manage water, the Government of Kenya was not able to achieve its goal of water supply to all by the year 2000 (JICA, 1992). In the current national development plan (1997-2001) the government wishes to provide water for all within reasonable distance (4km) by the year 2010. In addressing this issue, the government has concentrated on construction of water supply projects without taking into account the issue of water conservation measures and distribution. This could be one of the reasons why water resource management has not been sustainable as evidenced by scarcity and drying up of some of the rivers. The study advocates for approaches that address supply and conservation of water while enhancing collaboration among all the stakeholders.

Water and land are closely interrelated. Biswas (1989). notes that it does not make sense planning for water without thinking about land; land and water are to be seen as an interacting and interrelated planning unit. Water degradation for instance can be caused by direct use of water e.g. dams, flood alleviation systems, e.t.c.; or indirectly through human use of other resources such as land and vegetation. Overgrazing could lead to soil erosion due to the decreased ground cover. This reduces infiltration and increases runoff. The result is that water does not get to the water table to feed the aquifer and eroded soils cause silting in the rivers. The institutions are expected to link land use systems with water issues but this becomes difficult when each institution has its own set of uncoordinated policies, regulations and laws governing its operations. In Kenya however, there are separate ministries, departments, technical Institutions, agencies and organisations for each and every known biophysical component of the environment. The Ministry of Agriculture (MOA) deals with soil and water conservation but it hardly has any links with the Ministry of Water Development (MOWD) at policy and technical level. The Ministry of Lands and Settlement (MOLS) is a custodian of land while the MOWD has no powers over the same. Hence the narrow and sectoral approach to resource management.

Water conservation measures have not met with success and this is attributed to peoples' perceptions of the same as a social good and as such, God given.

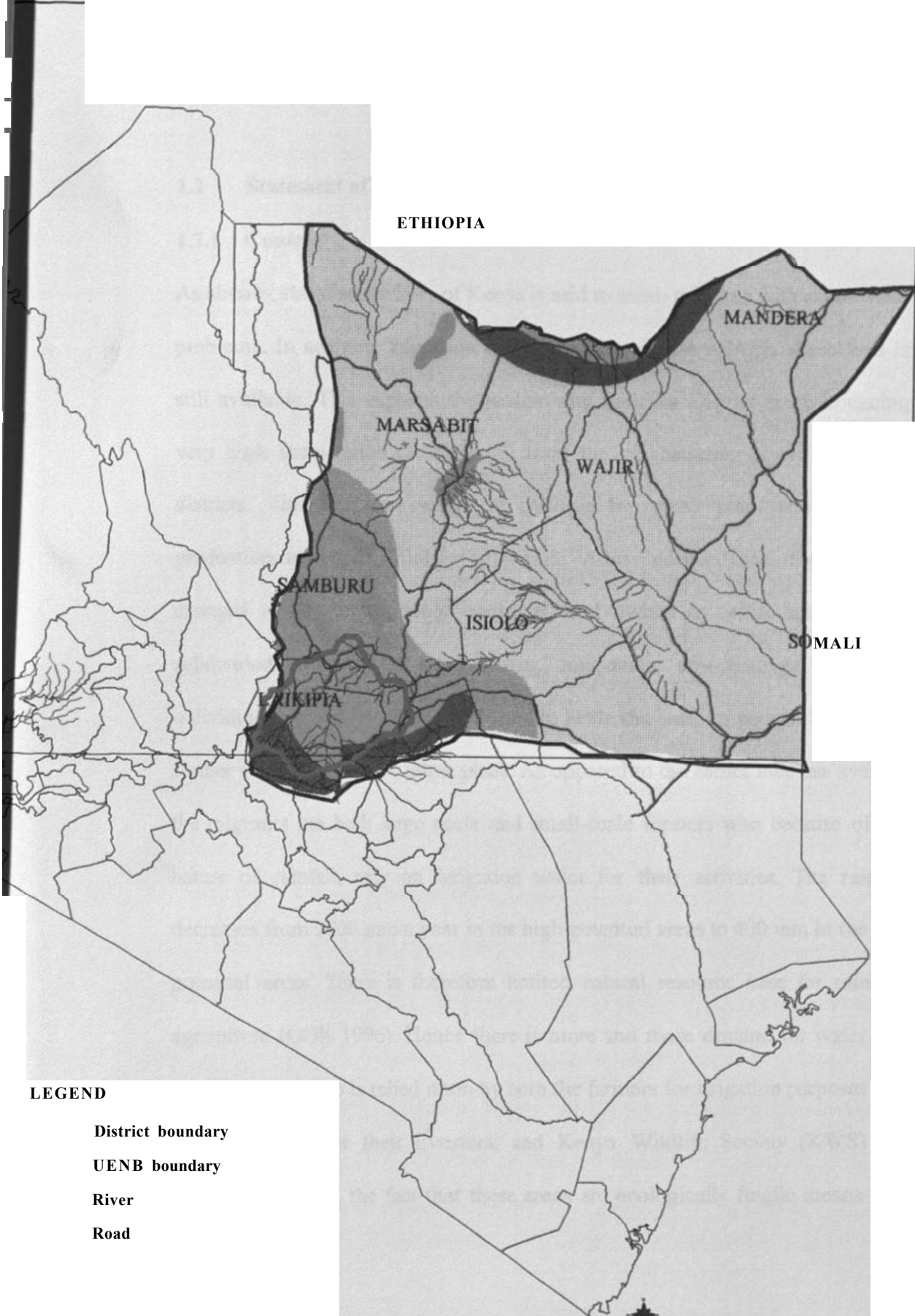
Consequently, people rarely link water with land/ their activities and in case of crop failure, it is attributed to climatic changes and not human activities. The different land uses in the Upper Ewaso Ng'iro North catchment are consequently in disharmony with the available water resources. The establishment of agro-based activities in an ecological zone that formally supported pastoral activities is not sustainable. There is unprecedented abstraction of water from rivers for purposes of irrigation. This is done in a selfish manner that does not take into account the needs of the users downstream. Given that water is likely to be the most significant resource issue of the 21<sup>st</sup> century, then, only if it is viewed as a scarce and a fragile resource to which every person has a basic right to use and conserve will problems of scarcity and unequal distribution be resolved. The study adopts this view.

The above scenario then calls for intervention of both local and external actors in the spirit of partnerships. The external intervention is supposed to ensure that internal and trans-regional demands, which relate to specific and general natural potential outside a particular region, are taken into account in resource allocation.

The study was expected to give insight into water management issues and options for better management strategies within the local context. The study

focused on the Upper Ewaso Ng'iro North Catchment given that water issues are best addressed on a regional context. More emphasis was on the Laikipia district because of various reasons: Although research work by Laikipia Research Programme (LRP) touching on aspects such as water resource management has tended to monitor dynamics beyond the district level, socio-economic characterisation has only been done within the district. Therefore socio-economic data is available at the Laikipia district. Secondly as noted by Kiteme, et al. (1998), Laikipia occupies a unique position in the basin in relation to highland- lowland interaction systems. Resource utilisation, through various land uses upstream, directly affects resource availability in the district. Conversely, resource utilisation in the district directly affects availability in the lower regions. Finally problems of resource management are first addressed at district level and this is in conformity with the District Focus for Rural Development.

Map .1.1 .The Location of Ewaso Ng'iro North River Basin in Kenya



## **1.2 Statement of the Problem**

### **1.2.1 Context**

As already stated above 80% of Kenya is arid to semi- arid area with acute water problems. In addition, migration trends are towards the ASALs where land is still available. This explains the reason why Laikipia District is experiencing very high immigration rates mainly from the neighbouring Nyeri and Meru districts. The land use system in Laikipia for many years was livestock production alongside wildlife habitation. After independence, the scenario changed as the former large tracks of land owned by white settlers were subdivided and sold to land buying companies, co-operatives and even individuals. In addition, there was need to settle the landless people. Since then further subdivisions have taken place. As opposed to the earlier land use system, the migrants are both large scale and small-scale farmers who because of the nature of rainfall, rely on irrigation water for their activities. The rainfall decreases from 1000 mm a year in the high potential areas to 400 mm in the low potential areas. There is therefore limited natural resource base for rain-fed agriculture (GOK 1996). Hence there is more and more demand for water and river Ewaso Ng'iro is relied upon by both the farmers for irrigation purposes and the pastoralists for their livestock and Kenya Wildlife Society (KWS) for wildlife. However, the fact that these areas are ecologically fragile means that



the activities may not be sustainable. The growing population and increasing scarcity of water renders management issues highly complex.

As a result of the above, the study will take the case of river water which is subject to conflicts. To resolve conflicts and ensure sustainable water distribution, effective institutions and enforcement of legal framework are needed. This study will examine the role of institutional set up and legal framework in the management of river water in the upper E.N.N.C.

### **1.2.2 Institutional Arrangements for Water Resource Management**

The success or failure of most projects is highly dependent not only on financial resources, land and labour, or technology but also on the ability of institutions to manage the resources efficiently. Water being the single most constraint in the development of the upper E.N.N.C., it is paramount that the little water available be properly managed. Currently, there are many institutions charged with the responsibility of water resource management for instance MOWD, Ministry of Agriculture Livestock Development and Marketing (MOALDM), Ministry of Environment (MOE) Ministry of Natural Resources (MONR), regional bodies such as ENNDA, ENNCB, and National Irrigation Board (NIB) among others. At the same time, there are NGOs that are directly dealing with water or water related projects such as World Vision, Laikipia Research Programme (LRP) among others. All these institutions have demands and responsibilities, which

require to be harmonised so that their operations are complementary rather than contradictory. Water resource management requires sectoral agencies that are not fragmented. Where disharmony occurs it could easily lead to conflicts as one department tends to emphasise or have bias towards its area of speciality. The MOALDM for example, when considering the interest of downstream users, may only consider such interests as far as livestock and agriculture is concerned. This would be in total disregard to domestic and industrial use (Gatheru and Roberts, 1998).

The study was to establish the extent of duplication of efforts, competition and misallocation of resources and how the same have affected water distribution. Further, water resource management responsibilities could be fragmented amongst sectoral agencies as mentioned and therefore the study was to assess its effect on integrated water resource management. To this end the study will establish the extent to which roles of institutions are not clear. For instance the activities of Ewaso Ng'iro North Development Authority (ENNDA) cut across the administrative boundaries but it has no direct link with the districts within its mandated jurisdiction. On the other hand, the District Development Committee (DDC) is seen as the collaborating forum at the district level. The District Water Board (DWB), which advises the Ewaso Ng'iro North Catchment Board (ENNCB), is not accountable to ENNDA. Some of these institutions may not be

playing any major role in resource management within the districts and the study was to reveal their role if any.

### **1.2.3 Legal Framework for Water Resource Management**

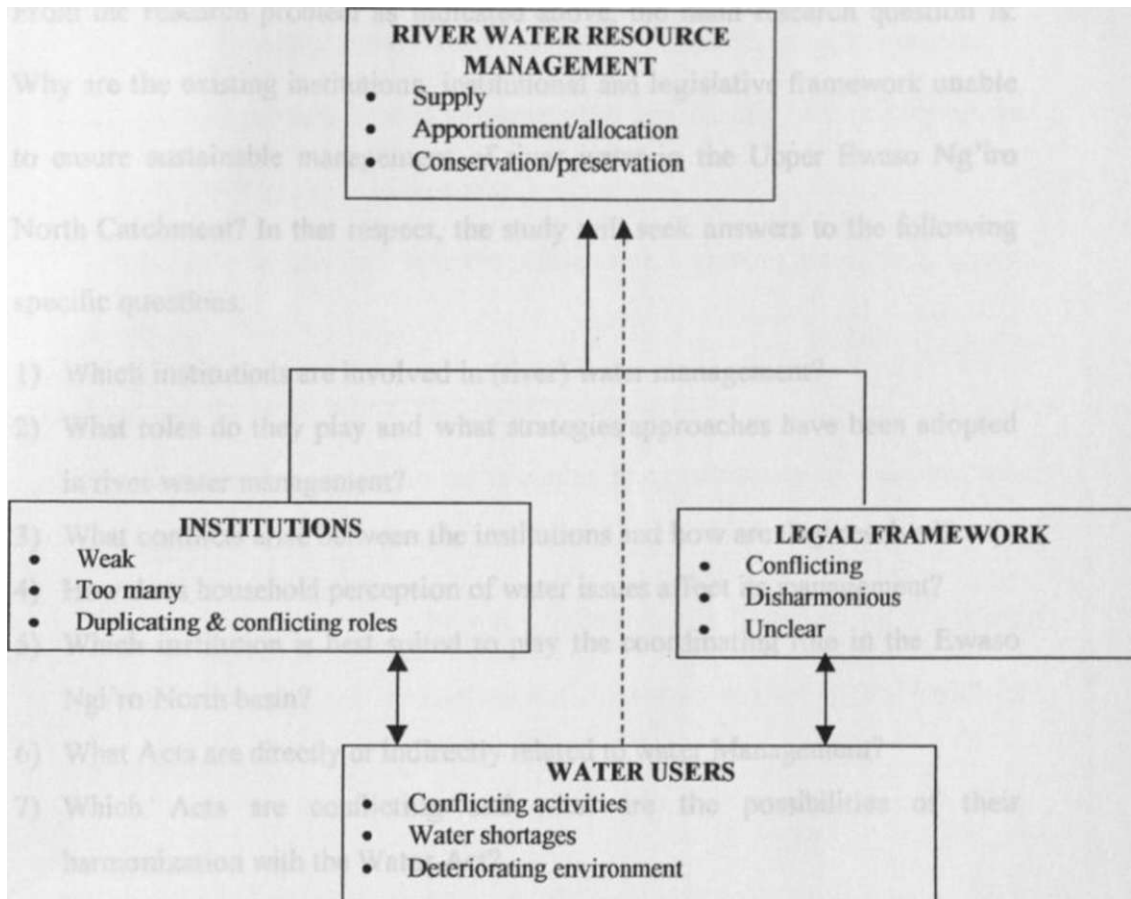
The Water Act (Cap 372) of the Laws of Kenya constitutes the main legal document that guides the management of water resources in Kenya. However according to some scholars the current Water Act falls short of closely facilitating the management of the country's resources (Hijji et al. 1996). Further more, there are other laws touching on the water management issues and there could be a possibility that they were enacted without due regard to the existence of the Water Act. For instance the Forest Conservation Act versus the Agricultural Lands Act for expansion and settlement of the land less. As people settle, they clear forests therefore, infringing on the Forest Conservation Act which emphasises on the need to conserve forests as protection of the catchment area.

What is emerging is that there could be weaknesses in both the institutions that are supposed to manage water and the legal framework that guides their activities. The problems of institutions can not be divorced entirely from those of legislative framework. Thus the problems like lack of: collaboration, coordination, enforcement, water ethic, awareness, stakeholder participation, among others are assumed to be as a result of weaknesses in the duo.

Consequently, the study will assume that these problems contribute to unequal distribution of river water. Of importance is people and institutions' perceptions, attitudes and values as regards natural resources like water, and hence their role in management of the same.

The study presupposes that prevalence of inequity in water distribution in upper E.N.N.C. is due to the weaknesses of both the legal and institutional framework. It assumes that there is lack of collaboration amongst the various actors whose number may not be justifiable. The situation requires a critical examination of the institutions in Upper Ewaso Ngiro North Catchment Basin to find out why they have not been able to solve problems of water. The anti thesis/issue is that there are weak institutions that cannot be able to manage the water resources, and that the legislative framework is in disharmony thus necessitating a change. Fig 1.1 is a diagrammatic representation of the problem.

**Figure 1.1: A Diagrammatic representation of the Problem**



**Source:** Author, 1999 (also refer to the conceptual framework)

The unsustainable management of water in Upper Ewaso Ng'iro Catchment is linked to the increasing demand among all user categories, unequal access to the resources and related conflicts that have not been addressed. The social and institutional organization as suggested by Flury et. al., 1989, does not allow articulation of needs. He concluded that the framework for resource management and planning is inadequate.

### **1.3 Research Questions**

From the research problem as indicated above, the main research question is: Why are the existing institutions, institutional and legislative framework unable to ensure sustainable management of river water in the Upper Ewaso Ng'iro North Catchment? In that respect, the study will seek answers to the following specific questions:

- 1) Which institutions are involved in (river) water management?
- 2) What roles do they play and what strategies/approaches have been adopted in river water management?
- 3) What conflicts arise between the institutions and how are they resolved?
- 4) How does household perception of water issues affect its management?
- 5) Which institution is best suited to play the coordinating role in the Ewaso Ng'iro North basin?
- 6) What Acts are directly or indirectly related to water Management?
- 7) Which Acts are conflicting and what are the possibilities of their harmonization with the Water Act?
- 8) What are the recommendations for appropriate institutional arrangements and legal framework?

### **1.4 Research Objectives**

#### **1.4.1 Broad Objective**

To critically examine the existing institutional arrangement and legal legal framework for water use and management in Upper Ewaso Ng'iro North basin

#### **1.4.1.1 Specific Objectives**

- 1 Identify the existing (river) water management institutions/ water actors.
- 2 Identify the existing Acts of parliament that are directly or indirectly related to river water use and management
- 3 Examine the institutions' operations/roles with a view to identifying areas of conflicts
- 4 Examine the Local actors' role in water management
- 5 Examine the law in as far as it guides the institutions to manage water resource
- 6 Give recommendations on how institutions should be organised to enhance collaboration amongst themselves and. on harmonisation of the legislative framework

#### **1.5 Hypothesis**

- Ho The fact that there are many river water institutions does not make management of river water difficult
- Ho The existence of conflicts between various actors has no relationship to the institutional organization nor the legal Framework
- H<sub>0</sub> The disharmony of water Acts has not contributed to poor river water management

Ho Local actors' perceptions do not have an influence on water resource use and conservation

### **1.6 Justification of Study**

Water has always been a subject of great interest to man since it is essential for human survival. The terrestrial ecosystem can not function without water. Water, according to a Greek Philosopher Pidar of the 5<sup>th</sup> century B.C.; is the best of all things. Water is one of the four components from which all world materials were constituted. The others are air, fire and earth (Greek philosopher Agrigentum (490-430 B.C.) (Biwas K. et. al., 1978). The total volume of water available in the world is fixed and it has been said that only one half of the total constitutes the basic supply available to Man. This makes rational water management crucial.

The environmental degradation and the social and economic marginalisation of inhabitants taking place in Upper Ewaso Ng'iro North Catchment (UENNC) and its surrounding environs is a serious issue which is directly related to problems of water. Agro- pastoral communities whose activities have proved to be incompatible with the ecology of the area have caused these problems. Despite this fact, Kenya is highly dependent on agriculture In Laikipia. the major land use is agriculture divided into small holder farms 26.3%, large farms 56.9% and



pastoralist 7.3% (District Development Plan.. 1996). The area occupied by the above land use is highly dependent on water resource. The main source of water is surface water and ground water. River Ewaso Ng'iro and its tributaries is the most important river in the region. This is for the simple reason that it is readily accessible and does not require a lot of effort of financial, technical and physical nature to tap. Besides, the river meets the highest percentage of water requirements for all users in the Upper Ewaso Ng'iro North Basin. It is for this reason that the study takes the case of river Ewaso Ng'iro. The perennial river also serves both upstream and downstream users. The need for apportionment of the water is important to sustain the two divergent communities in Laikipia.

Perennial rivers are important due to the fact that most communities are not well organised and developed socially and politically. Therefore mobilising local resources to maintain systems like bore holes or small dams is daunting task. In addition, rivers appear to the small holders to be the most reliable.

The high immigration of population means that the catchment encounters high water demands leading to high utilisation. The Highland Lowland system in the Upper North Ng'iro Ewaso basin is undergoing transition. The system varies from the humid highlands of Mt. Kenya to the semi- arid lowland plains (Lniger, H.,1995). There are a number of zones i.e the Afro Alpine Zone which is composed of ice and bare rock; the moorland zone; forest-bamboo zone; and the

dry montane zone. This last zone has been converted to agriculture in many locations, particularly in the northwest slopes. The semi-humid and semi-arid lower slopes and lowlands have come under increasing pressure from intensified agricultural activities. Previously pastoralists used these areas. The forest belt is now under National Park boundary and some part in the north of Mt. Kenya are under crop production. This change could cause conflicts.

Within the forest belt, resource uses are now becoming many. They include conservation of indigenous forest and wildlife, tourism, timber production, forestry and water catchment protection. This zone is experiencing abstraction of river water for irrigation and for urban centres. These activities have implications on the amount of water available not only at this zone but also downstream in the semi-arid to arid lowlands. In the dry periods, nomads and their animals are particularly dependent on the river water. The national parks in the lower parts are also dependent on this same water. The upper part of the basin, which is supposed to protect the ecosystems afforded by perennial flows, attract a number of tourists. All the water demands have to be weighed against one another and the study will propose that it is institutions that are expected to take this role.

Within the highland-lowland system, there have occurred, not only land use changes but ownership distribution. The land use distribution and redistribution during the pre-colonial, colonial, and post colonial led to the emergence of three broad categories of land ownership: pastoralism, large scale ranches and farms, and small scale farms, each of which is characterised by a diversity of land use types (Kiteme, et al., 1998). The division and sub division of land has increased the population densities as people are immigrating to settle in the formally sparsely populated colonial rangeland. Consequently, the need for better water resource management is made even more urgent.

Water is life and without it there would be no life on earth. Every kind of activity/ land use system for instance agriculture, livestock keeping, industrial activities, and domestic activities rely on water. Utilisation of water is for purposes of improvement of social well being, promotion of national economic development, Promotion of regional development, and conservation of environment.

The provision of adequate water, enough to meet the nation's needs is an enormous task and a big challenge. This is the reason why the study looks at regional actors and encourages full participation of the local community and the private sector. The Ewaso Ng'iro River sources its water from Mt. Kenya and

Aberdare Ranges, which are outside Laikipia District. Activities in Nyeri District will affect the quality and quantity of water in Laikipia District.

The choice of institutions is based on the fact that various studies have noted that problems especially in the third world arise from weak institutions especially public institutions. It has also been said that institutions are supposed to manage resources where individuals are unable to do so. Institutions then form a framework within which community resources are managed for the benefit of the whole community.

The case of Upper Ewaso Ng'iro North basin is selected on the basis of its unique characteristics - It is the area whose activities determine the availability or unavailability of water in the rest of the basin. Secondly, it has varying and conflicting economic activities. Thirdly it is an area that is experiencing high migration rates owing to its relatively expansive land. It is also a land of contrast with a very high potential for agriculture in the highland area and low potential in the lowland areas. The institutions' intervention is required in making sure that none of the areas are neglected at the expense of the others.

1.7 Conceptual Framework

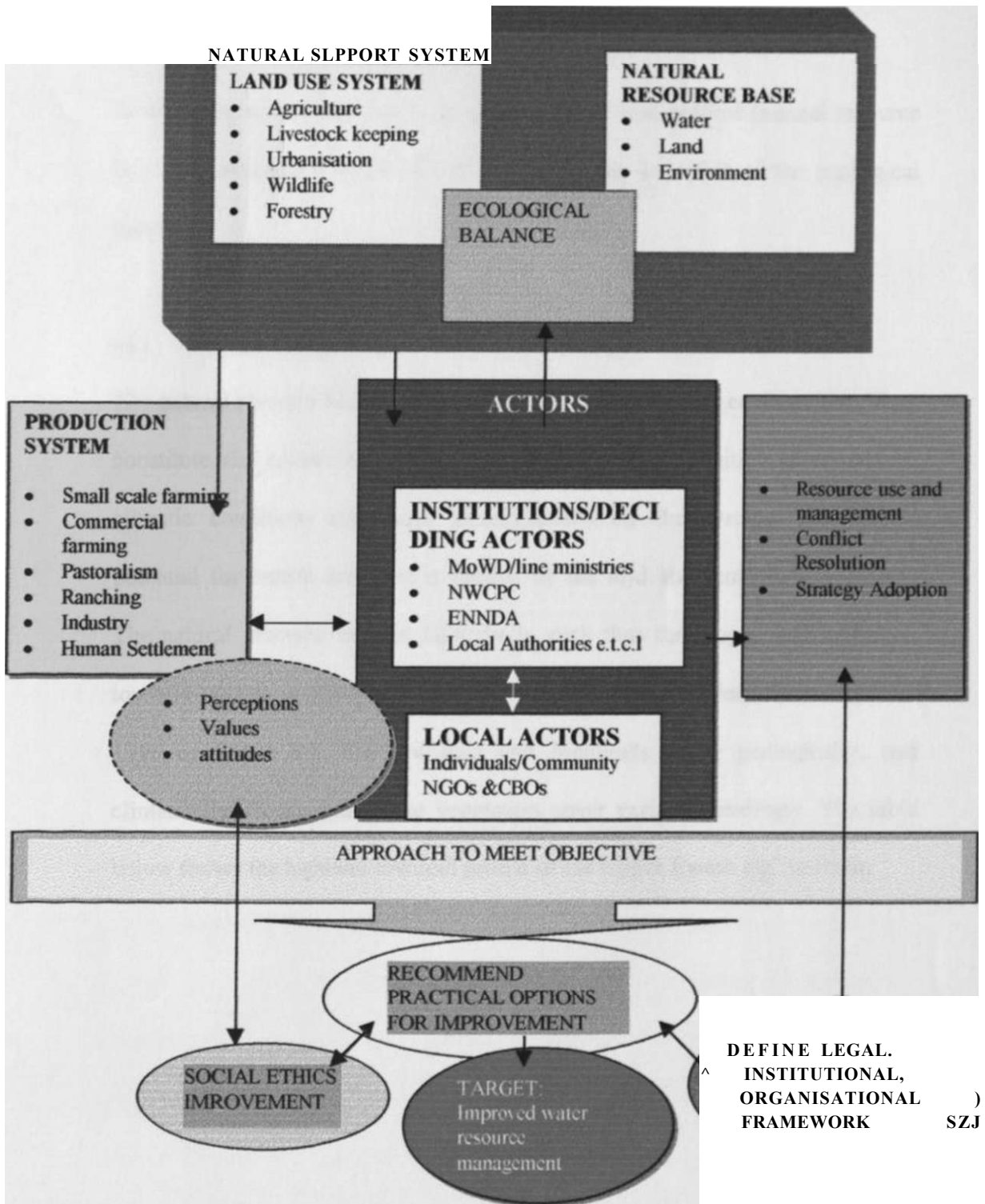


Figure 1.2: conceptual framework

Source: Basic concept from Author and further development from concepts in various LRP books and other publications

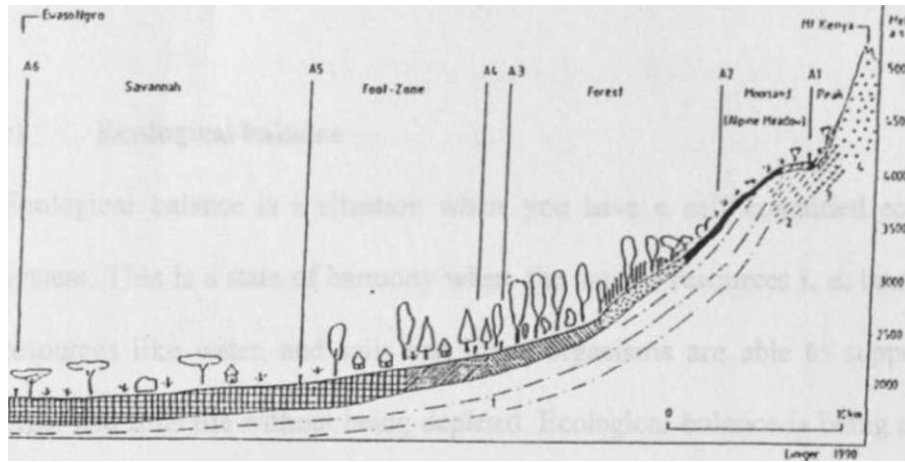
### **1.7.1 Natural Support System**

In this imaginary system, we have an interplay of two systems (natural resource base and land use system) whose interaction has an effect of the ecological balance.

#### **a) Natural resource base**

The natural resource base are Water, land, and generally the environment. They constitute the natural support system. Either human activities or exogenous climatic conditions cause any destabilisation on the system. The natural potential for human activities is limited by the arid and semi-arid conditions. The natural resource base in Laikipia is such that the biophysical highland-lowland system is highly vulnerable to sustainability problems (Kiteme et al. 1998 in Sottas B.). The lowlands and highlands differ geologically, and climatically. Consequently, the vegetation cover varies accordingly. The table below shows the highland-lowland profile of the Upper Ewaso Ng'iro Basin.

**Figure 1.3 The Lowland -Highland Profile of the Upper Ewaso Ng'iro**



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Source: Hanispelcr Liniger, 1995, *Endangered Water- A Global Overview of Degradation.*

*Conflicts and Strategies for Improvement,*

**h) Land use system**

All stakeholders determine the land use system be they planners, public and private institutions, the local people (through their culture and increasing population). The highland- lowland system dictates that the agricultural activities in the lowlands are not sustainable. In addition, the perennial river passes through the highland regions whose activities contribute to reduced

volume or shortages of water in the lowlands leading to destabilisation of nature and thus the ecological balance.

**c) Ecological balance**

Ecological balance is a situation where you have a self contained ecological system. This is a state of harmony where the natural resources i. e. land and its resources like water, and soils and living organisms are able to support each other and thus life without being depleted. Ecological balance is being accepted as constituting a key criterion of all projects and programs of development cooperation and resource management is working towards its achievement. The balance is interfered with when there is an interaction between land use system and the natural resources. People and animals determine the land use system and thus land is either used for agriculture, livestock keeping, forestry, wildlife and urbanization among others. Further, the land use system is greatly influenced by population increase of both people and animals.

**1.7.2 Activity System**

The system involves activities related to direct use and/or managing of the natural resources. This level constitutes of the actors both the deciding and the local actors. The production system has direct link with the both the actors. Perceptions, values and attitudes are influencing the production system through the decisions made by actors



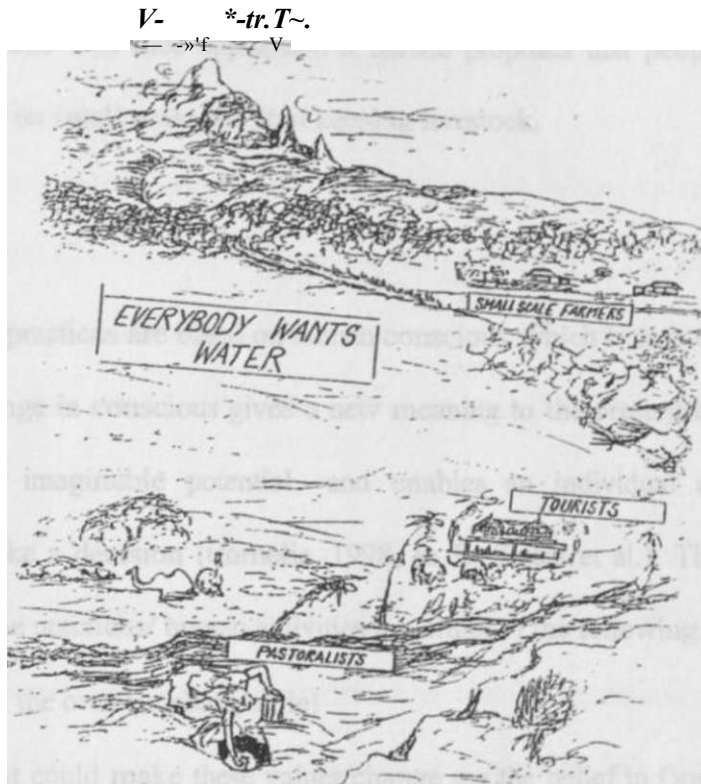
**a) Production system**

There is a direct link between the socio- economic dynamics (human activities) and biophysical processes (natural resources) (Kiteme et. al., 1998). The interaction between the natural system and the land use system leads to production systems. In order for production to take place, water becomes an important input for small-scale farmers, pastoralists and industrialists alike. The competing demand for water between the different producers in the system leads to conflicts. Large scale commercial farming and small scale farming use river water for irrigation, as rainfed agriculture has proved to be inadequate given the low and seasonal nature of rain. According to Wiesmann (1998), human induced ecological change is rooted in the direct and indirect use of natural resources, whether that use is intentional or not. The increasing pressure on land and water by human activities has a significant impact on the ecological system as water and land increasingly become unable to support life; and the activities become unsustainable given the weak ecological system in most of the catchment area.

Maintaining ecological balance therefore depends on ensuring that resource use does not cause depreciation of natural resources thereby affecting the ecological balance. The increasing pressure is well illustrated by a drawing below. It illustrates the Highland- lowland system in Ewaso Ng'iro basin. Every body wants water. Additional demand for water comes from the growing urban areas and industries on the foot slopes of Mt. Kenya.

## 1.4 The Highland-Lowland System in Ewaso Ng'iro Basin.

Different users in the different zones from the highland to the lowland make different demands on water resources. However, downstream users are always affected by uses further upstream.



Source: Hanispeter L., (1995) Endangered Water-A Global Overview of Degradation.

Production system apart from being dependent on the natural resource base, is influenced by the perceptions, values and attitudes of the actors. The decision by actors to for example to practice farming as opposed to livestock keeping is

based on culture and value systems. This is the reason as to why an external intervention to make people change the way of farming for example becomes difficult. For instance one will face opposition if he/she proposes that people stop practising farming on small scale and start keeping livestock.

**b) Perceptions**

According to Satre, all practices are based on human conscious, which is created by imagination. A change in conscious gives a new meaning to the present-by actually changing the imaginable potential -and enables an individual or collective subject to take a decision (Cornelia, 1998, in B. Sottas et al.). The driving forces behind the practices/ human activities are either of the following:

- The faith in oneself, the own (unchangeable)
- The values and what could make these values change e.g the belief in God, the hope for profit and the idea of sustainability.

The concept of the economic man further shades some light on the aspect of perceptions. According to King'oriah, (1998), man is essentially hedonic and follows a day to day activity that maximises pleasure or utility and minimises or eliminates disutility. This translates into profit maximisation and loss minimisation, which are today the key assumptions about the behaviour of man in his economic activities of production and consumption. The Study assumes

that the perceptions, values and attitudes of the actors may be an influencing factor to the problems of water management in the catchment.

c) **Institutions/ Actors**

The institutions are seen as interventionists between the activities on land i.e. the production system on one hand and the land use system (through planning e.g. physical planning), and the natural resource system on the other. The intervention is seen in their management role, which is guided by the legal framework.

There are two levels of actors: deciding Actors and local Actors. The deciding actors may make decisions with or without consultation with the local actors (community and individuals unlike the local actors. The local actors are also seen as beneficiaries of development. Their activities, (see the production system) are to be managed by the deciding actors in conjunction with themselves (the local actors). The two levels of actors are analysed in terms of their roles in management river water.

The institutions intervene to correct the ecological balance so that the natural system continues to support the production system. The aim is to stabilise and/or reduce the use of river water in the catchment. The issue of conflict resolution is up to the institutions both at the local and the deciding actor level to ensure the

needs of the community are met without compromising on the ecological balance.

The institutions operate within a legal system be it local level (by the community in terms of rules and norms) or National level through the Acts of parliament. The legal framework will provide operational mechanism for institutions to manage water.

## **1.8 Scope of the Study**

### **1.8.1 Scope of Analysis**

In terms of analysis the study limits itself to the influence of the institutional and legal framework on the water resource management and left out other factors. It focuses on the perceptions of both local and external actors towards each other, towards the resource and their roles and how they affect strategies adopted in the management of water. The forces that exist in institutional correlation may significantly influence the establishment of an environment that enables effective exploitation of local actors and deciding actors perception so as to integrate ecological values that will ensure effective water resource management. The study covers the following actors and legislative framework:

#### **(i) The Local Actors**

The study takes three categories of local actors namely: households, the NGOs and CBOs. The NGOs are categorized here because they are closely linked with the community.

(ii) External Actors/ Deciding Actors.

The study limits itself to institutions at the catchment level namely: relevant line ministries represented at the district, local authorities like Laikipia County Council and Nanyuki Municipal Council; and regional authorities such as the NWCPC, ENNDA, DWB, ENNCB.

(iii) Legislative Framework

The study covered the following Acts that in one way are related to water resource management more specifically those dealing with distribution, allocation and enforcement namely: The Water Act (Cap 372), The Agricultural Act, The forests Conservation Act, Land Planning Act, The Land Control Act, The Local Government Act Cap 265, ENNDA Act, among others.

### **1.8.2 Area of Study**

Considering the time and resource limitations, the research was deliberately scaled down to focus on the areas presumed to bear relatively greater significance to the output of the research. The study area, the upper E.N.N.C., will be divided into 3 ecological zones:

- 1 The Upper catchment zone, consisting of parts of Nyeri, Nyandarua and Meru districts. This is a semi humid zone with rainfall of 800-1400mm, dry forest and moist woodland, and has medium to high potential;

- 2 The medium to low potential catchment zone/Zone of transition consisting of Isiolo and Laikipia districts. Rainfall is 450-1100mm per year with dry woodland and bush vegetation.;
- 3 The lower catchment zone (Samburu, Marsabit and part of Laikipia district). This arid to semi arid with rainfall ranging from 150-550mm per year. Vegetation is scanty.

The study sampled Naro Moru in Nyeri to represent Zone 1; Nturukuma/Nyariginu area in Laikipia for Zone 2, This zone is the most crucial zone because activities taking place here are not sustainable. The area is also experiencing immigration from the neighbouring districts. Zone 3 represent low potential areas (arid to very arid) r.e Ill.Motiek in Mukogodo division of Laikipia district. The three zones are representative of Upper Ewaso Ng'iro North Catchment in as they reveal all the climatic characteristics and river water management issues. The exact locations are shown in Chapter 3. River water is used as a referral scheme for investigating institutional coordination and the legal framework weaknesses. This is based on the consideration that there is growing interest in the institutions, organizational strategies adopted to solve the problem of river water. The research did not attempt to directly measure the quality and quantity of water distributed but relied heavily on secondary data to provide indication of the pollution and quality of water.

## **1.9 Methodology**

The study made use of descriptive survey method and blend it with focussed synthesis based upon survey of recent, available and accessible literature. In addition, in-depth discussion with different stakeholders and selected experts, unpublished and published documents and, the writer's own experience in the past three years working in the Urban Development Department of the Ministry of Local Authorities will be used. Both secondary and primary data was used. The source of Primary data was informal and formal interviews. Secondary data sources were books, journals, government documents and unpublished works. Observation was used to give visual and analytical approach to phenomenon to ascertain verbal and written information.

### **1.9.1 Specific Methodology**

#### **1.9.1.1 Data Collection**

##### **(a) Legal framework**

Research in this area was concerned with identification of laws and regulation that constitute the legal framework for water management in Upper Ewaso Ng'iro Catchment area. Policy strategies were investigated as they related to activities on the ground. For this, the study made use of available secondary data and open-ended discussions with relevant selected experts. Data sources were Laikipia county council, Nanyuki Municipal Water and Sewerage Department, Laikipia Research Programme, Local University libraries and the British



Council Library, Ewaso Ng'iro North Development Authority (ENNDA), Ewaso Ng'iro North Water Catchment Board (ENNCB), and Ministry of Water Affairs, and other relevant ministry departments at the study area.

### **(b) Institutional and Organisational Setting of Water Management**

The initial findings from the legal framework provided a list of various organisations involved in water management within UENNC. Using semi-structured interview questionnaires, as guideline discussions were held with identified experts out of which different roles were discussed. The discussions were to help identify forces that deter local actors involvement and deciding actors correlation. Given that there are varying institutions study area use of stratified sampling was found necessary (see below).

### **(c) Attitudes, Values and Perceptions**

#### **i. Local Actors**

Questionnaires based on stratified sampling together with interviews were used to find out the brief history of the local actors and their attitudes and perceptions of the water resource. This was blended with secondary data on the same. The purpose was to find out how their culture and values influenced their willingness to integrate ecological values into water management.

## **ii. Deciding Actors**

The study used purposive sampling techniques to select responsible parties in different areas of water management as mentioned above in the legal framework. The purpose was to find out how perceptions influence collaboration strategies, conflicts in water management strategies.

### **(d) Photography and Observation**

Photography and observation were applied to give visual impression of the situation on the ground. This shed light on the influence of the increasingly different land uses and land use activities on the water resource. Use of observation throughout the study was important to be able to compare reported behaviour or issues with actual behaviour or situation.

#### **1.9.1.2 Sampling and sample frame**

##### **Area Sampling**

The sample frame is Upper Ewaso Ng'iro North Catchment-basin (UENNC). The basin covers 6 districts and is fairly representative of the problems in the whole catchment. It covers the highland-lowland profile of the basin. The 6 districts were further subjected to stratified purposive sampling to come up with two districts (Nyeri and Laikipia)

##### **Target Population**

The target population for this study were:

- (a) Households

- (b) Commercial firms like Chestnut
- (c) Community organisations/community water projects
- (d) Non Governmental Organisations (NGOs). They include the World Vision, ASAL(SARDEP) and the Catholic church.
- (e) Other middle level and national institutions. These are the water suppliers, allocators, distributors, They include MOWD, local authorities, District Water Boards, ENNDA, and Ewaso Ng'iro North Catchment Board (ENNCB).

The population was divided into two:

**i. Local Water Users/ local Actors**

For purposes of water users: household, commercial firm, community based water projects, NGOs questionnaires, three zones-Zone 1, 2 and 3 were sampled. In zones 1 and 2, households along the rivers Naro Moru and Ontoulili were picked randomly at an interval of 100m and questionnaires administered. However in zone 3 where population is scattered and does not necessarily settle along the rivers, several manyatta (groups of households settled within one compound). One commercial out of 10 identified firms was randomly picked. The community based water supply projects were chosen purposively i.e. one on river Ontuolili (in zone 2), one on Naro Moru river (in zone 1), and none in zone 3 as there was none. Out of the 7 active NGOs, 2 were purposively selected based on the area coverage.

Hence for each zone the following were interviewed: 15 households for each of the zones, 1 commercial firm in Zone 1, 2 community based projects in zones 1 and 2, 2 NGOs operating in all the zones

## **ii. Institutions/ deciding Actors**

These were not confined to an area because the institutions are not The following institutions were selected based on four factors, suppliers, undertakers, Allocators or those concerned with apportionment and the regional authority. The undertakers are the Municipalities, and the county councils on one hand , and the National Water Conservation and Pipeline Corporation (NWCPC) on the other. The Water apportionment factor were captured by the District Water Engineer (DWE) and the District Water Boards (DWBs) on one hand, and the Ewaso Ng'iro North Catchment Board, and Water Apportionment Board on the other. The suppliers i.e. the Ministry of Water Development, and other relevant ministries, were also analysed The regional authority (ENNDA) was analysed in its own right. The sample is representative of the large population and water issues of the upper E.N.N.C. What is true of the sample is also true of the larger population.

### **1.9.1.3 Data Analysis and Interpretation**

#### **i. Qualitative analysis**

The data collected was processed, and compiled in the form of tables, diagrams, graphs, maps and pictures. They will provide summary and illustrate

information. The use of geometrical figures such as stated above are important because firstly, they act as visual aids given their ability to present data in a simple and readily comprehensive forms, they help reveal trends; they are attractive and interesting to the reader, they synchronise information in few words.

## **ii. Quantitative Analysis**

Descriptive statistics and content analysis were used to analyse data This involved use of means, percentages and frequencies. The analysis describes how for instance perceptions have affected either positively or negatively, water management or distribution; how presence or absence of enforcement, collaboration, and water ethic has affected distribution of water.

The study made use of Measures of Association to illustrate relationships between variables especially for household analysis. The Gamma measure was used to establish the direction and strength of relationships. The strength of the relationship was determined by the frequency with which the variables occurred across the sample. The gamma measure shows the direction and strength of association between cross tabulated variables. It varies between -1.00 (indicating a perfect negative relationship and + 1.00 (indicating a perfect positive relationship). A gamma of 0.00 or near 0.00 indicates the lack of linear relationship between variables. Gamma measures is computed as below:

The cross tabulated tables appears as

A	B
C	C

$$\text{Gamma} = \frac{(A \times D) - (B \times C)}{(A \times D) + (B \times C)}$$

$$(A \times D) + (B \times C)$$

Statistical Package for Social Scientists (SPSS) will be used as a tool to help organise and analyse data

### 1.10 Operationalisation of Terms

The study adopted the following terms:

#### **Actors**

The study adopted Kunzi's definition of actors which is according to ASP concept.

**Local Actors:** According to Kunzi (1996), the local actors refer to the local resource users, with regard to their pattern of practices. The definition will be confined to the settlers and water users in the Upper Ewaso Ng'iro North Catchment. A local actor can be a farmer, group of farmers, pastoralist or a group of pastoralists.

**External /Deciding Actors** . These are institutions (or individuals acting for them i. e local actors) that have act on behalf of the local actors to plan, dispose, regulate access to or affect local or regional resource use.

**Sustainability**

This refers to the ability of institutions to meet the needs of the present water users without compromising the needs of the future water users. There are three dimensions of sustainability:

- (i) Ecological sustainability: This refers to the ability of certain actors to maintain ecological balance and possibility of changing to fit in the ecosystem (see section 1.7 above).
- (ii) Socio-cultural sustainability: This will be used to refer to the increasing compatibility of the peoples' way of life with ecological values.
- (iii) Economic Sustainability: This refers to the ability of water quality and quantity to meet the social and economic needs of the people. This is translated into the ability of institutions to manage the resource well in terms of maintenance, affordability, e.t.c.
- (iv) Technical sustainability: It is referred to as technology that is in line with the readily affordable and available human and other resources. It is used to refer to the increasing integration of ecological values to socio-economic values by both the local actors and the deciding actors. The integration is expected to lead to development that meets the needs and wants of the actors presently without compromising the ability of the future actors to meet theirs.

The term is used to specifically refer to the ability of the Ewaso Ng'iro at any time of the dry season to guarantee a continuous water flow sufficient to safeguard the existence of the population and ecosystems downstream.

### **Management**

The ability of institutions to preserve, conserve and allocate water equitably to all water users. It refers to their ability to share out responsibilities to avoid duplication of efforts and promote complementary roles amongst themselves.

### **Perception**

This is the attitude notions that an actor or actors has/have towards a given phenomenon/situation. Mostly the culture or way of life of people influences these perceptions/attitudes. Perceptions therefore determine how actors view resources and consequently undertake their activities.

### **Strategies**

This refers to consciously designed courses of action to any given situation.

### **Ecological System**

It refers to the natural environment- the totality of forms, attributes and relationships found in nature. Ecological system is understood as unlimited quantity and cannot be considered as value useful for measuring viability.



**Conservation**

It is used to mean the efficient use and saving of water, achieved through measures such as water saving devices, water efficient processes, water demand management and water rationing.

**Protection**

It is used to refer to anyone or all of the following:

- i. Maintenance of quality of water resources to the extent that the resource may be used in an ecologically sustainable way, and
- ii. Prevention of degradation of water resources; or
- iii. The rehabilitation of the water resource.

**Institutions**

The study adopts George Ngugi's definition. Institutions are conventions that any society establishes to define their members' relationship to resource use. These relationships strongly affect resource use patterns. They regulate individual behavior in the continuing interest of the group as a whole. It is used to refer to the water catchment agency, a river basin management agency, a water user association, a body responsible for internal or external water management.

**Legal Framework**

The legal framework refers to those Acts of Parliament that address water supply pollution, discharge, water conservation and other related laws that form the basis for management of water resource.

### 1.11 Limitations of the Study

One of the major limitations of the study was time and budget constraints which made it difficult to utilise a more detailed design. The researcher was not able to adequately apply participant observation because of limitations of time and finance. The other limitation was the government officers who were not willing to discuss the weaknesses of the institutional system for fear of victimisation.

## **CHAPTER TWO**

### **2.0 LITERATURE REVIEW**

#### **2.1 Overview**

This Chapter looks at the literature on water challenges at the universal level, at continental level and finally national level. In Kenya various developments in water are reviewed beginning with overview of population increase relating its consequences on land use with accompanying implication on water quality and quantity and distribution. The management challenges arising and strategies adopted based on the existing legislation and institutional principles are reviewed to establish what has been addressed by other writers or researchers, the gaps they have left and how the study has filled the gaps.

#### **2.2 Universal Review on Water**

Over the past few decades, demand for water has increased all over the world, however, water quality has deteriorated, the water environment has degraded and the cost of developing new water resources have risen dramatically. This combined with population growth and fragmented water management, has created unsustainable situation in many parts of the world. Following international conferences, particularly in Dublin and Rio de Janeiro, the World Bank published a water resource management in 1993 to address the global challenges. In this regard, Economic Development Institute (EDI) of World Bank developed a special initiative, "The Water

Policy Reform Programme" whose objective is to assist countries in preparing and implementing reforms leading to sustainable water resource management.

In 1993-1994 UNEP assisted some governments to launch plans of action to combat desertification among other activities. UNEP also encourages industrial practices that lead to sustainable development. It promotes technologies and practices that use natural resource efficiently and minimise pollution and risk. UNEP also seeks to develop an assessment of environment within developing countries through setting an Environment and Natural Resource Information Networks (ENRJNs). The aim is to discover the needs of national and sub-regional institutions and help them expand their information networking capacities, so that countries can work together on environmental assessments. Assessments are one of the areas that UNEP seeks to help countries to develop institutions and human resources to respond to environmental challenges. This shows that at the international level the problem of natural resource management is treated with the seriousness it deserves.

A great number of countries have realised the problems with the current approaches to water resource management i.e. sectoral approaches. Some are shifting towards longer term integrated management of water which targets total cycle and includes environmental sustainability as a key consideration. This approach is not a new concept but it has not been applied in most

African countries. The 1989 OECD council, which stressed integration, stemmed from the need for reform of scattered institutional arrangements governing water management, including administration and legal structures. This however was at the international level but is also relevant at national or regional levels. Water management is seen as a global problem not only because of the shared waters but due to the fact that water is closely determined and determines the conditions of other natural resources. Natural resource management is the only sure way of curbing global warming.

### 2.3 Africa's Situation

In Africa, especially in Sub Saharan Africa, access to clean water and sanitation is poor. This coupled with poor capacity to enhance the efficient use of water. In addition, the problem of poverty complicates the situation. Further, more and more land is being converted to commercial use thus increasing demand for water as indicated in chapter 4 below. In spite of these facts, the nations have had growing awareness and commitment. To this effect, many governments have undertaken National Environmental Action Plans (NEAPs), highlighting the importance of water in environmental management. In addition there is better dialogue between countries on issues of international water resources.

In spite of the above attempts, Africa is faced with five priority challenges:

1. providing access to safe water and sanitation services to the ever increasing population;

2. addressing water quality problems;
3. protecting water catchment areas and
4. developing mechanisms for dealing with conflicts.

It is interesting to note that Africa has only managed to exploit 5% of her water resources (JICA, 1992). The strategies adopted for water management have been good i.e involving of communities through Self Help Groups. Women involvement and bottom up approaches. However, the application of the approaches have been piecemeal, and have concentrated on the supply side rather than demand side of water management.

All actors may not address the above challenges if the institutional set up does not favour comprehensive and coordinated approach. Most writers may highlight this area but have not done a study to demonstrate the problem. Further, the legal framework is not given the weight it deserves especially for countries like Kenya where such laws are not harmonised. Kenya's situation is no different from Africa's as indicated below.

#### **2.4 Kenya's Situation**

The water resources of Kenya are rapidly becoming scarce and need to be managed carefully. In spite of significant investment in the sector (see statistical Reviews), the present effective level of water supply coverage is only 75% in Urban areas and 35% in rural areas (Hiiji, 1996).

Poor management of water resources, including poor financing and tariff policies, large unaccounted for losses, inefficient technologies, lack of demand management, ineffective management of water sheds, inadequate pollution control, deteriorating hydro-meteorological services impose major additional constraints that are threatening its long term sustainability.

The Government of Kenya has however initiated a series of systematic actions to address the challenges. It has prepared two National Water Management plans. The master plan (NWMP.1992) revealed that the country is not endowed with such vast water resources as previously believed. In addition the government has prepared an environmental action plan (1994) and is formulating an environmental impact assessment to emphasise integrated water management. However as seen below, Kenya's commitment is piecemeal and there is no political will as seen in the analysis of institutions in the Upper Ewaso Ng'iro North basin. With the current policy of eradication of poverty by the year 2015, priority should be given to water management as the first step to achievement of the goal. Other factors like population and settlement changes also influence water availability.

#### **2.4.1 Population and Land use Transition**

It has been established that Kenya's population doubles every ten years and it is one of the countries with the highest population growth rate (4.56%) per year (Glasbergen, 1995; GoK, 1996). The increased urbanization and consequently the fast land transition causes degradation on water and land

resources. The increasing population has put pressure on land such that people are increasingly migrating to previously sparsely populated areas. This is true of Laikipia district, which is mainly an ASAL area. Currently, the country is estimated to be 80% ASAL. The Kenyan economy is dependant on agriculture as it is the mainstay of our economy (GOK, 1996) and yet it experiences considerable problems in development and management of water resources. Only about 12% of the total area in Kenya receive more than 850mm of rain annually, a further 5.5% receive between 600-850mm. The bulk of the country-74% receives less than 600mm annually. This means that only a limited catchment area contributes significantly to the available water resource system. The pattern of human settlements has been strongly influenced by access to water. The rate at which existing settlements are expanding i.e. most people have migrated in the last 20 years (see chapter 4) necessitates a change in policy on migration.

The high dependency on agriculture means that since land is not expanding, there is instead an increased intensity in land use to cater for the increasing demand for food for local consumption and crops for export. The agriculture policy emphasizes the need to increase production through intensive farming methods, which have an implication on water because of irrigation and the pollution through application of chemical fertilizers. Further the population explosion means that farms are continuously being sub-divided into uneconomical sizes and this is true of Laikipia District as exacerbated by a number of studies carried out by Laikipia Research Programme in Laikipia.



The urbanisation that is a result of population increase has impact on the environment in terms of the domestic and industrial waste which mostly ends up in rivers (see chapter 4-pollution on river Likii).

The growing concern for environment has been shown but mainly in urban areas as opposed to rural areas. This is despite the fact that the consequences of urban activities are felt in the rural areas through the ever-increasing industrial waste in the rivers. Many of the chemical substances released into the environment ends up contaminating watercourses such as rivers and lakes. According to Glasbergen (1995), the wastes in developing countries have exceeded the capacity of nature to assimilate them. The resource degradation, he contends, limits other productive uses of resource resulting in economic losses and high cost of reclamation or substitution. He sites the example of Dakar in Senegal, which has had to rely on water pumped from Lac de Quiers, 200km away because the local surface water is highly polluted. The case of Dakar is comparable to the case of Nairobi which relies on water from Ndakaini in Murang'a over 100 km away.

The ever-increasing population, high dependency on agriculture coupled with increasing urbanisation means that water resource is at stake and can only be effectively addressed within the broad environmental approach.

#### **2.4.2 The Environmental Problem in Kenya**

Water is part and parcel of the environment and its use or misuse has environmental implications. The country's economic and political stability is critically dependent on maintaining her environment. Agriculture and tourism, the two largest sectors of the economy are dependent on environmental quality. In addition, Kenya's cultural and political structures are closely linked to the natural resource base. Despite all these facts at present there is no optimal national or centralized system for monitoring the state of natural environment, and so it is not easy to quantify the rate of overall depletion or degradation as indicated in chapter 4 below. However, through observation the situation is serious and likely to get worse unless concerted national action is organised and expressed down to the level of all users of the country's resources base. The numerous international initiatives and solutions so far have failed to come to grips with the reality of the situation in the field.

The evidence of environmental mismanagement is derived from numerous sources. Principal among these include:

- (a) The GOK /UNEP/UNDP project on environment and development. It provided sectoral studies of relationship between environment and development throughout Kenya;
- (b) The various papers submitted to the Kenya National seminar on Desertification prior to the UN conference on Desertification meeting in 1977;

- (c) The reports and studies of various government ministries and departments such as Marginal Lands Study (1978); among others.

The picture which emerges is one of increasing, horrifying, long-term loss of natural resources for short term returns almost entirely is resulting from rapidly increasing population pressure, unequal access to resources and malpractice. The losses result from activities such as:

- (a) Overgrazing, particularly in the drier rangeland like the North eastern Laikipia;
- (b) The expansion of cultivation into marginal rainfall areas and dry season pasture for example at Ewaso primary;
- (c) The depletion of forested and wooded areas for cultivation and for fuel. By 1980, 3.3 % of the land area believed to be gazetted forest was down to 2.5%. Outside the gazetted areas, there is no effective control over cutting of timber and no figures for loss;
- (d) The expansion of new settlements on an uncontrolled basis-there is no land subdivision law as indicated in the analysis;
- (e) The transformation of some perennial rivers into seasoning flows as the result of the destruction of upper catchment areas and the choking of streams with soil due cultivation even around the riparian reserves: and
- (f) The unregulated cutting of wood for charcoal (some of which is exposed) without any attempt to replace the stripped timber.

The Kenya cultivators are being driven onto ecologically hazardous areas in order to gain their subsistence. An attempt to address this was one of the subjects of the United Nations on Environment and Development (UNCED) held in Rio de Janeiro in 1992 on the link between environment, economic activity and social development. At the earth summit in Rio de Janeiro most governments/countries committed themselves to step up their efforts on environmental education and communication.

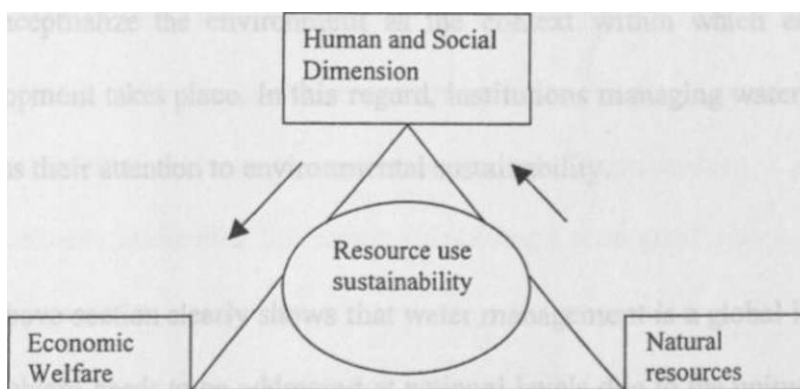
### **Critical Issues of Environmental Management**

Despite decades of talk, conferences and symposium. Kenyans still view the environment as a sectoral concern of the experts, enthusiasts and specialised United Nations bodies. The presence of UNEP secretariat in the country has not helped to root this belief but its style of operation has helped mystification of the environmental concept( Gatheru and Shaw, 1998)

In African and indeed Kenyan indigenous cosmology, the environment is part and parcel of one's entire livelihood and spirituality as noted by Anyanwu C.K, (1998). The western model has abstracted and reduced the environment into isolated biophysical components such as soils, air, water, atmosphere, climate, forests, e.t.c. The **Judeo -Christian ethic has placed human apart from nature**, a factor that has contributed to the global degradation of environment (Odera et al, 1991)

The other view is that environmental problems are due to the neglect of human and social dimension within the triangle of sustainability. The villain of environmental degradation has been identified as unequal development. This is spelt out in the report "Our Common Future" (WCED, 1987, better known as the Brundtland Report). Limits of growth have been recently introduced as the shortcoming of addressing only two aspects of the so-called triangle of sustainability i.e. limitations on the natural resources and economic welfare. There has always been a neglect of the third triangle of human or social dimension. This means that *participation by all actors or stakeholders as a normative requirement now has a prominent place in any public activity*. Diagram 2.1 below illustrates the three triangles of sustainability.

**Diagram 2.1 Triangle of Sustainability'**



Source: Author's interpretation, 1999

In spite of the above facts, Kenya's, environment/ natural resource management remain a subsidiary item on the agenda. For instance, Kenya's

NEAP came about as a result of intense donor pressure. The NEAP preparation process took off only after the World Bank had made it one of the conditions for resumption of donor funding to the country. The exercise was completed in 6 months principally to meet the donor-imposed requirement. What emerges is that *there is no real political will to manage and conserve resources*. This basically agrees with the Bruntland Commission report as above.

Gatheru et al. (1998), contend that the solution to environmental problems have tended to focus on economic and technical instruments leaving out political and institutional factors. NEAP reports that it is therefore structural change including specific policy intervention, legislative and political reform and institutional innovation that can enable a country to engage in an environmental sustainability agenda. The change provides an opportunity to re-conceptualize the environment as the context within which economic development takes place. In this regard, institutions managing water need to refocus their attention to environmental sustainability.

The above section clearly shows that water management is a global issue but the problem needs to be addressed at national levels due to the unique socio-political and economic characteristics of each nation.

Environment and economic welfare together with human and social welfare are as deduced from diagram 2.1 above, mutually dependent. It is high time

environment stops being handled as a sector of the larger economy and start being seen by every individual or group as a factor that influences and is influenced by their socio-economic, cultural and political activities. It is in this line that institutions and their policies and, the legal framework need to be understood.

## **2.5 Institutional and Legal Framework**

Environmental concerns have brought intense and continuous public scrutiny to water development relating to both existing and new facilities to meet the needs of the future. The public is questioning many existing laws and practices involving water allocations. Water shortages is forcing governments to seek new direction in water management (Frederiksen, 1992). He further argues that the conflicts between environmental objectives (to conserve the natural environment) and water use demands (to support Production system) are complicating the modernisation of water resources management. Also the country's economic policies that treat natural resource as mere capital stock to be exploited for short term economic benefits (agricultural production for export) discourage ecological and economic wellbeing of a country or region.

### **2.5.1 Water Policy**

The Water Policy aims at achieving sustainable development and management of water sector by providing a framework in which the desired targets/goals, outlining the necessary measures to guide the entire range of

actions and to synchronize all water related activities and actors. The policy document has addressed four basic areas: Water resource management; water supply and sewerage development; institutional arrangement and financing of the water sector. For our purposes we are interested in policy on the institutional framework and water resource management. As regards water management the policy aims at preserving, conserving and protecting available water and allocate it in a sustainable, rational and economical way. The policy objective on the institutional framework is to establish an efficient and effective institutional framework to achieve a systematic development and management of the water sector (Ministry of Water Development-Water Policy 1992).

The country's economic policies treat natural resources as mere capital stock to be exploited for short term economic gains (Gatheru et al, 1998). This encourages unsustainable exploitation of natural resources at the expense of long term ecological and economic well being of the country. Despite the fact that 80% of Kenya's economy is directly or indirectly dependent on natural resources, very little earnings from the exploitation of these resources are reinvested into the programmes and efforts to manage the same. Resource degradation continues as policies have failed to reflect the full economic value of natural resources. They do not for example reflect the cost of environmental degradation nor the full value of conserving the natural resources. The government has tended to put high value on irrigated crops as spelled out in the current National Development plan- this is at the expense



of conservation measures. Forests have been cleared to create room for agriculture without looking at the implication on water resources, thus "killing the goose that lay the golden egg". The forest Act as analysed in chapter 4 below gives power to the minister to degazette and gazette forest land at will.

To implement the water policies it requires a legal framework that is functioning. To this end the Water Act Cap 372 is under review. The main problem as far as water law is concerned, is that the Water Act has not been enforced adequately (see chapter 4). Besides, other laws touching on water issues have also been enacted without due regard to the existence of the Water Act. To this effect, one of the main omissions which the study identified is that the Water Act does not adequately specify opportunities for resolving conflicts arising from various demand sectors.

### **2.5.2 Legal Framework**

The legal framework prevailing in Kenya has evolved at a slower and less dramatic pace. After independence, several amendments and changes in terminology nomenclature were instituted. The main acts of parliament that address resource use and environmental management include Water Act, Forest Act, the Agriculture Act and Chiefs Authority Act (now repealed), the Local Government Act, the Wildlife Conservation Act among others. A study by Kinyanjui and Baker (1980), found out that some of the legislation dates back to the colonial era. They are also still associated in many minds

with the repressive systems of application in which implementation was not associated with popular understanding and so is resented by those it applies and avoided by those whose job is to apply it. However, the study findings are that majority of the households do not know a single law governing water. It is also true that they do not understand why their water abstraction should be limited as water still flows from the mountains.

The Water Act (Cap 372) was last revised in 1972 and it is currently under review (JICA, 1992). According to the report, active and strict implementation and enforcement of the laws are essential to manage water development and use pertinently. However, implementation and enforcement are not going to be successful if community is not sensitised.

A campaign workshop held in Nyeri did not emphasise on role of the community as evidenced from below: According to Mathuva, (ed. 1996), the water regulations are expected to:

- Give more powers to the field officers;
- Give more powers to the district and catchment water boards;
- Provide water and relevant water allocation procedures;
- Re-orientate the ministry from its current direction of supplying to that of protecting conserving and managing; and
- Establish better and comprehensive billing system which should be satisfactory to all water users in the country.

The role of community in legal framework is not taken seriously and yet they are the main stumbling block to enforcement of the laws. This gap together with the weaknesses in the multiple laws is brought out in this study (see chapter 4 and 5).

### **2.5.3 Water Resource Institutions**

A nation's institutions (laws, customs, organisation and all that is associated) comprise a framework within which a society functions. They constitute the framework for every action from group relations to commercial activities. This framework is constantly subjected to pressures to change as a country's economic and social demands change (JICA, 1992).

Customary and constitutional rights and legislation are the foundation of today's institutions. Many arrangements for the use of water have evolved over centuries particularly at the local level for community supply, drainage and irrigation. Broader water institutions developed along with country's civil government. The more recent institutions have developed to address water quality, pollution concerns, waste-water concerns and protection of environment. This has been due to the increasing demand for water and the need to manage the resulting waste.

#### **a) Governance**

Economic crisis and ecological degradation in sub Saharan countries including Kenya is also a crisis of society; the crisis of governance (World

Bank. 1989). Within the SAPs , the issue of institutional conduct besides economic liberalisation is important. Hyden (1992) contends that the issue in any society is governance. According to him good governance re-orientates administration towards effective management of services. Issues of water management in Laikipia in Kenya were initially unimportant. This is because the original unsophisticated ethnic groups who only required grasslands for grazing and water for use by people and their livestock- these activities always allowed the ecosystem to recover from the impact of human activity. The issue of organized resource management therefore was not as crucial as now, when population explosion in the adjacent high potential areas has driven agriculturist from the hills to the plains, in search of land to settle work and grow crops (Sottas et al, 1998).

t

Sottas et al., (1998), notes that one of the crucial issues affecting management of water allocation in Upper Ewaso Ng'iro is the *gap between normative framework and the practices of powerful Stakeholders*. The state of affairs hinders the implementation of transparent and coherent policy. Despite the involvement of a wide array of actors and institutions, there is lack of real policy dialogue between the administrative bodies, the political system, and the civil society. Decisions are not necessarily bound by jointly elaborated management plans but comply with the agendas of deciding stakeholders or derive from the needs of agencies that are sometimes irrelevant to the context of resource management. This is major finding that this study has confirmed (see Chapter 4).

Sottas et al further notes that the emphasis of many researches has been on accommodation to legal and planning frameworks while *less attention is given to implementation*. It has been assumed that publicly acknowledged laws and regulations will generate effects intended and that individuals will comply with the rules. This is not usually the case as the study found out that perceptions and attitudes of the individuals and institutions hinder performance or implementation as individuals refuse to comply. The perceptions of the actors viewing water as a commercial good may significantly hinder the deciding actors' roles in resource management for example concentrating in supply of water in urban areas and pockets of rural areas while the majority who are the poor are left out. Though the Act stipulates rule of allocation of water, a study done by Gikonyo (1996) showed that over 80% of abstractions occurring on river water was illegal thus confirming the influence of perceptions of abstractors. The Abstraction quantities were higher than approved due to use of several mobile pumps at different spots. The situation is worsened by the fact that the dominant approach of Command-Control -Correct attitude cannot work in the present society where people are demanding freedom and dialogue

Frederiksen (1992) on the other hand contends that institutional framework evolution has not kept pace with the new imposition on their resources. Special interests and long established customs of sectoral approaches are powerful constraints. Single purpose agencies delay needed cross-sectoral actions. As a result institutional changes often have been reactions to narrow

concerns. Attempts to move from centralised to decentralised management has not been genuine in Kenya as seen below.

**b) Centralisation/Decentralisation**

Frederiksen's contention is true given that one of the causes of failure in resource management in Kenya has been attributed to too much centralization of power and thus institutions. The District Focus for Rural Development (DFRD) was launched in 1983 for the purposes of decentralisation. Under this policy, resources are managed at the district level (Ndegwa et al, 1994). Within the DFRD strategy, planning, identification, implementation and monitoring should be the responsibility of the DDC. The high representation at the DDC is to some extent meaningless because power lies on the DEC- a sub-committee of the DDC, which is composed of civil services appointees. What has happened is that the DDC is no longer representing the wishes of the people but the wishes of a few influential people especially politicians. This is evidenced by the unequal distribution of resources for example water in Upper Ewaso Ng'iro Catchment and beyond.

Access to and use of water resources are controlled by the state through the MOWD, however, as noted by Betschart (1997) duties are scattered and delegated to a wide array of councils and institutions. At the district for instance the department of water, DWB, ENNCB, and the regional water boards on one hand and the other line ministry representatives on the other

are mandated to manage water resource. At yet another higher level is the WAB. This Top-Down orientation is at variance with the spirit of DFRD, which is based on the Bottom-Up paradigm. The DFRD policy has been said to enhance antagonism. The district has been viewed as a provider rather than a regulator with respect to control, distribution of collective goods hence presenting a regulatory backlog (Barkan and Chege, 1989).

**c) Traditional Concepts of Water Management**

In the African way of life, the spirit of socialism, which meant that there was mutual social responsibility for all activities including water management. There was no disproportionate power and influence by the economically and socially powerful members of the society (Ndegwa. 1997). There were traditional checks and balances including sanctions against any abuse of power. Leadership was based on merit and the person who gave more level headed judgement is the one who was given responsibility. Among the Kikuyu community this person was called "Muthamaki" meaning a ruler. The concept suggests that leaders were answerable and accountable to the community. It is the community that mandated the institutions as opposed to the current situation of To-Down approach. The study as seen in chapter 5 below, revealed that poor leadership is the major cause of water problems, not only in community projects but other government and NGO projects. These projects incorporate leaders from different angles namely political, religious, administrative, technical as well as church leaders. The interests of

these leaders are conflicting and this causes a lot of problems in water projects.

## **2.6 Water Supply Planning**

Water is being used faster than nature can replace it (UNEP, 1995). Current estimates of water supply in Kenya indicates that 75% of the urban population has access to safe drinking water, while 50% of the rural population has access to potable water from various schemes. However water is inadequate in both areas. Kenya's water supply services are provided primarily through 330 gazetted (public) water sources, which account for 80% of the served population countrywide. The other 20% is supplied by non-gazetted schemes (GoK, 1996). Majority of Kenyans depend on surface water from rivers, springs, lakes, and ground water like from bore holes and wells. The surface water highly depends on amount of rainfall which means that during the dry season, the volume of the water in rivers reduces leading to problems of famine especially in the semi arid to arid areas (Kinyanjui and Baker, 1980). The question is how the ASALs can make use of the surface water without affecting their future and their children's needs.

In the past, water supply schemes were concentrated in the urban areas. Further, the rural areas had no serious water shortages, as population was still manageable. The increasing water demand has now more than ever, necessitated need for planning decentralisation to the regional and local



levels. In Kenya decentralisation of water management is piecemeal as seen above, and the final authority or power lies in the MOWD.

Planning for water is urgently needed due to the ongoing dynamics of socio-economic transformation and the increasing pressure on water resources in the catchment. According to Wiesmann (1997) such water planning must take the following among others into consideration and find ways of fulfilling related requirements:

- 1) Problem of sustainable use of water and other natural resources:
  - Expansion of water must not be allowed to threaten water resource downstream.
  - Dry season discharge should be sustained by regulating abstraction during the dry period.
  - Control of land use and retention of vegetation cover.
- 2) Equity in distribution of water;
- 3) Technical sustainability of the supply systems;
- 4) It must address the problem of acceptance by small holders and decision-makers. This calls for links of District Focus for Rural Development (DFRD) and the line ministries; and
- 5). The problem of dynamic modification of water supply planning to adapt to changing supply needs.

In the past, water supply planning has typically focussed on technical means of meeting increasing demand. However in recent years more attention has

been given to adequacy and efficiency of existing institutional systems (Kindler & Harris, 1980) hence the focus of institutions.

Current water development planning is constituted by two main thrusts according to Kunzi (1998):

- A supply oriented thrust focusing on the participatory development of alternative supply systems within the Laikipia Water Development Plan; and
- and a more demand oriented concentrating, on one side, on promoting awareness of the sustainability problem regarding water use, and acceptance of alternative supply systems (Kiteme et al. 1998)

The above two thrusts of supply and demand oriented are seen as superior to supply alone. The study found out that little emphasis is put on demand side, which is highly dependent on the people and their activities.

## **2.7 Water Ethic**

Some writers have attributed the water problem to the lack of water ethic. They contend that the modern society is disconnected from water's life giving qualities. For many people all over the world, water simply flows from a faucet, and few think little about it beyond this immediate point of contact. By and large water has become a resource to be dammed, diverted and drained for human consumption. People have assumed the right to use water but are slow to recognize obligation to preserve and protect it. What is

needed is a water ethic -a guide to right conduct in the face of complex decisions about water. People must start viewing themselves and water as related parts of a greater whole. It may be true that effective society cannot be built on social ethic alone; but without it, it cannot be built at all (Hirsh F. 1978, Kindler and Hams- eds, 1980)

A water ethic demands that water users care about their environment and other users. It is about being good neighbours as individuals, companies, communities, states, districts and nations. The study identified lack of water ethic as a major influence to the way water is perceived and therefore used.

## **2.8 A Review of Researches on Water**

I

A number of researches have been done on water resources. Most have not been given the social-science approach but are based on the natural sciences. And are therefore not subjected to review in this study which is social science based. Those that are based on social sciences have not addressed the institutional and legal framework, but have concentrated on other aspects as enlisted below.

A study done by Baker, 1984 whereby he looked at water management in South -Western Marsabit District. Baker assessed the water demand for both livestock and people. He did not look at river water and the problems of institutions. His interest was on the water users and the problems they face

and how they are solved. He only looked at the water users while this study looks at the users and the managers.

Kinyanjui and Baker (1980) jointly wrote a report on the institutional framework for environmental management and resource use in Kenya. It focussed on environmental policy and natural resources from a general point of view. They recommended a common law to deal with natural resources- a single corpus of legislation to deal with actions that might degrade the environment. They did not look at the management of water in particular, and specifically river water.

Njuguna (1985) did a research on planning for water in rural areas. He focussed on the demand and supply of water within Murang'a District in Kenya and most specifically problems of water supply projects regarding their implementation, operation and maintenance. He identified problems of personnel in terms of inadequacy, lack of co-ordination, wastage, and poor water conservation. He concluded that the crucial issue on water is whether it is being used wisely for the benefit of all the water users. For this study, the crucial issue on water is whether it is being distributed to all the water users.

Another research by Njuguna (1981) was on planning for water in Gatundu division. He assessed the available water in the division and considered how best water resources could be exploited to meet the needs of the people. He examined the expected benefits resulting from the provision of water

supplies. He concluded that water just like any other resource does not become an economic resource unless it is exploited and made accessible to the people. He recommended that resources should therefore be invested in water. He underscored the importance of co-ordination between the Ministry of Water and other related sectors, and conservation of water and control of pollution.

From the above studies, it is evident that none of them dealt with institutions and the legal framework as far as they relate to river water management. In addition, despite the fact that there is general awareness that resource institutions in Kenya are facing difficulties in carrying out their functions; and that the legal framework that is supposed to guide their operations could also be wanting, no study has been done to unravel the facts. The study has identified the gap in most studies in that it has brought to board major institutions ranging from the household level through the middle level to the national level. Analysis is done across the board (chapter 4-6) showing areas of duplication and conflicts. Further, the role of community projects in water management is seen as a pointer to decentralization strategies of involving the community in management of their resources, which is a sustainable approach in the long run. An integrated approach is recommended (chapter 7) though it may not be easy in the short run due to the poor capacity of the water actors. At the end of the analysis roles are proposed (on the assumption that capacity will be built), and conclusions made.

## **CHAPTER THREE**

### **3.0 STUDY AREA**

The chapter looks at the three zones of study, their physical and climatic background and how the same have affected land use and conversely how the land use has affected water resources. Deforestation, irrigation activities and pastoralism threatens water and soil resources. The different sources of water are identified and surface water singled out as the most plenty, and most abused by both the users and those vested with responsibility of managing it. The emerging challenge is that with the current activities, the flow regimes are low and cannot cater for the ever-increasing population. The sector approach to water management as indicated in chapter two above jeopardises an integrated approach to water management in the study area.

### **3.1 The North Ewaso Ng'iro Basin**

The North Ewaso Ng'iro Basin is made up of 15 sub-drainage areas. It has its source in the northern slopes of the Aberdare ranges and Mt. Kenya. It covers an area lying between 36°30" East and 41° East, and 0° 30" South and 4° 30" North of equator. The whole of the basin covers 210,226Km<sup>2</sup> which accounts for a third of the total area of Kenya. This drainage is the largest of the five drainage basins into which Kenya falls. The Northern Ewaso Ng'iro Catchment basin which forms a part of the whole region stretches from the foot regions of Mt.

Kenya and Aberdare ranges and extends up to archers Post. It covers about 15,300km<sup>2</sup>. This basin covers parts of Meru, Isiolo, Nyambene, Nyandarua and Nyeri districts whereas Laikipia, Samburu and Marsabit districts are wholly within it. Map 3.1 shows the location of the whole of Ewaso Ng'iro North basin in the context of Kenya, and map 3.2 shows the Upper Ewaso Ng'iro North catchment.

The basin receives low amounts of rainfall, which is attributed to its location on the leeward side of Mt. Kenya, the Aberdare and Nyambene ranges. Mean annual rainfall ranges between 2030mm in Mt. Kenya to fewer than 300mm in the lowlands in parts of Samburu, Isiolo and Nyambene districts. The rainfall distribution is generally bimodal with April to June and October to December being the rainy seasons with intervening dry and hot months of January and February. Rainfall maxima occur in April and November respectively (Mathuva, 1996). This catchment is the worst affected by water allocation problems especially during the dry season. Map 3.1 shows the rainfall analysis of the Upper Ewaso Ng'iro Catchment

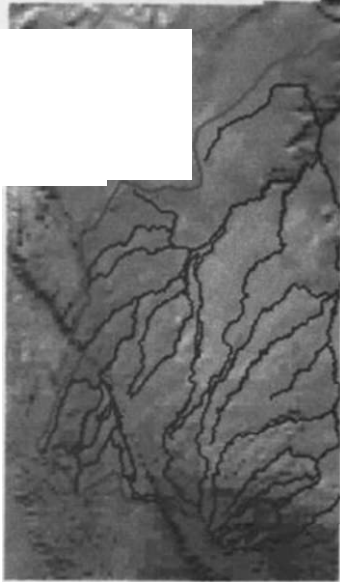
Map 3.1

ANNUAL

## Rainfall Analysis

Of the Upper Ewaso Ng'iro Basin

Concept / analysis: HP Unlger, G. SchwUch  
 GS compiation / layout: G. Schvrfeh  
 Data source: NRM3 oatabase, Berger 1989  
 Interpolation model: D. Gycistras  
 Photo: HP Unlger

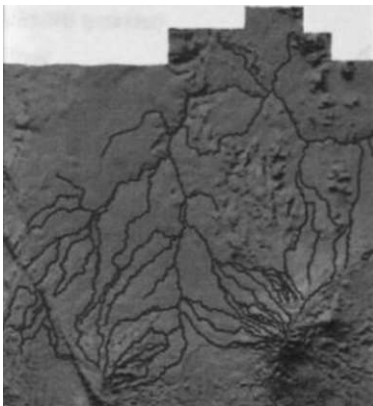


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Archer's Post

### NaroMoruMet

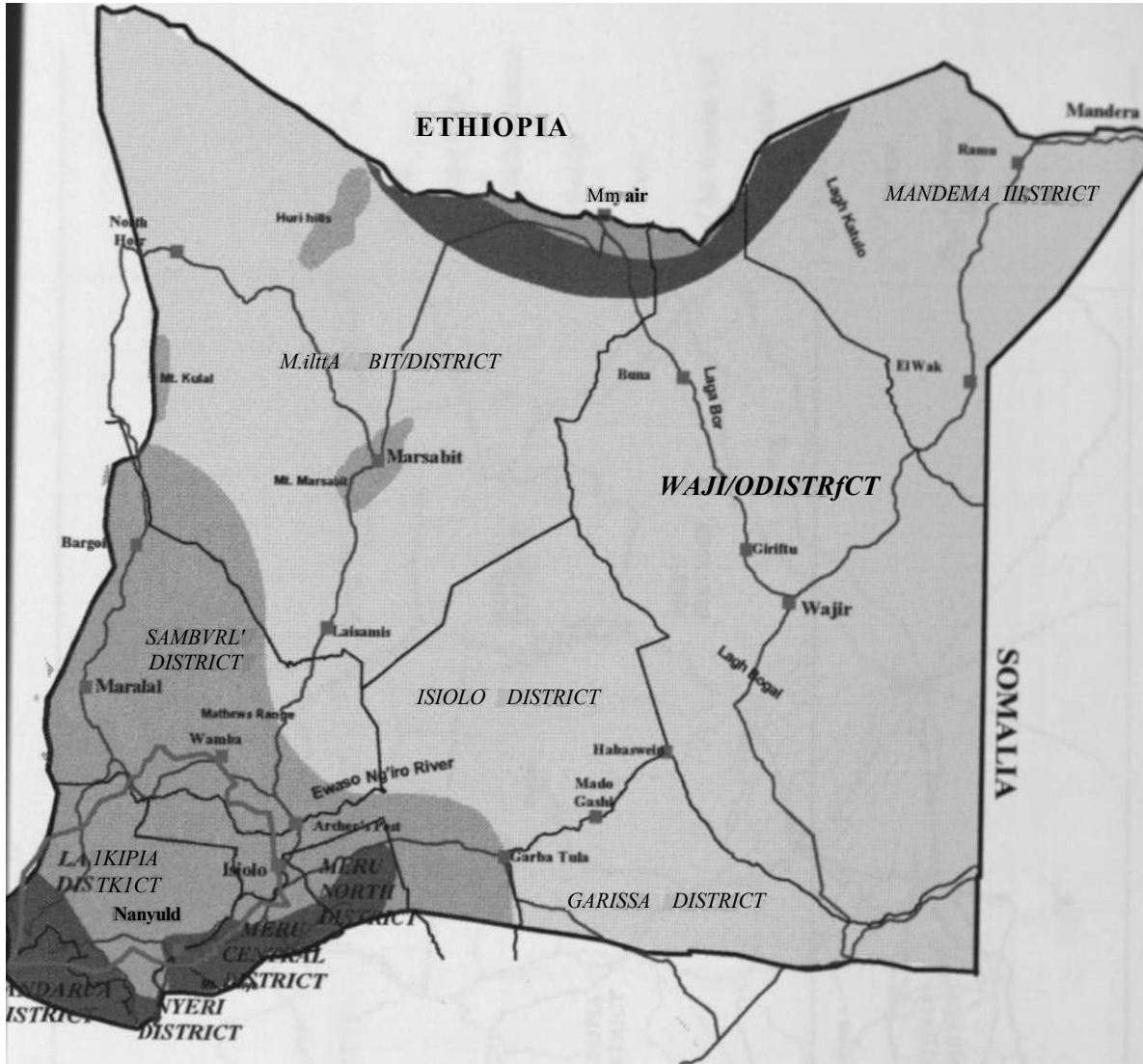
	monthly	annual mean
●	0 - 19mm	0 - 299 mm
	20 - 39 mm	300 - 399 mm
●	40 - 59 mm	400 - 499 mm
	60 - 79 mm	500 - 599 mm
	80 - 99 mm	600 - 699 mm
●	100- 119rrm	700 - 799 mm
—	120 - 139 mm	800 - 899 mm
—	140- 159 mm	900 -999mm
• i	160-179 rrm	1000- 1099 mm
• i	180- 199 mm	1100- 1199 mm
• i	200 - 249 mm	1200- 1299 mm
•	250-299 mm	1300- 1399 mm
	300-399 mm	1400- 1499 mm
<b>m</b>	>= 400 mm	>= 1500 mm



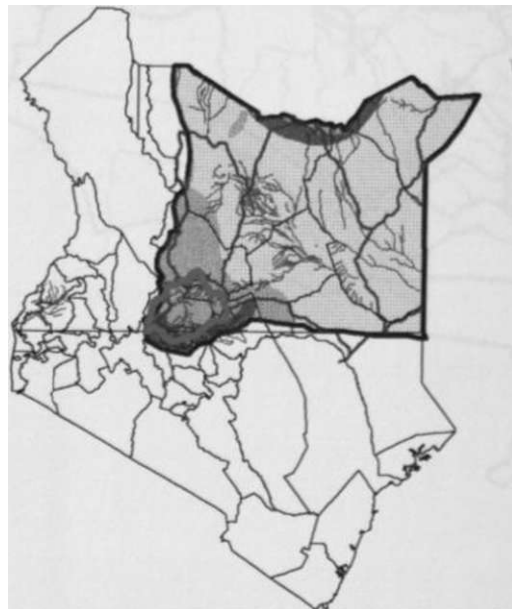
Ranfai cftilbxition calculated by means or Inverse dtetance  
 Interpolation and orographic regressions.  
 Base data: 1973-1996.  
 Preliminary model output.



2: The location of Upper Ewaso Ng'iro North Basin

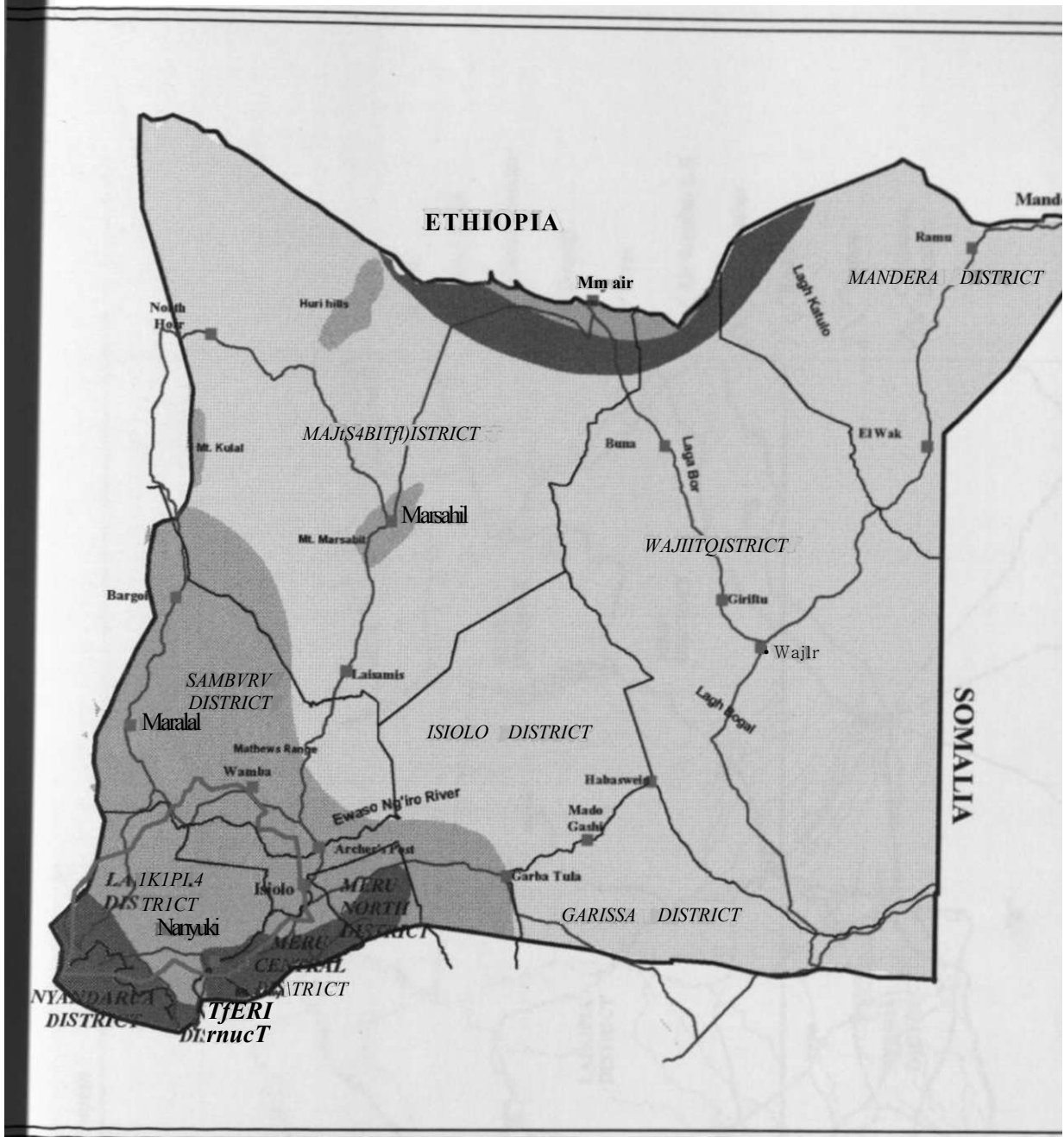


**D**  
 ENNB boundary  
 District Boundary  
 Potential  
 High to medium  
 Medium to low  
 Low  
 NDA Area



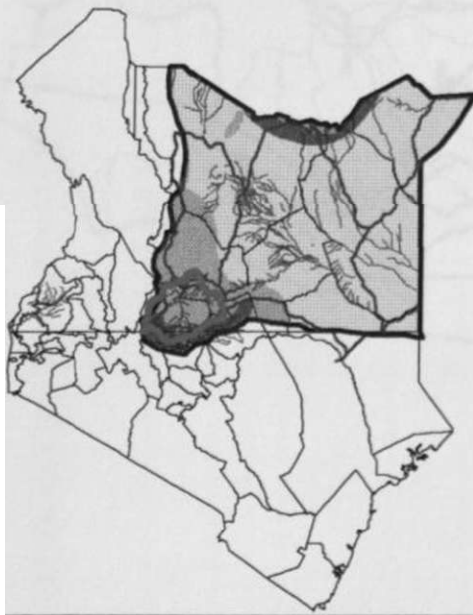
Basin map • Omani area © IUMU;  
 MWD 1/0

Map 3.2: The location of Upper Ewaso Ng'iro North Basin

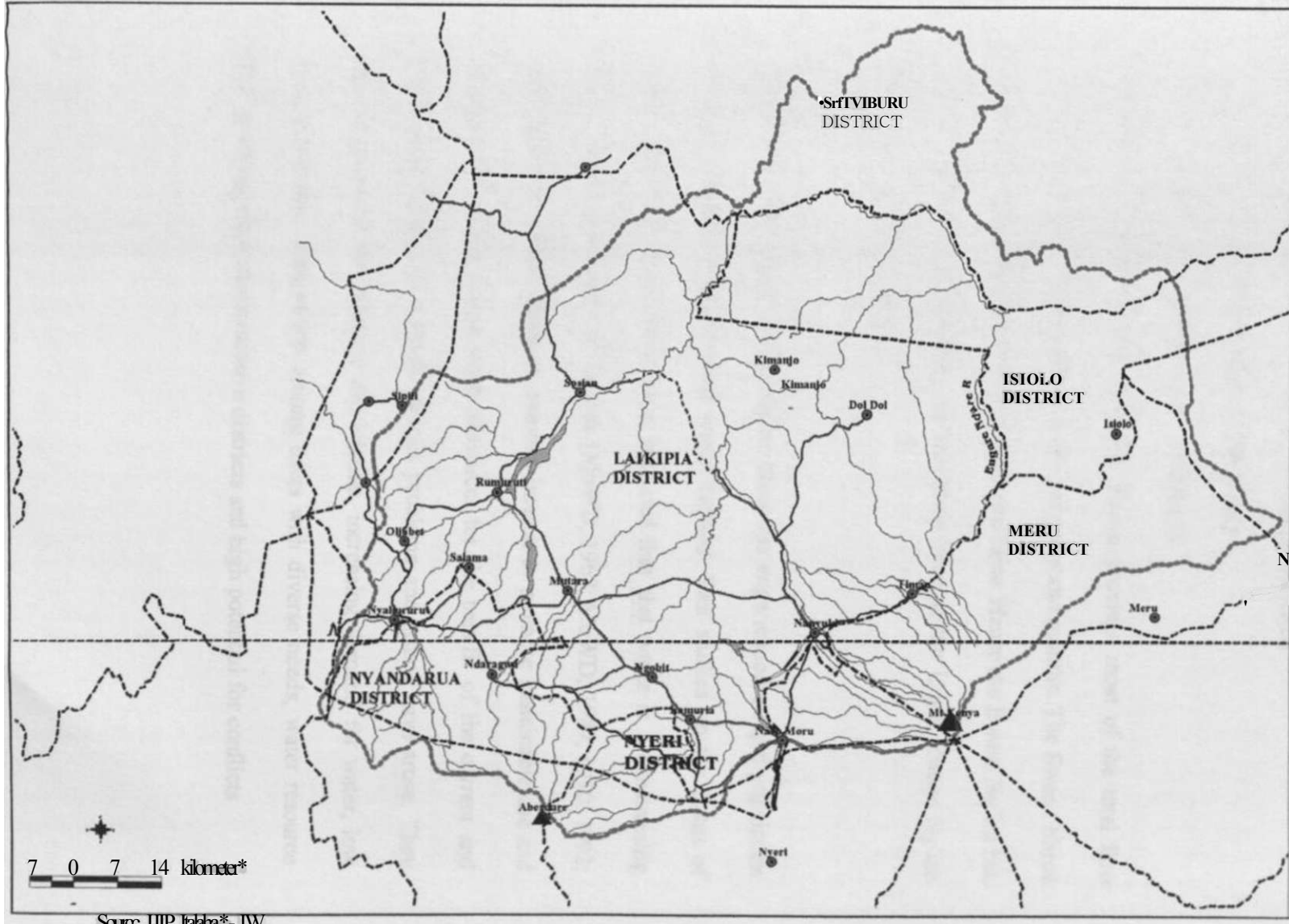


3 END

- UENNB boundary
- River
- District Boundary
- Road
- logical potential
  - High
  - High to medium
  - Medium to low
  - Low
  - Very low
- ENNDA Area

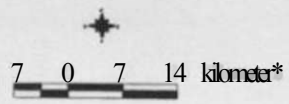


Map 3.3: The Upper E. nso Ng'iro North Catchment



**Legend**

- Major town
- - - District boundar
- Swamp
- River
- N / V ^ " Weather L.S
- A / Dry Weather
- / ^ Railway
- / \ / Tarmac
- J \ y Catcluiieni boundarv



Source IJIP Itaha\*- IW

The Ewaso Ng'iro North can be divided into 3 sub- catchments

- a) Ewaso Ng'iro Mt Kenya catchment (4640 Km<sup>2</sup>)
- b) Ewaso Narok catchment (3380 Km<sup>2</sup>)
- c) Ewaso Ng'iro lower basin (7180Km<sup>2</sup>)

The Ewaso Ng'iro flowing from Mt. Kenya provides most of the total flow during the long and short rains and the wet years and months. The Ewaso Narok provides rain during the period of continental rains. Hence the Ewaso Ng'iro Mt. Kenya catchment is important for this study because the Upper Ewaso Ng'iro north basin falls within here.

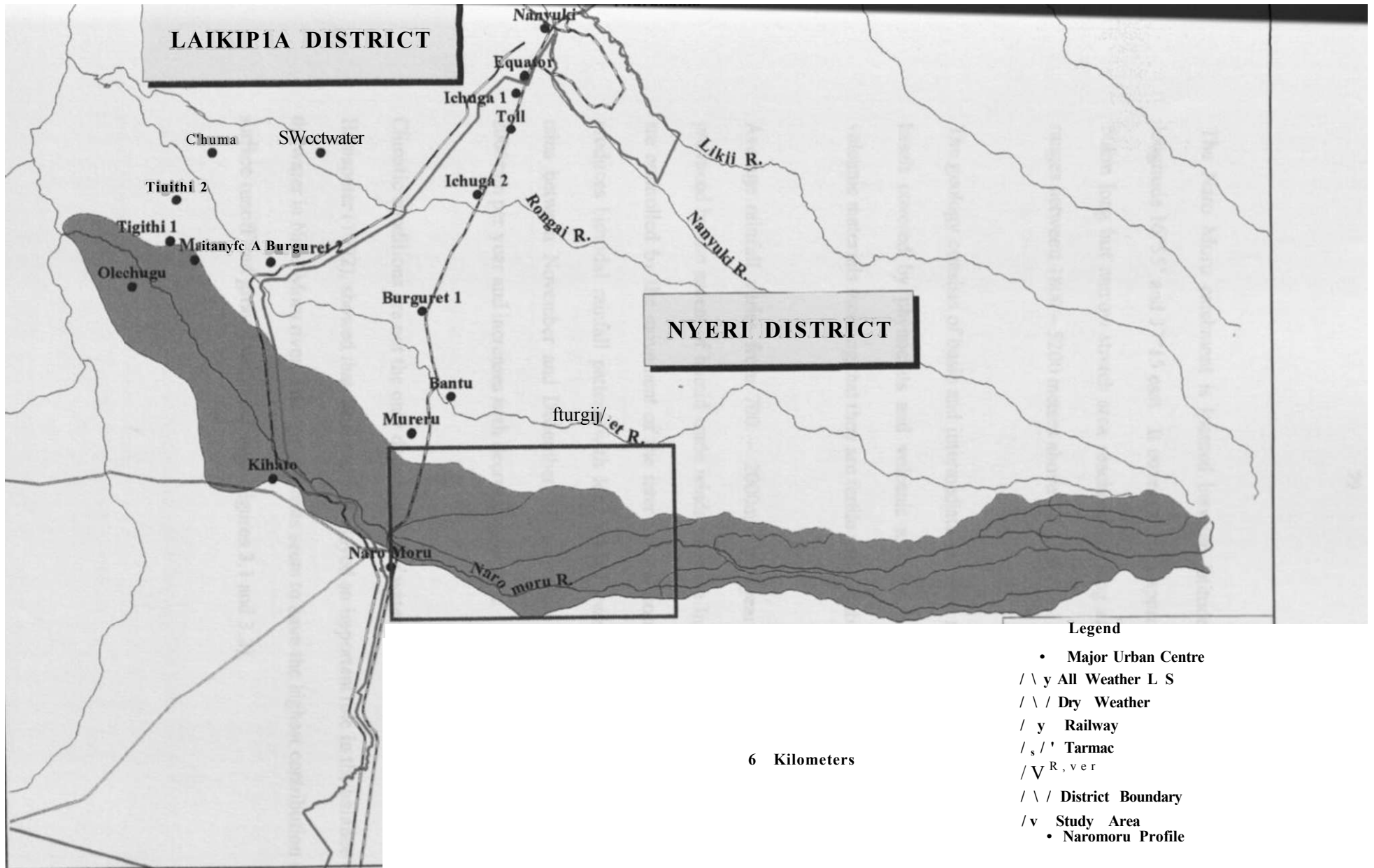
Since 1960s the Upper Ewaso Ng'iro basin has experienced a rapid population increase coupled with increased water demand. Past studies on the status of water resources of the basin have indicated that that water is a constraining factor to the development of the area (MoWD, 1963, MoWD, 1987; 1990; 1992, and Decurtins, 1992). There is renewed interest to promote sustainable use and management of the scarce water resources for the benefit of the current and future generations. As a result various problems and issues have arose. They include potential for resource degradation, increasing demand for water, low water efficiency, competition among users with diverse needs, water resource sharing among nine administrative districts and high potential for conflicts.

The flow of Ewaso Ng'iro at Archer's post in a dry year or month is highly dependent on contribution of Mt Kenya. The lowland plains produce significant proportion of the total flow in wet years and months due to high surface runoff during the rainy seasons which is rarely captured as seen in chapters 4 and 5. The highland areas are therefore crucial to the sustainability of the flows downstream particularly during the periods of high rainfall. The flow at Archers Post has been dropping over the years: 9m<sup>3</sup>/s in 1960s, 4.5m<sup>3</sup>/s in the 1970s, 1.2m<sup>3</sup>/s in the 1980s and 0.9m<sup>3</sup>/s in the 1990s (Liniger, 1995). The river dried completely for a stretch of 60 Km in 1984, 1986, 1991, 1994 and 1997. The alarming trends are attributed to the abstraction at the upper lower mountain slopes. This is the basis upon which the following study areas namely, Naru Moru, Daiga and Kimanju were sampled to represent the the Upper Ewaso Ng'iro North Catchment.

### 3.1.1 The Naro Moru River Basin

#### Physical Background

The Naro Moru catchment forms one of the small catchments that make up the mount Kenya sub-catchments of the Ewaso Ng'iro basin. Map 3.4 shows the location of the study area.



Sonne: LRP Database IW9

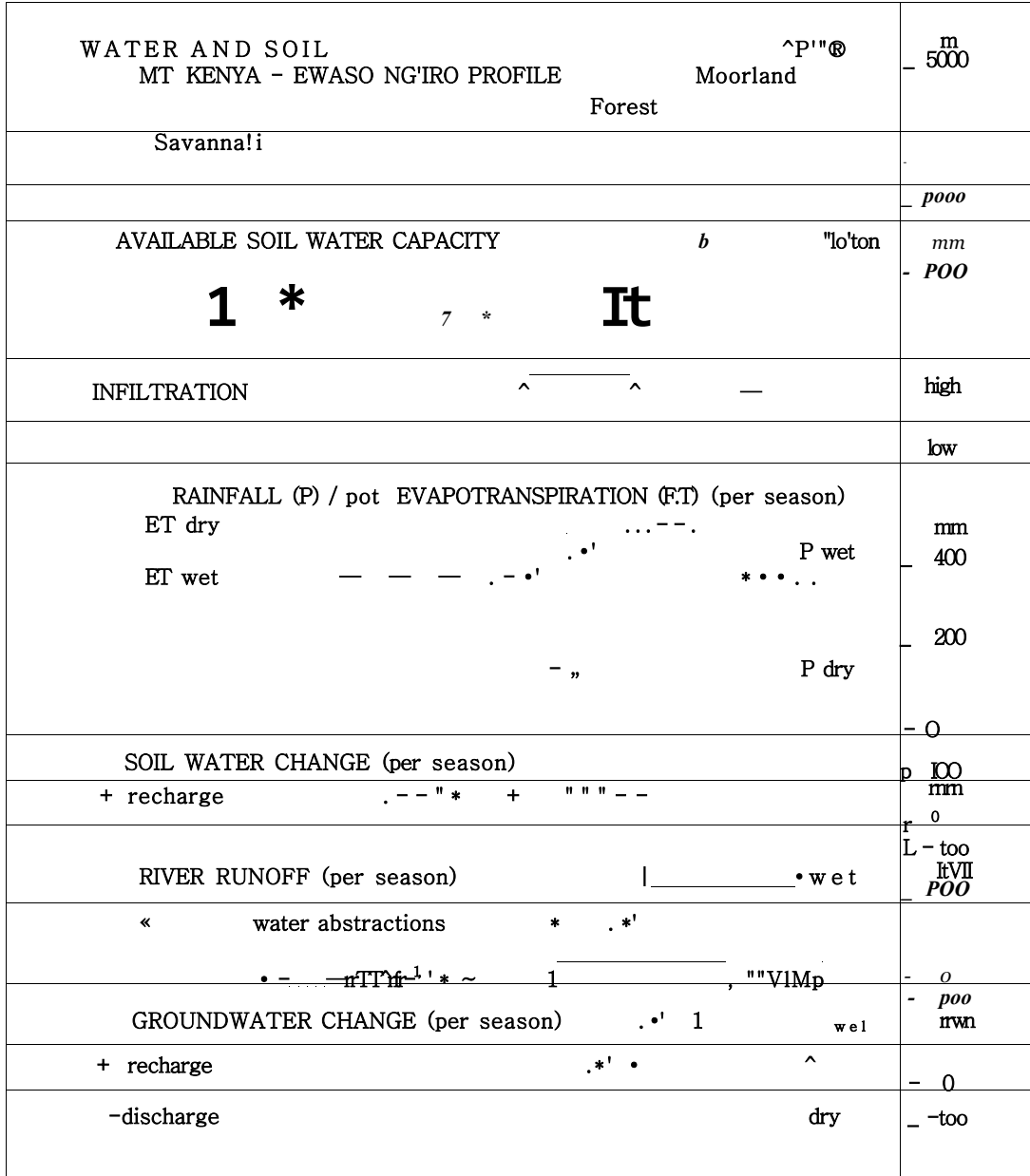
The Naro Moru catchment is located between latitudes 0°03' and 0°11' north and longitude 36°55' and 37°15' east. It covers an area approximately 170km<sup>2</sup> formed by a 50km long but narrow stretch area reaches 5km long at its indent point. The altitude ranges between 1800 - 5200 meters above sea level (a.s.l.)

The geology consists of basic and intermediate volcanic rocks i.e. trachytes, kenytes and basalt covered by phynocrats and volcanic ash. The soils are derived from recent volcanic materials meaning that they are fertile and suitable for crop production.

Average rainfall varies from 700 - 2000mm per year and is basically orographic produced by the ascent of humid trade winds from the Indian Ocean. The trade winds are controlled by the movement of the inter tropical convergence zone (ITCZ) which produces bimodal rainfall pattern with long rains between April and June and short rains between November and December. Evaporation rate ranges between 1200 - 2000mm per year and increases with decreasing altitude.

Climatic conditions are not the only determinants of water availability. A study done by Hanispeter (1992), showed that the forest belt played an important role in the balance of the water in Naro Moru river. The upper forests seem to have the highest contribution to surface runoff and ground water recharge (figures 3.1 and 3.2).

Figure. 3.1: Water and soil Profile of Mt. Kenya -Ewaso Ng'iro (Naro Moru)



Source: Hanispeter (1992). Wilcr. Soil Conservation and Utilisation on the North-west side of Mt.

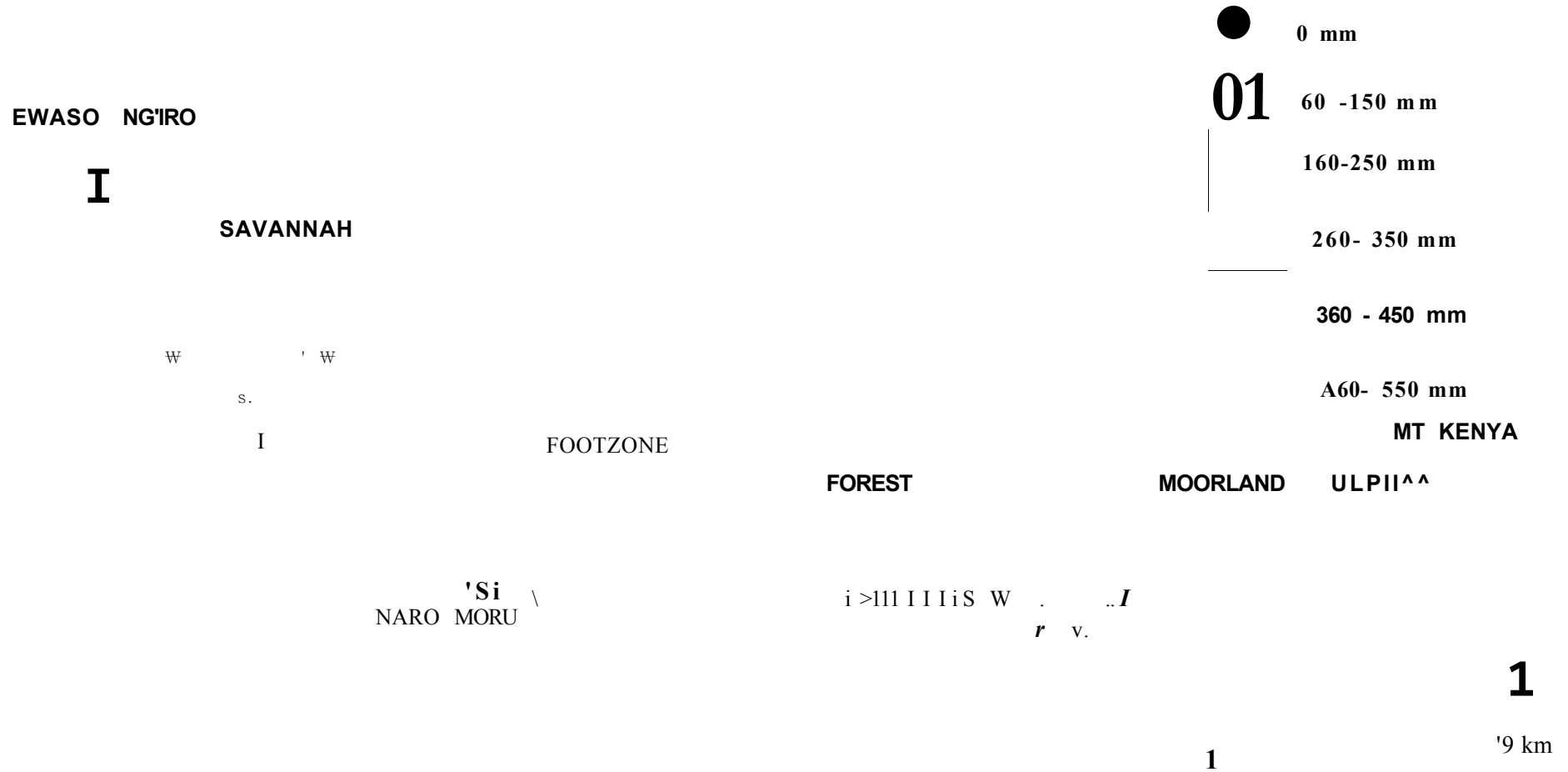
Kenya. LRP Vol. 12 No 4

The arrows show expected trends due to increased pressure of land use. The results are presented for wet and dry season based on 1982/93 measurements.



The fact that human activities at the foothills of the forest have exposed the forest to abuse such as deforestation exacerbated by the Shamba system (see plate 3.2), means that there is reduced river flow because of low water recharge

FIGURE 3.2: EXPECTED SURFACE AND GROUND WATER RUNOFF DURING THE RAINY SEASON — OCTOBER-DECEMBER 1984



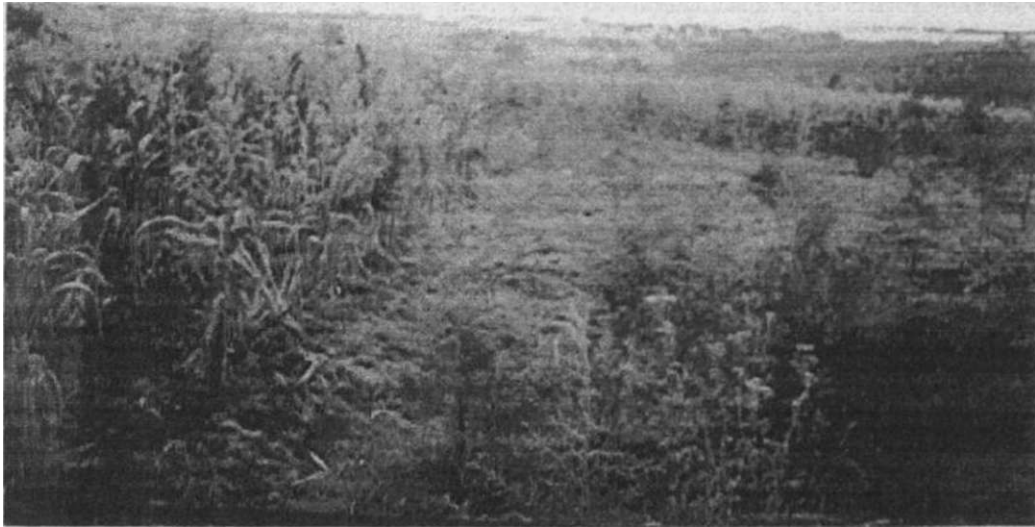
Source: Linig«c and D«curtins 1992

This belt (forest belt) and the lower moorland belt are the areas of highest rainfall, low evapotranspiration and limited water storage capacities. The glaciers in the alpine zone contribute greatly to the dry season flow. The lower forest belt (2400 - 3000m) is important because of the **very** high holding capacity of the volcanic soils thereby providing the river flow during the dry seasons and reducing the flood flows during the rainy season/periods.

Below the forest belt there are human activities (illegal and legal water use), which exceeds the amount supplied by runoff thereby implying that this is an area where large amounts of water is used. Intensified land use seems to increase water and soil loss thereby reducing its productivity. Hanispeter's study therefore identified two areas of concern for sustainable use of water and soil, which are

- The forest belt on Mt. Kenya where deforestation threatens the loss of water and soil resources in a longer term perspective; and
- The semi arid foot hill slopes where immediate water conservation measure for increased productivity and controlled river water use are needed.

**Plate 3.1: Shamba System in Formerly Forested Areas**



**Source:** Photo by author. 1999

The shamba system has a negative impact on the afforestation programmes. Although the farmers are required to move out once the seedlings grow, in practice, it rarely happens.

**Land Use in Naro Moru**

Three main categories of land use are observed (Kohler 1986, 1987). They include

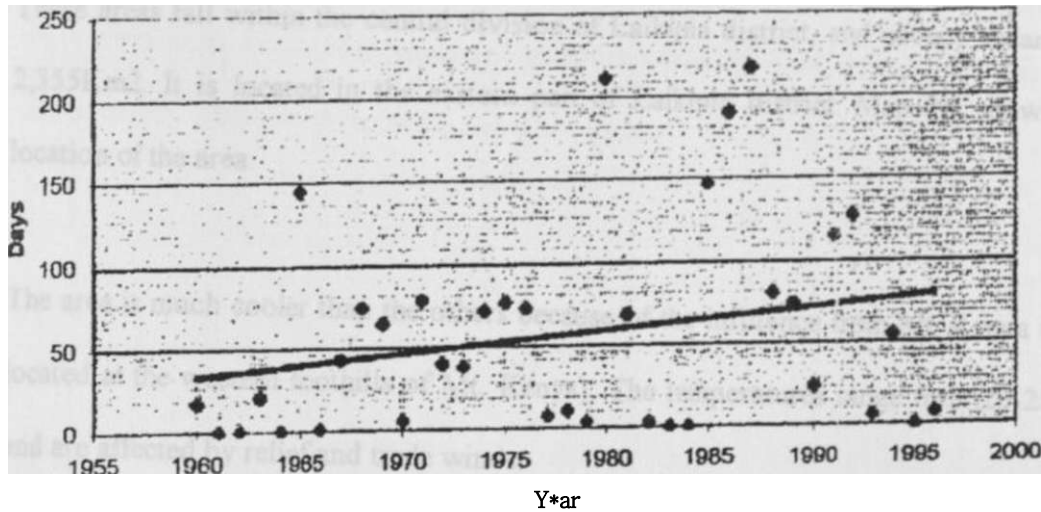
1. The Mt. Kenya National Park. This is 3200m a.s.l. The Park authorities manage the mountain natural resources to protect from human interference;
2. Mt. Kenya forest reserve is below the national park (below 3200m a.s.l.). The upper part of the forest consists of indigenous tree species conserved to

protect water resources, while the lower part is used for economic forestry - it is planted with exotic cypress and pine plantations. The study notes that natural forests possess higher infiltration rates in comparison to cypress forest plantations. Hence the effects are increased flood flows and decreased low flows of the drainage system. See figure 3.8 on the natural flow analysis of River gauging stations (RGS) in the region; and

3. Individual owned land: below the forest reserve (below 2100 m a.s.l). the land previously owned by European farmers is now subdivided into small plots. As indicated in Chapter 4 the plots are under small scale mixed farming, which are experiencing population increases due to immigration and natural growth from adjacent high potential areas. The crops are both cash crop and food crops. The main cash crops include maize, beans, potatoes; the cash crops are snow peas, onions tomatoes, cabbages and potatoes. Land use is quite intensive given the fertile soils, reliable rainfall, river water for irrigation and good transport.

There is no evidence of collaboration between the different land-uses, as the demarcations are not respected. People take their cattle to the forest plantation reserve in search of pastures thus destroying the young seedlings. Wild animals stray from the national park to the forest reserve and also cause further degradation. These conflicts together with land use change leads to degradation of vegetation cover and low river flows as seen earlier.

**Fig. 3.3** Days with Natural flow<sup>1</sup> below the 80% Flow



**Source:** Natural Resource Management Modeling and Monitoring (NRM3), 1999

There is an increase in the number of days with natural flow below the 80% reliability flow. Since there has not been significant change in rainfall over the region, the above flow regime changes can be attributed to land use change.

<sup>1</sup> The natural flow of river is the expected flow without artificial developments such as abstractions and storage. In a region, it is computed as the measured flow plus the abstractions upstream of the point in question.

### **3.1.2 Nturukuma/Nyariginu Area**

#### **Physical background**

These areas fall within the central division of Laikipia district, and occupy an area of 2,355Km<sup>2</sup>. It is located in the eastern part of Laikipia district. Map 3 6 shows the location of the area.

The area is much cooler than the others because of the influence from Mt. Kenya (It is located at the western foothills of Mt. Kenya). The temperatures range from 20-28° C and are affected by relief and trade winds.

The rainfall ranges between 400-750mm per annum. The seasonal distribution of rainfall makes rain-fed agriculture difficult thereby necessitating need for irrigation water. The type of soil is Red Brown Sandy Clay Loam Luvisol. It is fertile and suitable for crop production. As one moves towards the lowlands, the soils are Black Clay Vertisols and Planosols, poorly drained and with limited potential for crop production but high potential for ranching. However ranching is not the main activity as seen later in chapter 5.

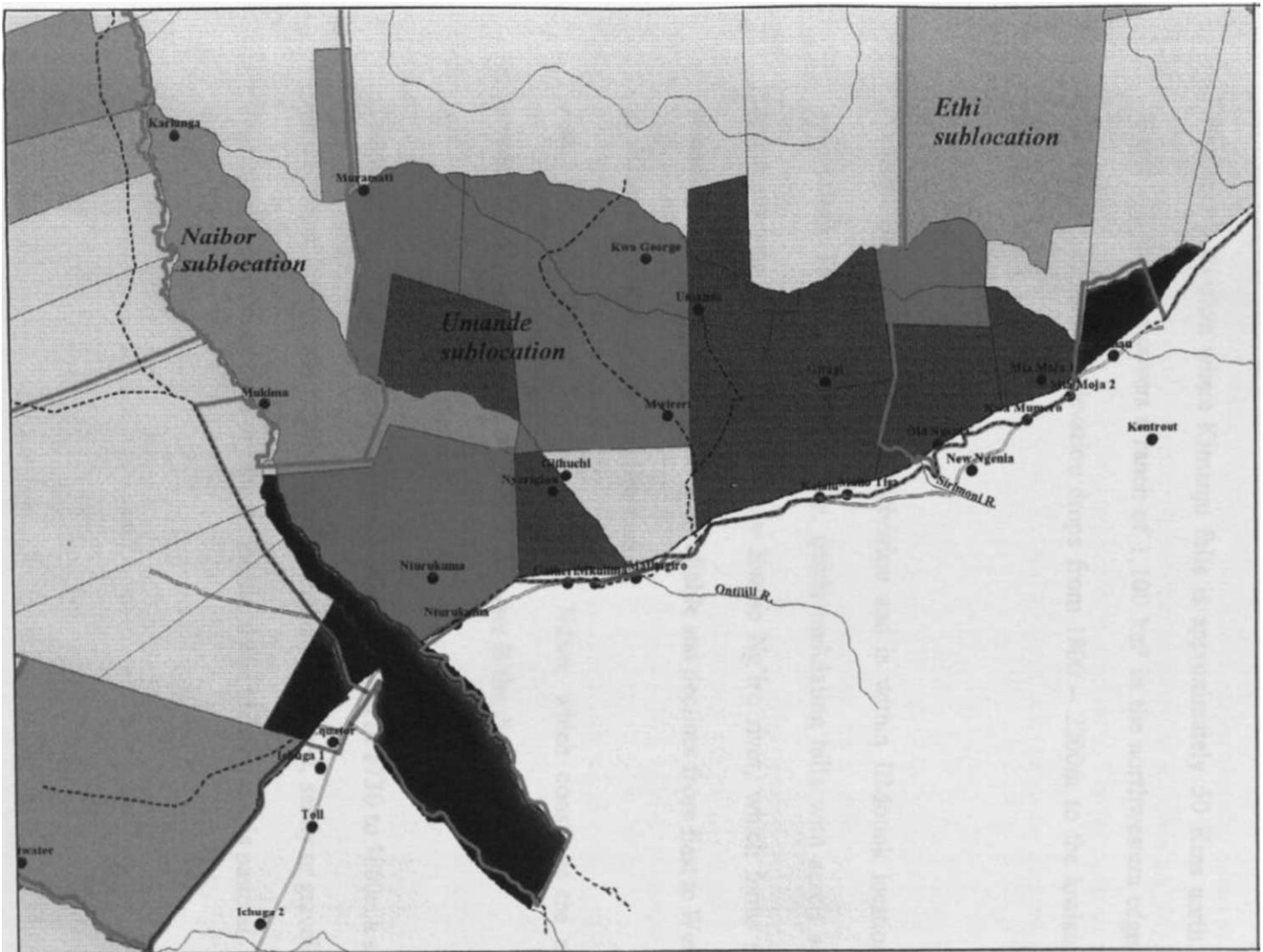
#### **Population**

The division has the third largest population in Laikipia (84,025 in 1999 and 92,048 by 2001) The community is needy, they depend on agriculture but have unreliable rainfall. The land sizes range from 1-5 acres Majority of the households have 2 acres This is a

transitional Zone where water abstraction is highest due to the high demand for irrigation. They use water from river Likii and Ontoulili (see map3.5). The major cash crops are wheat, snow peas, onions and tomatoes while the food crops are maize, beans and potatoes. They also keep cattle sheep and goats.



Map 3.5: Nyariginu/Nturuikiimii Study Area



**Dominant Landuse and Population Density**

- Urban area
- Small scale farm areas (1963 - 1972) (> 150 person\*1m2)
- Small scale farm areas (1973 -1982) (75-150 persons 1cm2)
- Small scale farm areas (1983 -1992) (25 - 75 person\* Vm2)
- Small scale farm areas (1993-1996) (<25 persona km2)
- Claiming units boundary
- Railway line
- Tarmac road
- All weather road
- River
- Sublocation boundary
- Major centre



Source: LRP Database. 1999

### **3.1.3 IIMotiok-Kimanju area**

#### a) Physical background

Mukogodo division where Kimanju falls is approximately 50 Kms north of Nanyuki town. The division covers a ranch of 1,100 km<sup>2</sup> in the northwestern edge of Laikipia district. On this fringe elevation drops from 1800 - 2200m to the lowlands of Isiolo district at about 1000m.

Kimanju lies in the west of the division and is within IIMotiok location, UMotiek sublocation. The relief here is steep, gently undulating hills with acacia savanna and sparse grassland descend towards the Ewaso Ng'iro river, which forms the western boundary of the division. Rainfall is unreliable and declines from East to West from 700 to 400mm/year with a bimodal distribution.

Apart from the Ewaso Ng'iro and Ngare Ndare, which constitute the eastern and western boundaries, there are no perennial rivers in the division.

Temperatures are cool ranging from 18 - 20°C, elevation of 1730 to 1880m.a.s.l. Soils are developed from metamorphic basement rocks and are red, sandy or gravelly.

Vegetation comprise of open dry thorn, bushland and the land use is pastoral

b) Land use

The main land use is livestock rearing with a few people planting beans as a food crop. Generally the livelihood depends on cattle, sheep and goats. Camels are being introduced in this area. The land is fragile and subject to degradation, yet they present a potentially important resource, which if managed carefully, can help serve the income, employment and food sufficiency goals.

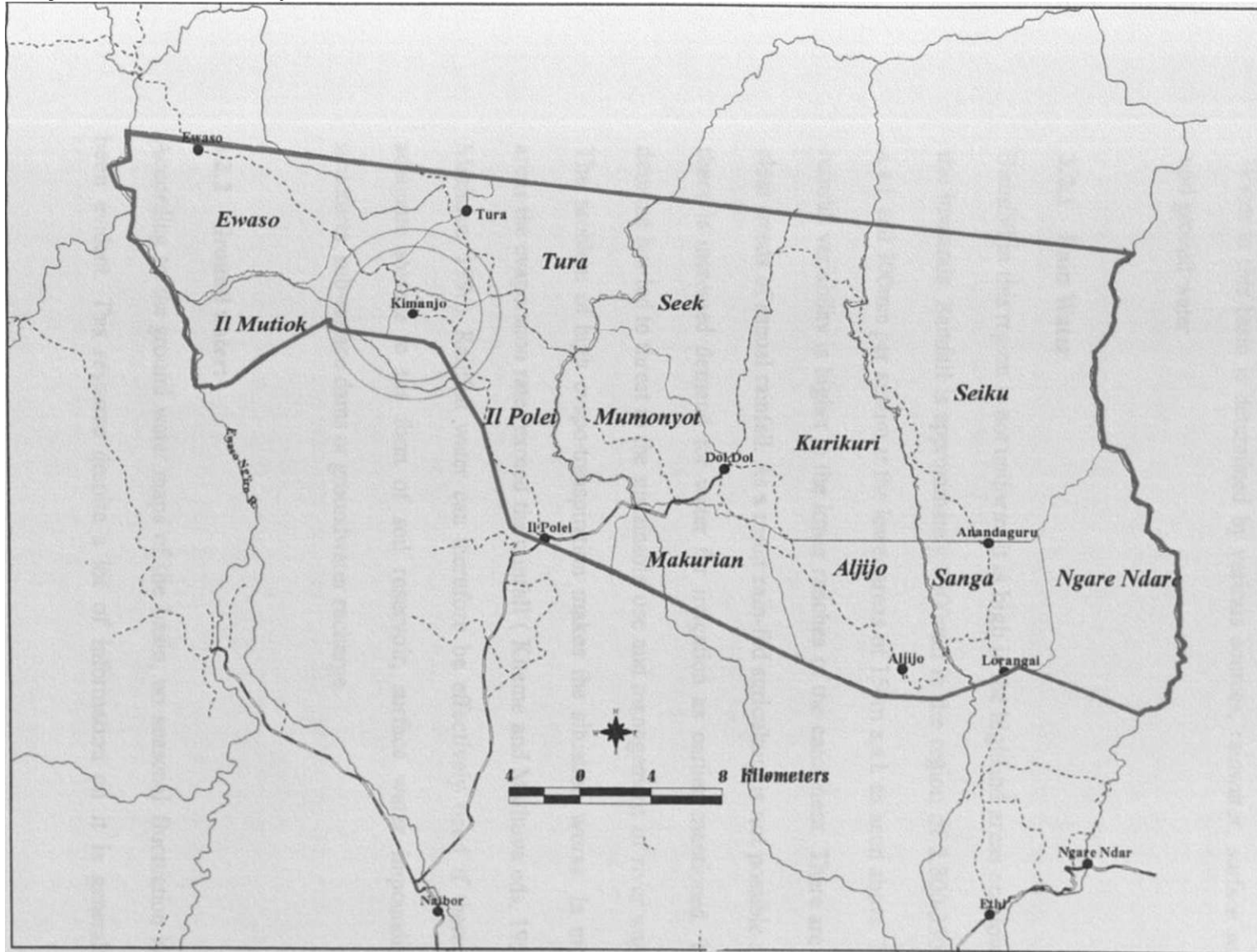
It has often been said that many African pastoralists have suffered from the parallel processes of marginalization and integration into the national markets (Ensminger, 1984; Little, 1983, 1985). As a result, social-economic stratification has been growing in pastoral societies. Mukogodo division in general and Kimanju in particular has been experiencing problems since the pre-independence era, when the colonialists had advocated for the formation of "native reserves" which forced the Maasai out of their prime grazing land by the colonial settlers. Throughout the colonial period, the Mukogodo remained a marginal and isolated anomaly within the district, which belonged to the Kenyan white highlands and was dominated by large scale white owned ranches. The reserves were bounded in the south and west by a solid perimeter fence with two police gates separating it from the ranch area and in the north and east by an unpopulated state owned quarantine block. After independence, a good part of the former settlers ranches was reverted back to African small holders but this has not changed the isolation and neglect of Mukogodo division. The ownership as seen later in

chapter 5 is communal and may bring problems due to its characteristic of confining pastoralists to one area. This is not sustainable in the long run because the climate dictates that they move across boundaries in search of pasture and water.

c) Population

With an estimated population of 17,222 in 1999 and 18,867 by the year 2001 Mukogodo division is the least densely populated division in Laikipia. (Laikipia DDP, 1996). The problems experienced include pastoral mobility, which makes it logistically difficult to provide water.

Map 3.6: Location of Kimanjo Area



Source: LRP Database 1999

### **3.2 Sources of Water in the Upper Ewaso Ng'iro Catchment**

Water in this basin is determined by various sources, rainwater, surface water and ground water

#### **3.2.1 Rain Water**

Rainfall in this region is not uniform. It is high in the highland areas and low in the lowlands. Rainfall is approximately 1500mm in the region of 2,800-3300m a.s.l. and 300mm per annum at the lower areas of 150m a.s.l. as seen above. The rainfall variability is higher in the lower reaches of the catchment. There are no clear trends of annual rainfall. As a result rain-fed agriculture is not possible and there is increased demand for water for irrigation as earlier mentioned. The demand has led to threat to the sustainable use and management of river water. The problem of high evapo-transpiration makes the situation worse. In most areas the evaporation rates exceed the rainfall ( Kiteme and Mathuva eds, 1995, Mathuva, 1996). Rainfall water can therefore be effectively used if there is adequate storage in the form of soil reservoir, surface water impounding structures, sub-surface dams or groundwater recharge.

#### **3.2.2 Ground water:**

According to the ground water maps of the basin, no seasonal fluctuation has been evident. This resource despite a lot of information on it is generally

difficult and expensive to exploit and maintain. The hydrological studies done show that it has proved difficult to maintain bore holes because of the machinery, technical know-how and operational costs involved. Bore hole water is also for limited use (domestic and livestock but not for irrigation purposes). The yields are also constant and cannot be varied. This is one of the reasons why demand for surface/ river water is high.

### **3.2.3 Surface water:**

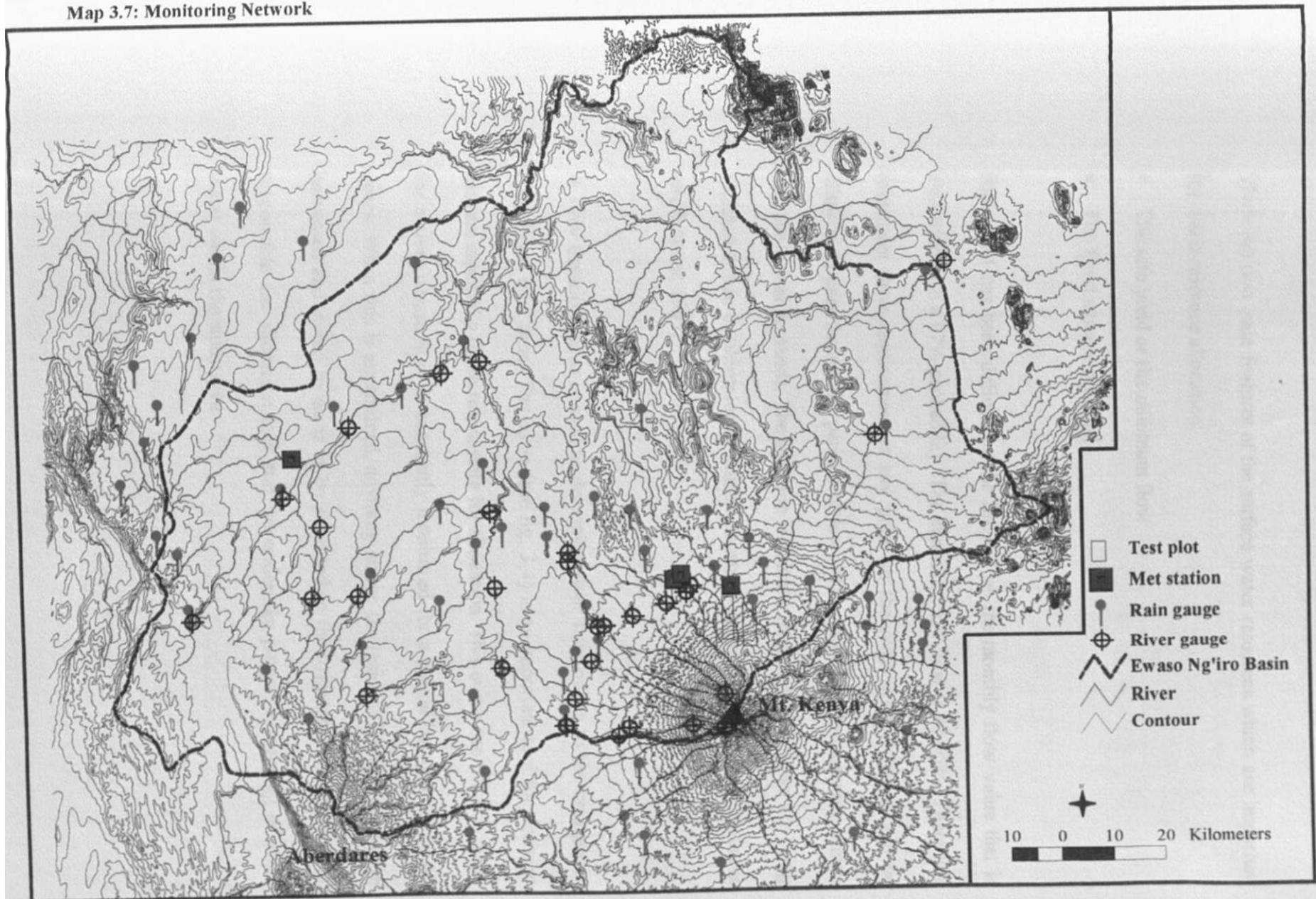
This water is available in the form of rivers and streams. It is the most important resource in the basin. There are problems of assessment and allocation. As seen above it is subject to abuse (pollution), misuse (over abstraction), and user conflicts as mentioned earlier. There has not been a fair assessment of the amount of water in the river, how much is being used, and the balance. This has been difficult due to the daily, and seasonal fluctuations.

One of the major problems affecting any efforts to assess is the unknown upstream abstractions. Therefore allocation within the basin faces anomalies. It has been established that whenever a potential user applies for a permit, the tradition has been that the bailiff has tended to calculate the balance based on a single gauging without regard of the season. The spot checks done by water bailiffs may be taken during the rainy season when there is adequate water unlike the dry season. This will mean that water allocation is based on the flow

of the wet season instead of both flows, and a single gauge instead of several gauges. The board allocates what is in the stream without determining the actual balance. The board has also not clearly distinguished between flood flow, normal flow and low flows. There is data by natural Resource Monitoring Modeling and management (NRM<sup>2</sup>) and Water resource Assessment Programme (WRAP) if the map below Map 3.7 is anything to go by. However the use of the data is not depicted as there is continued issuance of permits in spite of water scarcity.



Map 3.7: Monitoring Network



Source: LRP Database, 1999

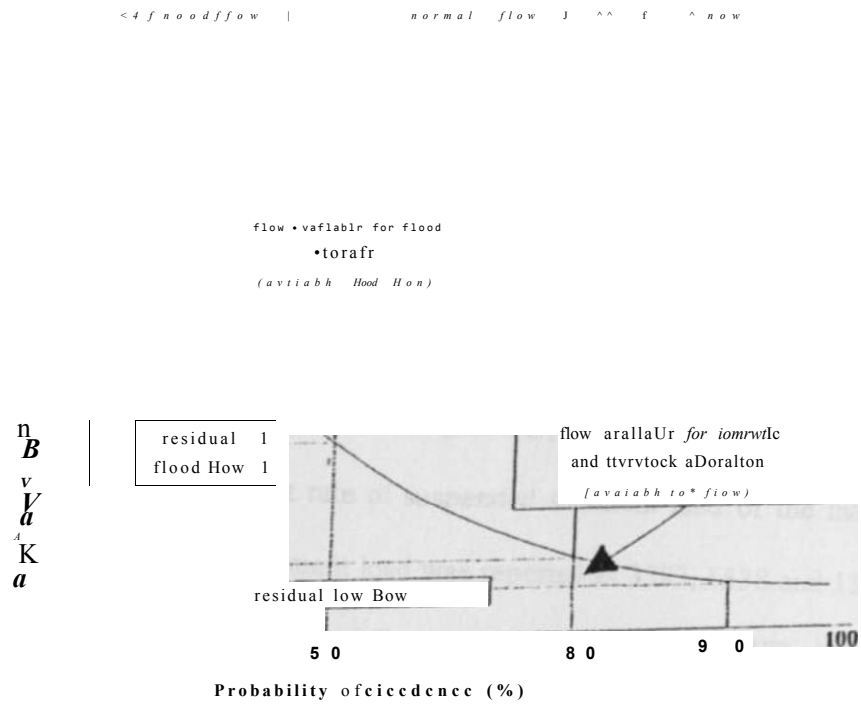
There are two main features of the surface water resources which are important for water resource allocation:

- The safe yield or the minimum flow
- The flood storage potential

Safe yield has been defined by the MoWD as the monthly flow value that is exceeded with a 97% probability. The minimum low flow is 90-95%. There is a minimum flow requirement at any point in the river system that should be allowed to pass during the periods of low -flow to satisfy downstream human and ecological demands. The situation is that the minimum low-flows are being violated due to combination of rainfall shortage and over abstraction ( Mathuva and Kiteme, 1995).

A flow duration curve is used to determine river flow owing to the changes in river flows over time. The curve (see fig. 3.4) is an important tool for decision makers especially those responsible for allocation. This curve can only be made for a river whose flow is constantly monitored for a period between 20 to 40 years. When this is ascertained, anything above the residual flood flow can be harnessed and stored in dams to be allocated to the irrigators. The authorities responsible for allocation lack staff to undertake proper monitoring of river water within the study area.

**Fig 3.4: The Duration Curve for Water Resource Management.**



Source: Mathuva J M (ed, 1996) Water Awareness campaign- Workshop on Sustainable Use and Management in Water Resource Development Unpublished

The model is based on the assumption that anything above the flood flow can be harnessed, stored in dams or tanks. Storage as indicated in chapter 5 below is done on a very small scale.

### 3.2.4 Surface Water Quality

Surface water quality has not been studied exhaustively, since the major concern has been on water scarcity. The data available shows that there are reasons for concern in some places particularly during the low season when the concentration of the pollutant is expected to increase. The main forms of pollution are

#### a) Physical

Sediment load is the major form of physical pollution taking place in the surface of the basin. Sediment monitoring at Archer's post between 1950 and 1960 indicated that the river had a sediment load (MoWD, 1963). The EwasoNg'iro is said to have the second highest rate of suspended sediment load of the major rivers in Kenya. Suspended sediment load was reported as 3387, 1538 and 1328 ppm for Perkenra, Ewaso Ng'iro, and Tana River respectively (MoWD, 1992). Sedimentation also affects the flow of water.

#### b) Chemical

Surface water is said to have acceptable quality for irrigation, livestock and domestic use. Decurtins (1992), reported that Ewaso Narok and Naro Moru rivers had very high concentrations of sodium and high electrical conductivity

c) Biological

The main source of biological pollution is sewage from major urban centres, namely: Nyahururu, Rumuruti, Nyeri, Nanyuki and Isiolo. Bacterial analysis of Nanyuki river water downstream of Nanyuki town showed considerable faecal pollution. However there is no data on the health impact of such levels of pollution.

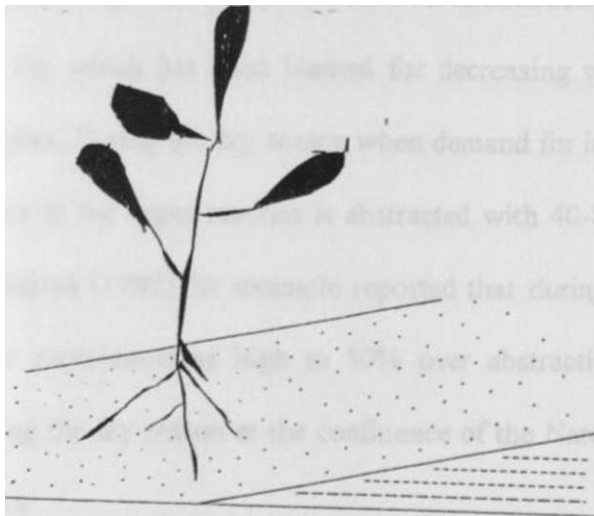
However pollution is not the main concern of this study though it should not be overlooked. There is need for a study to find the exact levels of pollution and how they could be managed.

All the above study areas are faced by competing demand for water due to either immigration, change of land use as seen above. There are distinct water users in the highland and lowland regions. The highland people are arable farmers, (i.e. Naro moru) both large scale and small-scale farms, growing rain-fed crops supported by irrigation. The lowlands are inhabited by cattle ranchers and pastoralists with the latter being dependant on the mainstream flow of Ewaso Ng'iro for survival (i.e. II Motiok). This situation creates diverse competition between people on one hand, between livestock and wildlife, and between people and the latter two.

### 3.3 Effects of Competing Water Resource Demand

Competing demands and over-abstraction are the main problems of water facing both users and managers in the study area. The activities have been said to be unsustainable, as they affect the balance between rainfall and output (evapotranspiration). From the natural science point of view, soil and vegetation conditions are important to the water resource system. Liniger, (1991) presents a simple vegetation-water balance equation for the situation as shown below:

Figure 3.10 Vegetation Water Balance



$$P = SWC + Ro + DP + ET$$

The Model above illustrate the situation

- P rainfall
- SWC soil water change
- Ro runoff
- DP deep percolation
- E evaporation
- T transpiration

Source: Linger (1995) *Endangered Waters A Global Overview of Degradation*. Connict and Strategies for improvement Development and Environment Report No 12 Bern

Different vegetation types influence the storage and output components of the vegetation-water balance system differently, and consequently, the water resources of the area in which they are located. However, the Institutional framework and the law is supposed to form a framework that will ensure that the competing needs are met. Enforcement of the water laws is one of the ways of ensuring equitable water distribution, but has been identified as one of the areas that are lax.

Another Impact of competition is over abstraction in the upper reaches of Ewaso Ng'iro, which has been blamed for decreasing water availability in the lower reaches. During the dry season when demand for irrigation is highest, 60-80% of water in the upper reaches is abstracted with 40-80% of it being unauthorized. Gathenya (1992) for example reported that during the dry season, Naro Moru river experiences as high as 80% over abstraction leaving no water flowing during the dry season at the confluence of the Naro Moru and the Ewaso Ng'iro rivers.

### **3.4 Institutional Arrangement**

At this stage it is important to mention that as already indicated earlier, the institutions managing water in the study area are diverse. Water management is a responsibility of separate departments or separate organizations with isolated

environmental departments. There is very little collaboration (see Chapter 4). In addition, the laws governing water are also fragmented in various Acts.

### **3.5 Emerging Challenges**

The challenge is coping with the increasing demand for water. Changes in the flow regimes as a result of global warming, land use changes and cultivation and draining of swamps will affect the state of water resources within the catchment, conservation needs and potential exploitation. This calls for concerted efforts involving catchment protection, improved water allocation guidelines, monitoring of water abstractions and pollution, law enforcement and adoption of water saving approaches and technologies. It also calls for policies to discourage immigration. This challenge is the basis for the next chapter, which analyses the institutions, vested with the responsibility of water management, ranging from the national level to the local community level.



## CHAPTER FOUR

### **4.0 WATER RESOURCES ADMINISTRATION AND MANAGEMENT**

#### 4.1 Overview of Institutions

Resource management in Kenya has gone through a transition since independence. In the colonial times, the government made all decisions and was supposed to initiate development through public sector institutions. After independence, there were minor modifications with elective local authorities given more authorities. It also saw the establishment of provincial Development Committees and District Development Committees. Further decentralization to the district level was in the hope of further decentralization so as to meet the resource needs of the population at a local level.

The approach to the management of natural resources in Kenya has been through scattered and uncoordinated collection of sectoral institutions and donor funded programmes. For a long time ordinary Kenyans have been treated as passive recipients and consumers of regulations, legislation, technical packages and policies planned and designed by never ending teams of experts and consultants. If the solution to water management problems is to be found in the number of institutions, then Kenyans need not to worry! There are separate ministries, departments, corporations, technical institutions, agencies and organisations specifically for each and every known biophysical component of

the environment. Each of these institutions has its own set of policies, regulations, and even laws governing its operations. Hence the department dealing with soils and water conservation is in the Ministry of Agriculture and Livestock Development (MOALD) but hardly has any links with the Ministry of Water Development (MOWD) or Ministry of Lands and Settlement (MOLS) at policy or technical level. At policy level, the Ministry of Environment (MOE) does not have any powers over how land is alienated and utilized in the country and therefore cannot authoritatively question the land use system. Hence all unalienated land under the custodian of the government is totally under the powers of the Ministry of Lands and Settlement. The common practice is that the Ministry can alienate trust land or government land anywhere in the country for unspecified development purposes irrespective of ecological value of such land to the country, and the inhabitants. Wetlands for instance have been allocated in Laikipia though they are good grazing ground during the dry season.

To add to the institutional dilemma, the government split the once MENR into two separate ministries, one for natural resources and the other for environment conservation. It becomes difficult to manage resources with subdivisions and clearly, it's a waste of resources. It will therefore require a lot of political will as indicated in chapter 7, to be able to coordinate activities between the different ministries.

The institutions in water management include but are not limited to the following: Ministry of Water Development, Ministry of Lands and Settlement, Ministry of Agriculture Livestock Development and Marketing, Ministry of Local Government, Ministry of Regional Development, , Ministry of environment and Natural Resources. Water undertakers like National Water Conservation and Pipeline Corporation and local authorities, NGOs and Community Water Projects.

## **4.2 Ministry of Water Development and Related Agencies**

### **4.2.1 Ministry of Water Development**

The Ministry of Water Development is the most important ministry both in water development and conservation. The other ministries involved deeply in water development are Ministry of Agriculture, Ministry of Regional Development, Ministry of Local Government, Ministry of Energy, and office of the President, which administers the District Development Committees (DDCs). Prior to the Ministry of Water Development, the overall responsibility of water development had shifted between three ministries: Ministry of Public Works, Ministry of Agriculture, and Ministry of Natural Resources under the water Development Department. In 1974, this department was elevated to become Ministry of Water development. The Ministry took over the operation of government constructed water schemes and all county councils (which should be under the Ministry of Local Government) and settlement schemes (which should

be under MOLS), as well as several Self Help Groups Besides the Ministry, National Irrigation Board still handles all major irrigation developments.

The functions of the Ministry of Water are: monitoring, conservation and control of water, registration of water rights that is done in co-operation with the Water Apportionment Board. The Ministry also does planning and design and is in charge of training. This duplicates what Kenya Water Institute (KEWI) does. The Ministry also executes the actual construction works, which include agriculture, water conservation and drilling. Maintenance is also up to the ministry in addition to research and formulation of policies. Co-ordination of all the activities of the ministry is another responsibility. There is a Water Resources Authority, which was made defunct in 1968 when its functions were taken over by the Water Development Department and later MOWD; this change however has not been reflected in the water Act. The Ministry is also in charge of appointment of water undertakers like NWCPC, local authorities, and NGOs. What is emerging is that there is no provision for private sector participation in undertakership, though private sector undertakership is expected to ease the burden of providing water by the public sector. Secondly, the government takes the monopoly in undertakership through NWCPC and thus is the major water distributor/supplier. In addition the MOWD undertakes all water related activities (see summary table 4.13).

#### 4.2.2 National **Water Conservation and Pipeline Corporation (NWCPC)**

The study found out that the Corporation was established in 1988 with an objective of attaining water development. It is directly responsible to the MOWD and hence supplies water to areas predetermined by the latter. The functions of the corporation is to plan, manage and procure equipment for construction of dam and water supplies; promote efficiency in operation for existing water projects (hence monitor and ensure projects that are financially viable. Of the assigned tasks, the most important is bulk water supply to water undertakers and persons. The works are usually large-scale projects, which the corporation implements on behalf of the ministry in spite of the fact that the ministry also supplies water. NWCPC has also taken over the management of a number of urban and rural water supplies. Through its projects, it generates revenue, which is not used for conservation measures. The corporation leaves out liquid management to the towns who neither have revenue nor the expertise to manage the same. The corporation has various gazetted projects in Upper Ewaso Ng'iro North catchment and since they are assigned by Ministry of Water Development, it is possible to tailor them to particular areas and not others.

#### 4.2.3 **Water Apportionment Board (WAB) and District Water Board (DWB)**

The WAB is another public body, which gives permission and controls use of water and hydraulic infrastructure. It has over 400 staff with majority from

province and district water offices. WAB has virtually no technical staff. It consists mainly of appointees of the minister i.e. 12 out of 13 members are appointed. WAB is therefore subordinate to MOWD. From technical point of view, MOWD should take over the functions of WAB since it has technical capabilities, but which would not be ideal because an independent body should handle issues of water permit. The Ministry of Water needs to be more involved in proper management of data on permits as an effort to monitor water use. Issuance of permits by WAB is dependant on the record on water abstractions from ENNCB yet evidence from the latter's office revealed that record keeping is poor as evidenced by poor filing system.

The DWB is the first stage of screening of water abstraction applicants and they are the ones who hand over the approved permits to the abstractors. Its function is to ensure proper co-ordination and planning of water activities at the district level and thus a Subcommittee of the DDC. It is supposed to protect, conserve and preserve of all catchment areas within the district. It partitions, allocates and authorises use of all water bodies. It is supposed to ensure water balances<sup>^</sup> as flow is maintained to allow water to reach the downstream users. The function of overseeing and co-ordinating of water activities in the district is the other important function of the DWB, which is duplicated by ENNDA. Rivers as already mentioned cut across administrative boundaries meaning that the base-

flow may be determined by users in other districts. The DWB may therefore make no impact in terms of cross boundary water resources

The District Water Board ranked water needs as follows:

1. Domestic and livestock
2. Irrigation
3. Town councils for domestic purposes
4. Industrial
5. H E P. production
6. Wildlife consumption
7. Fisheries

Domestic use and irrigation take the lead and the rest can come in any order. However, the study found out that majority of the water applications are for irrigation purposes. Further it allocates water based on demand and not need. This means that the DWB has no mechanism of ensuring that domestic water needs are met before allocating water for irrigation.

#### **4.2.4 Catchment Boards-Ewaso Ng'iro North Catchment Board**

The board covers the whole of North Ewaso Ng'iro catchment. The board meetings are held in the provincial water office in Nyeri and therefore have no permanent office. Its role is to allocate or apportion/approve water permits. It was established that its approval is based on information it receives from different districts and not their own data. Decisions to allocate are based on

information given to it by the different district boards within its area. The board has no way of ascertaining the validity of data from the districts. It relies on utmost good faith. It is interesting to note that the Provincial Water Engineer (Central Province) is the secretary to the board. Though part of Nyeri is within the catchment, majority of the districts are in Rift valley (Laikipia), Eastern (Meru) and Northeastern provinces (Isiolo, Marsabit, Garissa, Mandera, Wajir, Samburu).

The data upon which the board allocates /apportions water may not be reliable because, due to few staff, it is not continuously monitored. There is also poor networking with the district staff, spot checks are rare due to lack of vehicles. A visit to the secretariat of the board revealed that record keeping was poor as records were not updated. It was difficult for instance to get a list of permits issued per district each year. There was also no indication for renewal of permits. With such poor record keeping, abstractions continue without renewal. And therefore it is difficult to know how many people or how much water is legally being abstracted.

In terms of membership, the board is well balanced with both administrative and technical staff. However having technical staff at the provincial level is a duplication of resources. The study established that there is actually no need of provincial water engineers because water cannot be managed administratively.



Further, with decentralisation strategy these personnel are mostly required at the district level, which is a planning authority. These personnel should be redeployed to the districts or Ewaso Ng'iro North Development Authority (ENNDA).

#### **4.2.5 Regional Authorities: Role of ENNDA in Water Resources Management in Ewaso Ng'iro North River Basin**

Ewaso Ng'iro North Development Authority (ENNDA) is one of the six drainage basin based resource development authorities established by an act of parliament , ENNDA Act Cap **448** of **1989** of the laws of Kenya. The aim of establishing it was for promotion of economic development within the region. ENNDA region occupies 36% (210226 km<sup>2</sup>) of the total land under development authorities and it covers eight ASAL districts namely Isiolo, Marsabit, Samburu, Moyale, Laikipia, Wajir, Mandera and Garissa. It also covers parts of high agricultural potential districts like Nyeri, Meru, Nyambene and Nyandarua.

According to ENNDA its functions include the following:

To plan for the development of the area and initiate project activities identified through the government and come up with up to date development plan of the area. The projects are to exploit the natural resources for the benefit of agriculture, wildlife, tourism, industries, mining, and fishing and recommend

economic priorities. The authority is also supposed to monitor and evaluate the design and execution of planned projects within the area.

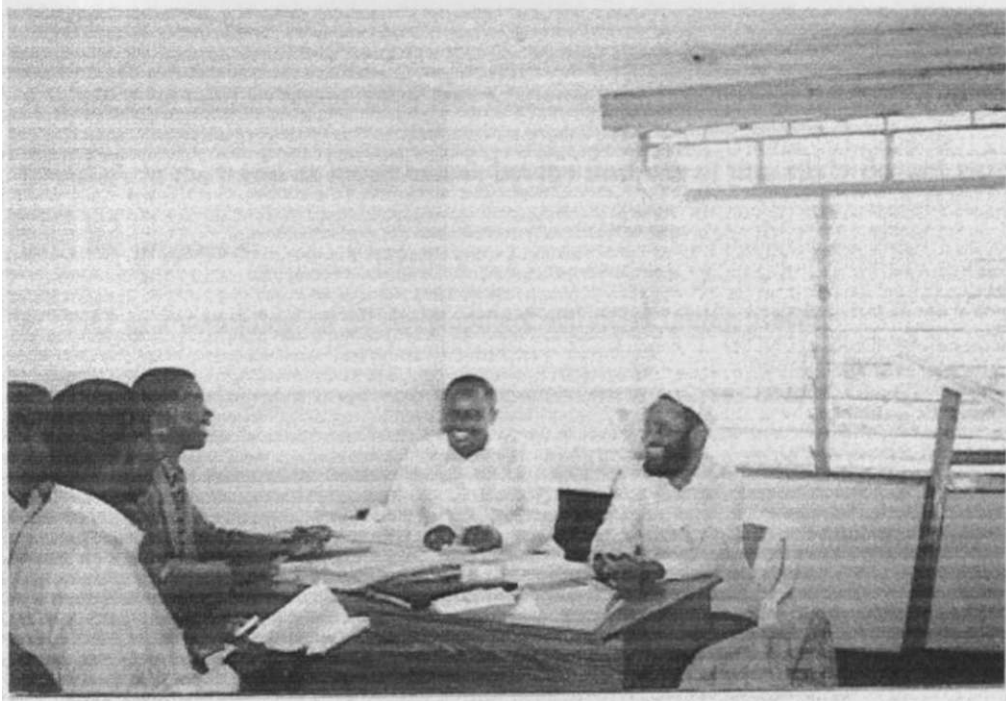
It has been given the role of coordination of present abstraction and use of natural resources, especially water and set up an effective monitoring of abstraction and usage. It is supposed to maintain liaison between government, private sector and other agencies in view of limiting duplication of efforts and ensuring the best use of available technical resources.

ENNDA is also supposed to effect construction of any works deemed necessary for the protection and utilisation of the water and soils of the area. They have to make sure that landowners in their jurisdiction protect water and soils and monitor effects of development on inflow and outflow of rivers thus, champion environmental protection. In addition, the authority is mandated to identify, collect, collate and correlate all data related to the use of water and other resources and also economic activities within the area for planning purposes. These functions duplicate the functions of the district planning unit though at a regional level.

The above functions are enormous given that the workforce consists of 10 professional staff in agriculture, community development, planning, water engineering. There are 76 administrative, personnel management, finance and

sporting staff (see table 4.2). The board of directors consists of representatives from each district and relevant ministries. With this kind of establishment and responsibilities, and the fact that ENNDA does not levy any tax for its services, often relying on the meager ministerial budgetary allocations, it is next to impossible to perform such roles.

**Plate 4.1** The Senior Staff Members of ENNDA in a discussion



Source: Photo by Author, 1999

**Table 4.1 Staff Capacity**

Category of Staff	Number of staff
<b>1) Management Staff</b>	
a) Resource Management	<b>10</b>
b) Administration/Finance	<b>10</b>
c) Others	<b>6</b>
<b>2) Clerical Officers</b>	<b>8</b>
<b>3) Secretaries/Drivers</b>	<b>13</b>
<b>4) Computer Operator</b>	<b>1</b>
<b>5) Artisan</b>	<b>2</b>
<b>6) Subordinate</b>	<b>36</b>
TOTAL	86

Source: Field Survey, 1999

A workshop held in Nyeri 1996 (see Mathuva,1996) proposed the future role of ENNDA in the basin as listed below, but the findings of this study do not agree with the proposals:

- Act as a watchdog on all development activities taking place,
- Act as an arbitrator over conflicts concerning resources use;
- Guarantee adequate water reserves to meet every ones needs;
- Devise schemes for water resources development and management in collaboration with other water bodies such as DWBs, Catchment Boards, etc.;
- Develop water data banks, and participate in the study of the instruments for economic analysis in this field, and
- Become a source of specialist knowledge on the natural environment, pollution control technologies and related subjects and to make this knowledge available to political and administrative decision-makers.

It is however doubtful that these future roles of the authority are defined while bearing in mind that there are other institutions who could be dealing with the same issues and with better resources to do so. For instance on the component of developing data banks other institutions like Natural Resource Management Modeling and Monitoring (NRM3) and the district water offices could be of use ENNDA should avail data from existing institutions. Secondly specialised knowledge of the environment is expected to be a role of the Ministry of Environment and Natural resources (MENR) which is represented at the district level.

#### 4.2.6 Others Agencies in Water resource Management

Table 4.2: Other Water Resource Management Agencies

Agency	Function/Role
Ministry of Local Government	Municipal water supply and sewerage except for county councils and other councils not water undertakers
Ministry of Lands and Settlement	Planning and construction of water supply on settlement schemes with technical assistance from MOWD. physical planning and urban development plan
Ministry of Culture and Social Services	Control of self help water supplies in Rural areas
Ministry of Regional Development	Regional development Fisheries, irrigation and in charge of regional authorities like ENNDA and LBDA
Ministry of Agriculture and Livestock Development	Soil conservation and irrigation development
Ministry of Tourism and Wildlife	Water supply and Sewerage in its wildlife projects and the surrounding community
KWS	Construction of water supply for wildlife and national parks (also supplies water to neighboring societies)
Ministry of Industry	Provision of control guidelines for effluent, and waste water from factories.
Ministry of Environment and Ministry of Natural Resource	Forestry development, natural environment protection excluding water protection
Presidential Commission on Soil Conservation and Afforestation	Co-ordinates ministries concerned with prevention of soil erosion and forest devastation by encroachment on catchment areas.
District Development	Approval of all district projects Establish local development

<b>Committee</b>	<b>priorities. Monitors the technical work of its executive committees Meets 4 times a year.</b>
<b>Non Governmental organizations (NGOs)</b>	<b>Examples in Ewaso are World vision. ASAL, Catholic Church. CPK among others Provide people with ready access to safe drinking water, basic sanitation Proude alternative means (apart from agriculture) of earning a Ining.</b>

Source: Field Survey, 1999

### 4.3 Government Departments

This section analyses the roles of the departments of water, agriculture and forestry, which are crucial to water management. For instance, water department performs the functions of conservation, preservation and control of water in the district. Department of agriculture is involved in land development of activities such as soil conservation, irrigation development, agricultural research among others. The forest department is supposed to conserve forests for both economic purposes and as a water conservation strategy

#### 4.3.1 The Water Departmets

##### a) Laikipia District Water Office

Table 4.3: The Role of the Department in Water Management

Activity	Area
<b>Monitoring</b>	<b>25 stations in Laikipia but only 5 are operational</b>
<b>Water apportionment</b>	<b>Whole district</b>
<b>Water pollution control</b>	<b>Likii river which was polluted by human waste</b>
<b>Modelling</b>	<b>Done by WRAP. Model on regulation of rivers and conservation of water</b>
<b>Plan &amp; design of water works</b>	<b>Whole district</b>
<b>Operation and maintenance</b>	<b>Whole district</b>

Source: Field Survey. 1999

On monitoring, every river has a gauge station for monitoring but most are closing down because of lack of adequate gauge readers. Some gauges are in the forests, and are risky. There was a sad incidence at Illmotiek in Mokogodo where a gauge reader was attacked by an elephant and died. Up to date, he has not been replaced. In addition, once, an abstractor has been given mandate to construct works, the department does not ascertain its appropriateness and the abstractors end up diverting water from the rivers. Poor monitoring at this level means that abstraction commences even before issuance of permits. On modelling part, the hydrologist section is updating records on abstraction and hope to complete the same in December 1999. However the modelling is not harmonised with NRM3's modelling.

#### Strategies Adopted for Water Management

Initially, the Water Department was supply oriented but now have realised that they have to employ a conservation principle-though in piecemeal. They supply water on demand, which means that although it is a government policy to equitably supply water, this principle is not practised. Policing is sparked usually by complaints of water shortages and not through their monitoring activities e.g. the Ewaso Narok case mentioned above. Another example is that residents along Nanyuki river who were up in arms against a major water abstractor namely: Kenya Horticultural Exporters in June /July 1999. This action made the water department to restrict their pumping to night. The department

does not go out of its way to ensure that everyone who needs water gets it and this is the reason why there are conflicts in water use. The department does not go out of its way to involve the community, but only does so when there are complaints from the people on illegal abstractions.

The study found out that the formation of Water Users Associations is an important strategy for management of water at local level. The establishment of Water users Associations (WUAs) dates back in the colonial era, but it was abandoned after independence. WTJAs are already established in Mutura and Pesi in Laikipia. In Nyeri, a workshop has already been held to sensitise project members on WUA ideologies. The formation of WUA may reduce water conflicts as it is based on a river catchment and all the members are represented and are governed by their own constitution. Since it will cover a small area, monitoring will be by members and hence equitable distribution may be possible.

Policing is another strategy but is not efficient as water guards stay in one locality for a long time making enforcement difficult as they get used to the people in those localities. They only get transfers when there are complaints on poor performance. An example of enforcement (Instigated by people) was in Ewaso Narok river, where an abstractor was causing the river to dry downstream. The abstractor was taken to court in 1998 and he stopped abstracting illegally. There is a discrepancy between the abstractions as



computed by using the permits information from the district water offices compared to the actual abstraction taking place because water applicants lie about the sizes of their land so as to qualify for water permits

Collaboration as a strategy for management is not used. There is no conscious effort made by the department to collaborate with other actors like ENNDA, which supplies, enforces and monitors water; between itself Las and NRM3

Table 4.4 Collaboration of Water Department with other Acton

Collaborating agency	Nature of collaboration
<b>1 Other government departments</b>	
<b>Agriculture</b>	<b>Planning and design of water projects</b>
<b>Social services</b>	<b>Community mobilisation</b>
<b>DDO/Planning</b>	<b>Project formulation prioritization implementation</b>
<b>2 other districts</b>	<b>Meet at the catchment board level</b>
<b>3 local authorities</b>	<b>Water supply and catchment conservation, permits</b>
<b>NWCPC</b>	<b>None</b>
<b>ENNDA</b>	<b>None</b>
<b>NRM3</b>	<b>None</b>
<b>ENNCB</b>	<b>Form part of the secretariat</b>
<b>NGOs</b>	<b>Help in design works</b>
<b>CBOs/Community</b>	<b>Management and implementation of water proje</b>

Source: Field survey, 1999

#### b) Nyeri District Water Office

As compared to Laikipia, Nyeri has less serious water problems. It is upstream and some of the rivers flowing through Laikipia originate here. Due to this, the water office does not find it necessary to monitor abstractions. The enforcement

office acts based on complaints from downstream water users especially during dry period.

The study established from the existing records that 90% of the gauging stations are not working and just like laikipia they have few water guards. A water guard is allocated an area of 10 Kms and given that they have no vehicles, it becomes difficult to monitor illegal abstractions.

**i) Conflicts**

Complaints on water shortage reported from Laikipia District are resolved at the board level. This is as a result of multiplicity of water undertakers in Nyeri i.e. MOWD supplies water to Karatina, Nyeri Municipal Council to Nyeri town, Nyeri County Council to Naro Moru town, KWS to the national park, NWCP to Mathira rural and Aguthi. All of them except for Nyeri municipal give water without sewerage services. This means that effluent, which is not taken care of is released to the rivers, and one can not actually tell the source. For example, the study found out that Karatina Town Council is releasing its effluent to the rivers without treating it.

It becomes difficult to manage water quality when water supply and sewerage services are divided amongst agencies. For instance, Ministry of Water Development supplies water to Karatina but collects both water and sewerage

rates, and expects Karatina Town Council to run the sewerage section. This could be the reason why Karatina is emptying raw sewer to the rivers causing contamination.

There are conflicts between the water department on one hand and agriculture on the other. Water department designs domestic projects while department of agriculture designs irrigation projects. A problem arises when the agriculture design is not in conformity with the available water thus forcing the water department to redesign the works hence putting resources into waste. An example is Aguthi water project that experienced the problem. In addition, agriculture does not have a water quality team and the domestic component in agriculture is not well defined and therefore ministry of agriculture are under no obligation to provide wholesome water as long as it can be used for irrigation. It is only prudent that the quality of water be established by both ministries and thus harmonised.

**ii) Collaboration**

There is no evidence for collaboration in Nyeri district and this can be attributed to less water problems as compared to Laikipia. The study established an incidence of duplication of efforts due to lack of collaboration. Marua project in Nyeri was funded twice due to the non collaborative nature of institutions, the Marua project was funded by SISDO and another NGO. An intake was allocated

twice to different projects namely Kianganina water project (allocated by water department) and kawaitumu water project (allocated by SISDO). Another example is protection of catchment areas. Protection of catchment areas is a responsibility of water department, but MOLS allocates forest land without involving or informing MOWD. This was evidenced by lack of copies of letters of allotment at the Water departments, informing them of allocations.

The District planning Unit, headed by the DDO has not been able to co-ordinate NGOs' activities in the district. The reason is that NGOs sneak to the district after they register in Nairobi with the NGO Council after which some are never heard of. Further, the DDO has no control over their activities nor can he/she relocate them. According to the Nyeri DDO only a third of NGOs are genuine going by the records.

Going by past records and public statements, the government views NGOs with a lot of suspicion, and the converse is true. This is because donors see NGOs as alternative way to fund Mwananchi while the government is afraid of loosing its mandate. There is therefore a need for collaboration and coordination

### **4.3.2 Other Departments**

#### **a) Forestry Department**

Forests are the custodians of water sources (forests). If they are cleared without replacing they lead to destruction of the catchment. There is evidence of encroachment of forests in Nyeri where in 1999 an hectare in each of the Five stations was cleared. The indigenous forests are supposed to be cleared as they protect water catchments. There is an area set aside for commercial purposes for each of the twelve stations (20-30 hectares for plantation forests for each station). However the proceeds are not just ploughed back to the forests but go to consolidation fund in the ministry of Finance. The department gets 9.5% of the proceeds, which is not enough to run it.

Forests can only contribute to river flows but during the rainy season harnessing is very crucial as a conservation measure. The forest Act Cap 385 does not cover forest areas outside gazetted forest areas, which means that these can be cleared at will. Further, reforestation is taking place slower than deforestation as evidenced by decreasing revenue from the proceeds of plantation (see table 4.5).

Table 4.5 Revenue Collection Trend for Naro Mora Forest Station.

Year	Amount of revenue (Ksh.)
<b>1993</b>	<b>1.125.009</b>
<b>1994</b>	<b>930.968</b>
<b>1995</b>	<b>327.777</b>
<b>1996</b>	<b>666.861</b>
<b>1997</b>	<b>892.934</b>
<b>1998</b>	<b>455.458</b>

Source: Field Survey at Naro Moru Station. 1999

Out of the twelve stations in Nyeri district only three have shown a sustained income over the last six years. On the average the plantation revenue has decreased by 46% in the district.

Table 4.6 Deforestation and Reafforestation Trends for Ontuolili Forest for period 1995-1999

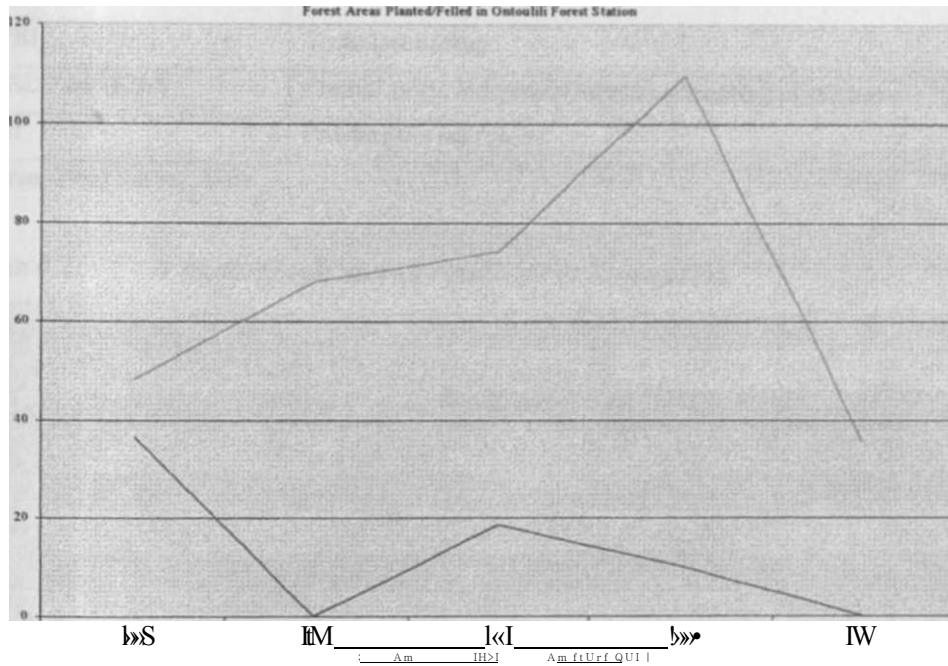
Year	Area Felled (Ha)	Area Planted (Ha)
<b>1995</b>	<b>48.2</b>	<b>36.5</b>
<b>1996</b>	<b>68.0</b>	<b>0</b>
<b>1997</b>	<b>74.1</b>	<b>18.5</b>
<b>1998</b>	<b>109.6*</b>	<b>10</b>
<b>1999</b>	<b>35.6**</b>	<b>0</b>

Salvaged due to fire damage

\*\* Clear felled as part of the exercise for settling squatters

Source: Field Survey, 1999.

**Figure 4.1 Felling and Planting of Trees at Ontuolili Forest Station**



Source: Field Survey, 1999

Despite the vital role of forests in soil, water and biodiversity conservation, felling of trees exceeds the rate of planting. Further, plantation forestry is an integral part of conservation efforts as it wades off pressure from indigenous forests by providing wood based products. However, if the same trees are not replaced; indigenous forests or gazetted forests will also be cleared. The study noted that human settlements in plantation forests (shamba system) are also on going despite the danger of this activity to the survival of forests.

Table 4.7 Collaboration

Agency	Area of Collaboration
<b>KEFRI</b>	<b>Technical backup</b>
<b>MOALD and K.WS</b>	<b>Control of the indigenous forests and fencing of the parks</b>
<b>Other</b>	<b>Funding but not formal</b>

Source: Field Survey. 1999

**Plate 4.2: A photograph shows results of deforestation**



Source: Photo by Author. 1999

## **b) Agriculture**

### **Water demand for irrigation**

The main types of consumptive water users in the catchment are agriculture, domestic including livestock and wildlife. Irrigation is the highest water



consumer. For agriculture to irrigate 1 hectare of land one requires approximately 12,000m<sup>3</sup>/year. This works to 30-70m<sup>3</sup>/Ha/day (70,000 l/Ha/day); or 1-2 l/s/ha. Domestic and livestock demand is 15-25 l/day and 25-50 l/day per animal or person respectively. Therefore each hectare irrigated consumes water equivalent to that consumed by 3500 persons or 1725 livestock units

Based on NWMP,1992 report, demand for water for irrigation is more than the available yield. Demand from surface water is 37.198m<sup>3</sup>/s or 3,213,907.2 m<sup>3</sup>/day. The available safe yield is 674,784m<sup>3</sup>/day. Thus the demand from surface water is 5 times the available surface water. Further, The small-scale consumers are the majority and monitoring them is difficult because they have portable pumps, which they use to abstract water illegally as indicated in chapter 5. In addition most of the projects are operating along the furrow which is said to be an inefficient water conveyer. Further, horticulture has established itself as a stable revenue earning activity resulting in increased demand for water

#### **Availability of water for irrigation**

The table below show an evaluation of water availability for irrigation schemes in Ontuolili river, Naro Moru and Ewaso Ng'iro. It clearly depicts that there is no enough water for irrigation.

Table 4.8 Availability of Water for Irrigation

Scheme name	Water source	Net Area to irrigate (Ha.)	Est. Scheme water required m <sup>3</sup> / s	Available Flow m <sup>3</sup> / s
Mukima/ Kariunga	Ontuolili	200	0.116	0.027
Ex-Weh/ Mwireri	Ontuolili	1053	0.611	0.020
Kangaita	Ontuolili	100	0.058	0.027
Nvakairu	Ontuolili	400	0.232	0.027
Steik Furrow	Ontuolili	400	0.232	0.027
Kabanga	Naro moru	200	0.116	-
Lechugu	Naro moru	200	0.116	0.058
Matanyi	Naro moru	1600	0.928	0.024
Ewaso OldoNg'iro	Ewaso Ng'iro	100	0.058	0.745

Source: District profile Laikipia (1994)

Measured flows of Naro Moru and Ontuolili rivers show that the flow is not adequate to satisfy all the water requirements.

Table 4.9 Flows in the Study Rivers

River	Station	Flood Flow (I«) Q1	Normal now (L/s) Q2	Low Flow 0/»)Q3	Flow Avail For Irrigation
Naro Moru	5BC2	310	217	136	93
Ontulili	5BE2	203	133	70	70

Source: Laikipia District Profile (1994)

Assuming that the farmer had a storage facility, the water department permits the farmers to extract 10,000litres per day per acre in flood flow. It is assumed that the farmer will store it in October and November to use it in January- and February. During this period, the crops require 4.5mm per day. This is

equivalent to  $4.5 \times 10,000 / 86400$  l/s per Ha. = 0.52 l/s per Ha. Since the farmers usually abstract water during the dry period, 10,000 L P D per acre is only 0.28 l/s per ha-hence  $V_i$  of the amount needed. Hence the farmers need to irrigate less in the dry periods

The NRM3 clearly states that there is insufficient river water at base flow for irrigation. The report is however silent on the present abstractions-whether to reduce them through control measures or stop them altogether. In the meantime, it is ironical that the water department continues to issue permits

### **Irrigation Agencies**

The study found out that there are too many agencies dealing with farmer organisation and training in the area of agriculture especially irrigated agriculture, e.g. World Vision, SARDEP, MOWD, MOALD, MONR, Catholic Church, ACK and SISDO. These agencies are not concerned with water conservation measures especially in zones 1 and 2 as evidenced from the farming methods and the lack of rain water storage tanks

There is also lack of collaboration between the water and agriculture department. For instance in the Ex- Web/ Mwireri/Mwakamuga Project, the irrigation Engineers have already began works and yet it seems that water available is not going to be enough for irrigation. The water yield will only be 50 litres per second. It is doubtful whether the same will serve 2000 families.

More water is required based on national standards of irrigation i.e. 1-2 l/s/Ha. Thus assuming each farmer irrigates 1 hectare and uses 1 litre per second, the water demanded will be:

$$1 \text{ l/s/Ha.} \times 2000 \text{ farmers} = 2000 \text{ l/s/Ha.}$$

There is therefore a deficit of 1950 l/s/Ha. Seemingly, the sponsor (World vision) when designing the community project, did not take into consideration demand for water

### **Utilisation of Water**

Utilisation of water is uneconomical as most farmers as seen in the household analysis in chapter 5 below. Further, the furrows are poorly maintained leading to seepage and evaporation. The department does not train the farmers on irrigation technology and most of them employ wild flooding even during the rainy season.

### **Storage Facilities**

A random sample from the Ewaso Ng'iro north records of water abstractors show that water storage is not taken seriously and very few abstractors have storage facilities (see figure 4.10). There are also cases of overabstraction (see figure 4.11).

Table 4.10: River/ Number of Abstractors Storage Facilities

River	District	No. of abstractors	No. with permits	No. with storage facilities
<b>Likii</b>	<b>Laikipia</b>	4	4	2
<b>Nanvuki</b>	<b>Laikipia</b>	59	-	2
<b>Rongai</b>	<b>Nyeri</b>	20	-	<b>0</b>
<b>Burget</b>	<b>Nyeri</b>	12	-	<b>0</b>
<b>karemeno</b>	<b>Nyeri</b>	<b>16</b>	-	<b>1</b>
<b>TOTAL</b>		<b>101</b>	<b>4</b>	<b>5</b>

Source: field Survey. 1999

Out of 101 abstractors only 5 have storage facilities meaning that a lot of water could be harnessed through storage and thus reduce pressure on surface water during the low flows.

Table 4.11: Permitted, Average Actual and Percentage of Illegal Abstractions for Naro Moru and Ontoulili Rivers

River	Abstractions					
	permitted		Average actual		Percent illegal	
	NF m <sup>3</sup> /s	FFm <sup>3</sup> /s	NF m <sup>3</sup> /s	FF m <sup>3</sup> /s	NF	FF
<b>Naro Moru</b>	0.01197	0.13784	4.03	5.96	99.7	97.7
<b>Ontoulili</b>	0.04012	0.10732	<b>1.11</b>	1.24	96.4	91.3

Source: LRP/NRM3. 1997

River Water abstraction assessment was done upstream of the Ewaso Ng'iro and Timau junction for 13 rivers, Ontoulili and Naro Moru inclusive. These covered abstractions by portable pumps, fixed pumps, hydram pumps, gravity pipes and canals. To determine the legality of abstractions, a water permit inventory was done. The assessment came up with the above results.

It is evident that river water abstractions constitute a large percentage of the river water resource especially during the low flow periods. The normal flow allocations apply in the months January to March and July to September since these are dry months. Flood flow allocations apply for the rest of the year. It was found that most of the abstractions exist without valid abstraction permits. By comparing the total river abstractions and allocation according to permit, it is evident that the dry months abstractions have an illegality of 99.7% for Naro Moru, and 96.4 % for Ontoulili river. The water department is aware of these abstractions that are taking place on the basis of authorization, but are illegal.

The government had initiated a scheme under which abstractors would pay for water according to what they have been authorized. However illegal abstractions still continue unabated. There are no way of knowing how much is being extracted by each user so that he is made to pay on the basis of amount of water used rather than on the amount allowed (Mathuva, 1996). The study noted that there is no effort to regulate water intake and the system capacity is often the limiting factor.

Record keeping at the departments was also found to be wanting especially for rivers falling within different administrative units. Abstractions were reported to be taking place before permits are given (during the procedures of issuing permits). This happens for example when abstraction takes place on the basis of

having tendered an application letter for water permit or abstraction work going on before inspection of abstraction works thereby giving room for illegal use of pumps. Records at the Ewaso Ng'iro North Catchment board offices revealed that many of the existing permits are expired. Asked why they do not renew their permits, the households said that the procedure for renewal is too long and some are afraid their permits might be detained. The illegal abstractions are sustained by the above factors and also enhanced by poor enforcement of the laws.

### **Collaboration**

There is lack of collaboration in activities that are related. For example the involvement of the Agriculture Department in the scooping of dams and pans, design and supervision of weirs of sub-surface dams without involving the Water Department. Other departments within similar activities include public health (Spring protection, water jars and tanks), Culture and Social Services (jars and tanks), County Council (spring protection). The NGOs undertake public projects without involvement of the relevant staff from the public sector hence making projects expensive and unsustainable.

A case in point is conflict between the upstream farmers in Meru district and the downstream ones in Laikipia district, which was eventually resolved through formation of Ngarendare water Users Association. The study also found out that

the conflicts are more in Laikipia (zones 2 and 3) than in Nyeri (Zone 1) because the former is downstream of the latter. This is the more reason why water should be apportioned based on a river catchment and not administrative boundaries.

There are also fragmented responsibilities in soil and water conservation (see table 7.1) which contributes to gaps and duplication of responsibilities e.g.:

- a). The safe disposal of storm water runoff from roads and road reserves to the nearest watercourse has not been the responsibility of any government ministry. The design of transport system has not taken into consideration soil and water conservation.
- b). The responsibility of afforestation and reforestation is fragmented between three ministries (Agriculture, Energy, Environment and Natural Resources, and Office of the President)
- c). The Ministry of Water constructs dams and pans, but the same are rarely maintained by Ministry of Agriculture and Livestock Development., which is responsible for animal husbandry

#### **4.3.3 Synthesis**

With the above actors or water undertakers who rarely collaborate, it becomes difficult to control the amount of water they use or supply. Further, it was reported that the water undertakers have no measuring devices. They receive a fee for their services, and would like to supply as much water as possible, which



is usually at the expense of the downstream water users. However, it is evident that with the establishment of water users Associations, it is possible to achieve equitable water supply. In addition the district engineer blamed the water Act which is too lenient. An example was given of Moyo River where an illegal abstractor was fined a sum of Ksh. 100/=. It was interesting to note that though Nyeri is the source of most rivers flowing to Laikipia, they have no water assessment programme.

#### **4.4 Local Authorities (LAs)**

The local authorities also use water from the rural areas and the study looked at their activities in water management. Local Authorities have a mandate to provide services to the residents within the towns as spelled out in the Local Government Act Cap 265. However most of them are concerned with water and not waste-water, supply and not conservation, and yet the main pollutants of rivers in the rural areas are the LAs. This fact causes conflicts in water management. A case of Nanyuki Municipal council is analysed below.

Nanyuki has one of the most elaborate water and sewerage systems in urban Kenya. It has a modern water supply and treatment plant with current net production capacity of about 351,540 m<sup>3</sup> per month (according to data provided by the Municipal council officials). The water source is the slopes of mount

Kenya and water flows by gravity for about 6 Kms to a water treatment works. The present production capacity is estimated to satisfy the town's water requirements up to the year 2000. There is no indication that these water needs for town residents are harmonised with water needs for the rural folks.

The water supply and distribution system is managed by Nanyuki Municipal Council (NMC). Over 70% of people with water connections are also connected to the town's sewerage system. However, the current tariff structure according to the General Manager Water and Sewerage is among the lowest in Kenya. The charges range from Kshs. 2.50 per m<sup>3</sup> for consumption of up to 90m<sup>3</sup> and Kshs. 3.00 for consumption of over 135m<sup>3</sup>. The tariff should be raised as a conservation measure, which will discourage wasteful use of water or alternatively a certain amount of funds set aside for water conservation purposes.

On the average the council collects about Kshs 20,000,000 per year from water and sewerage as compared to a total of about Kshs 30,000,000 from all other revenue sources. The cost of running both the water and sewerage systems in Nanyuki (compared to other water undertakers in Kenya) is relatively low as the system uses gravity and no pumping is necessary. However despite this huge finances from water, councils are not mandated to conserve water and yet this is the most important component in water management. In addition, most of them

as seen above e.g. Karatina empty their raw waste to the rivers causing pollution to the downstream users.

Nanyuki Municipal Council does not have enough inspectors to monitor leakage and illegal connections adequately. Other problems are: The tariff structure is very low, among the lowest in Kenya; unaccounted for water leakage, illegal tampering of meters. The study found out that conflicts exist between town councils (who are not on sewer system and thus empty their waste in rivers), and water undertakers such as Nyeri Municipal Council and NWCPC as indicated earlier. The study found out that county councils are not water undertakers but help in operation and maintenance of community water projects.

#### **4.5 Non Governmental Organisations (NGOs)**

NGOs are promoting water supply projects. They contribute to the water supply sector especially in the rural areas

The study found out that NGOs are not collaborating with other water institutions unless of course it is absolutely necessary. Further, there is no law requiring NGOs to perform certain functions and not others. In other words, there is no restrictions on the sectors they wish to operate in. They therefore deal with all kinds of problems ranging from water, food, education, health and housing. Given this situation, the District Planning Unit, headed by the District Development Officer is expected to play the coordinating role to ensure that efforts are not duplicated.

There are a number of NGOs in the study area namely: Action Aid, CPK, Muslim foundation, Applied Research Unit, but the study was limited to ASAL and World Vision. Which are analysed below

##### **4.5.1 World Vision**

World Vision is not only involved in water projects but education, infrastructure, agriculture and other income generating activities. It operates in central and Mukogodo divisions in Laikipia and Baguret water project in Kieni

East in Nyeri. It assists communities construct their water intakes for both domestic and irrigation. Unlike the ministry, it is the community, which comes up with projects to be assisted in and they are not vetoed at the higher levels.

### **Collaboration with Other Actors**

The table below indicates that the NGO is collaborating with other agencies. However, this is piecemeal.

<b>Agency</b>	<b>Area of collaboration</b>
Agriculture department	Irrigation engineers carry out surveys e.g. Ex-web Mwireri scheme
Water department	Maps and permit

There is no collaboration with other NGOs. There is also no co-ordination of activities and although collaboration is indicated above, the construction of the Ex- Web/ Mwireri/ Mwenyama intake does not show this element. The intake is meant for domestic and irrigation purposes, but the water department conceded that the water may only be sufficient for kitchen gardening. In addition, World Vision, which is funding the project, never consulted other projects with intakes downstream of the same river namely Nyakairu and Homegrown.

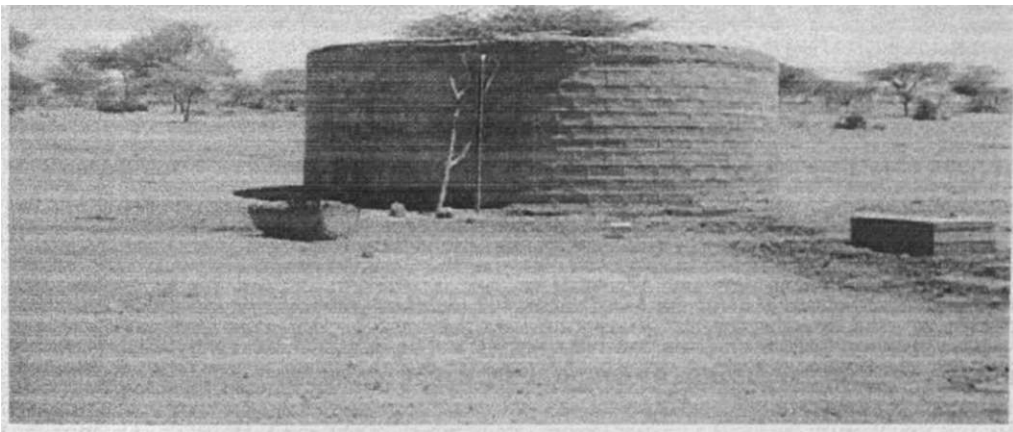
co-ordination is necessary because they operate different sectors. World vision is involved in areas that the community expresses need for assistance ranging from education, water, and range management to health. Since they have

inadequate staff, they contract to other players. There is no law compelling them to utilize the already available government staff who in most cases are idle due to lack of transport or fuel.

World Vision funds projects based on community proposals and it is possible therefore that a community benefits from different agencies. For instance Osiligi CBO benefits from SARDEP and World Vision. In addition, Soitoudo Rock catchment was proposed by the community to both ASAL and World Vision. World Vision have gone ahead and established committees at local level to do ground work on what is happening so as to avoid duplication hence creating an institution to resolve an institutional problem.

The NGOs are more involved in community projects than the government agencies because they get direct funding from donors. The problem of collaboration is due to different policies by the different NGOs. World Vision has had an impact in Mukogodo by building 2 boreholes and 2 rock catchments. The photo below shows.

**Plate 4.3** A Bore Hole Water Tank at Kimanju Centre Illmotiek location.



**Source:** Photo by Author, 1999

#### **4.5.2 Arid and Semi Arid Lands Programme (ASAL)**

ASAL operates under a bilateral agreement between Holland and Kenya Government. Its objective was to improve the economic status of the people of Laikipia through several activities in various sectors namely agriculture, water, health, and education. They also operate in diverse areas namely Nanyuki/Timau, Mukogodo/Illgvesi, Mutara/Lorian swamp, and Kinamba/Sipili. ASAL also assists women groups just like the ministry of

culture and social services. Since there are no limitations to areas of operation duplication of other agencies is evident. Further, logistical costs are high and the same could be avoided through collaboration. ASAL has the following water projects: 9 (number) in number in Mukogodo, 2 in Central, 3 in Lamuria, 2 in Nyahururu, 3 in Rumuruti and 2 in Ngarua.

ASAL has an applied research unit, which deals with crops, livestock and natural resource management. This unit should essentially compliment efforts of established research institutions. Hence in the name of being self-sufficient a lot of resources are duplicated. ASAL for instance has only 16 staff and they are required to contract out work sometimes to private consultants instead of using government officers to save on the cost.

#### **ASAL's Collaboration with Other Actors**

Collaboration is difficult and any attempt to collaborate brings conflicts because each NGO has their own policies and strategies for resource management. For instance ASAL emphasizes on cost recovery while the catholic church organizations and Kenya Wildlife Services (KWS) believes in providing everything. Past efforts to initiate a forum to collaborate with other agencies have failed. Another aspect that may make collaboration difficult is that donor and by extension bilateral agencies may dictate where they wish to work and the finances. As the saying goes, he who pays the piper calls the tune However



there has been one incidence where KWS, CPK and ASAL were interested in Kurikuri water project in Mukogodo. The three co-funded the project but this spirit is not there today.

ASAL has helped reduce water conflicts among water users especially in Mukogodo through construction of 3 rock catchments, 4 bore holes, and 2 wells; with collaboration however resources will be used more efficiently. Collaboration is necessary to ensure that certain projects do not receive funding more than once.

The important aspect that the NGOs have contributed is sustainability of projects. This is through compulsory contribution by the community, enhance ownership of projects and capacity building through training. ASAL for instance helped each of the locations in Laikipia come up with a planning document

#### **4.6 Community Water Projects**

In the present management strategy of involving the community in management of their own resources, coupled with inability of the government to provide, and manage water given the limited resources, community water projects have become popular. In addition, community water projects have proved to be more versed with water problems affecting members and are more sustainable in the

long nan. This section looks at two projects- Nyakairu and Getue water projects in abid to demonstrate their potential and weaknesses in water management

#### **4.6.1 Nyakairu Water Project**

The project began in 1983 with a membership of 400. Currently there are 2000 members owing to the increased settlement and also population growth. The objective of the project was to provide both domestic and irrigation water for its members. However these objectives have not been met because members complain of water shortage. As a result water is rationed and its not enough for irrigation.

The history of the project reveals that its design was not by experts, and hence did not anticipate the current increased demand Secondly, the management of the project is in shambles. The project operates through committee system. They have a central committee involving all the communities and six sub committees from each of the six communities. The committees rarely meet because of the laxity of the office bearers. The Chairman for instance was elected on the basis of wealth and not capability to lead, and he has held this office for the last 20 years. Although the members complain of the chairman's incapability to lead, come election, they still elect him. Most of members complained of misappropriation of funds. For instance, they contributed 30,000 to build a weir which ahs never been built.

There is lack of proper coordination with the Department of Water because, according to their permit, the amount of water they are supposed to abstract is more than the available balance on river Ontoulili. According to the records, Nyakairu is supposed to abstract  $0.232\text{m}^3/\text{s}$  but the available balance is only  $0.027\text{m}^3/\text{s}$ . This means that they even take longer to abstract the permitted water ( $13.4\text{m}^3/\text{day}$  of low flow for domestic,  $800\text{m}^3/\text{day}$  for irrigation, and  $40\text{m}^3/\text{day}$  of normal flow) hence leading to pressure on the little water available. The actual amount of water abstracted could not be established because the project has no measuring device though law requires it. The project does not pay for water and it cannot remember the amount paid for renewal of permits. Despite this problem, the Ministry of Agriculture, in conjunction with World Vision is constructing an intake for a larger community Nyakairu inclusive. It seems that MOWD does not analyze and monitor the changing water needs against availability of water. The poor management of the project and illiteracy of its members worsens this situation. The chairman, when asked for a solution for their water problems, suggests that they should increase the size of the pipe. Collaboration with other projects on the same river is non-existent. Consultations are held with the water department and the agriculture department as need arises.

Despite the above problems, they perceive their contribution to water management to be better than government projects and blame the government

ministries for poor water distribution. Community based projects are good initiative of management of water, but problems faced should be tackled through giving the office bearer training and enhancing planning and coordination at the ministry level.

#### **4.6.2 Getue Water Project**

The project, which began in 1983 is located in Nyeri district, Naro Moru location. It is favorably located in terms of transport and communication to market major urban areas like Nairobi and Nyeri. It is no wonder that the farmers here cultivate vegetable including snow peas both for local consumption and for export market. It constitutes 300 households, and 900 cattle

The objectives of setting up the project like the Nyakairu project was to supply water for domestic and irrigation purposes. However the water is not enough for irrigation purposes because they use a small pipe while the demand for water has increased due to increased land under irrigation. They have already approached IFAD for the pipes and it has donated 4.2 million. The community will do the supply lines Presently, the community has 2 water tanks of 50,000 gallons and 20,000 gallons respectively, and delivery is through gravity pipe. It seems that whenever a problem of shortage of water arises projects seek for solutions from various external actors who provide financial assistance without addressing the real causes of the water problems. They view increase of size of

intake pipe and not their own activities, as a solution to increased water demand. The study found out that conservation measures do not receive any attention from both users and managers of water.

There were no records of the amount of water the project is permitted to extract meaning that they can abstract as much as they wish. This is evidenced by the fact that they are in the process of fixing a 6 inch pipe at the intake as opposed to the previous 4 inch pipe. Apart from the permit fee no other fee is charged on water thus no economic value is attached to water and is thus, is subject to abuse. When there are shortages especially during drought, the committee regulates the water used through rationing to its members.

Collaboration with water institutions and other water projects is negligible. They collaborate with the Ministry of Water only when they have a technical problem i.e. regulation of air valves at the water intake. They collaborate with the Ministry of Agriculture and Livestock Development during farm demonstrations but attendance is quite low. There is no collaboration with other projects within the river Naro Moru catchment. They have not heard of water guards meaning that monitoring and enforcement of water regulations by the ministry is not taken seriously.

At the project level, the study established that the project is better organized compared to Nyakairu water project. The members participate well in meetings, and elections, and their financial contribution is high. The committees are able to enforce the set rules. They have their own by laws e.g. if one fails to pay for water maintenance, their water is disconnected. The project perceives water as essential for everyone, although they do not visualize outside their own project. Just like Nyakairu, they prefer to manage their own water and suggest that the government should improve the roads. Asked whether they would be willing to pay for water, they are positive but would require awareness and sensitization on the same.

The project complained of people cultivating up to the rivers, and clearance of forests meaning that the agencies supposed to conserve water and soil are not collaborating with the forestry department. Cattle grazing in the forests have increased and contributed to destruction of forests and soil erosion

#### **4.7 Private firms in Upper Ewaso Ng'iro North Catchment-A case of Chestnut Farm**

Private firms are apart from the households, the major consumers of water. They grow crops for commercial purposes although they pay no fee to the water department. Crops grown (snow peas) consume a lot of water and there are doubts as to whether the Ministry of Agriculture and Livestock development has undertaken a study to establish its water needs and whether the available water can meet these demands. The areas under irrigation range from 100 acres to 500 acres per farm. The Ministry of Agriculture regulates the establishment of the firms, while provision of water is by Ministry of Water. As already noted earlier the two do not collaborate thus leading to establishment of more and more firms and increased water demands. Some of the firms irrigate illegally and get away with it. In addition political interference is a handicap to proper enforcement of the laid down water regulations.

Chestnut farm was established in 1997 as an extension of Mwigwa Brooms and is located on a 200-acre land. Its objective is commercial growth of horticultural for export and local market. The reason for location Naro Moru is the infrastructure and favourable climatic conditions. Irrigation is used for growth of snow peas, garden peas, runner beans, French beans, strawberry, corn and baby carrots for export. Vegetables like kale are grown for local market.

Most of the private firms give wrong information when applying for a water permit. For instance Chestnut's water permit states that they are to irrigate a 10-acre farm. Contrary to this, the study established that it is irrigating a 200-acre farm. The permit authorises them to abstract  $4.5\text{m}^3/\text{day}$  ( $4500\text{ l/d}$ ) for domestic and  $90\text{m}^3/\text{day}$  ( $90000\text{ l/d}$ ) for irrigation and irrigation is allowed only at night. The study could not establish the amount of abstraction given that the farm has no measuring device. However the amounts abstracted is definitely higher than the permitted given the amount of water required to irrigate one hectare as already discussed in Chapter 4, and the size of the farm being 20 times the permitted size. If we use the amounts recommended for irrigation i.e. 1-2 l/ha/day, the amount of water the farm uses ranges between  $3,499.2\text{m}^3/\text{day}$  to  $6998.4\text{m}^3/\text{day}$  instead of the permitted  $90\text{m}^3/\text{day}$ .

In addition, the farm is illegally using Naro Moru River since in its application, it is meant to use water from the seasonal stream at the adjacent Kadara valley. They have built an earth dam of  $250000\text{m}^3$  instead of a concrete lined one. The water in the tank can last between 36 to 71 days if used to irrigate the farm and not 90 days as stipulated in the water Act. This finding is based on the following calculation:

If the farm uses 2 l/s/d, it will require:	$\frac{250000\text{m}^3}{6998.4\text{m}^3/\text{d}}$	=36 days
If the farm uses 1 l/s/d, it will require:	$\frac{250000\text{m}^3}{3499.2\text{m}^3/\text{d}}$	=71 days.



The picture below (Plate 4.4) shows the earth dam, which is exposed to evaporation and seepage. The dam water is not being used although this is the dry season.

**Plate 4.4** Chestnut Earth Dam in Naro Moru, Nyeri



Source: Photo by Author, 1999

It was observed that they use inefficient irrigation methods i.e. high power sprinklers, which are however cheaper than drip irrigation. The claim that they had a 2-inch pipe at the intake was doubtful given the volume of water and the extent and intensity of irrigation on the farm. Irrigation takes place throughout the day and part of the night.

The farm and this applies to all private commercial farms views water as a commercial resource that enables them to produce tons of snow peas per month for export market, and provides employment for 300 casuals during the peak season, and 100 casuals in low season. According to the farm, priority should be given to provision of water for irrigation. If irrigation is of higher priority, it should be made to pay for water to meet the costs of conserving and providing alternatives for domestic water users. The picture below shows a contrast between adjacent irrigated and un-irrigated land which also shows a disparity in the level of income.

**Plate 4.5: Irrigated v.v. Un-irrigated Land.**



**Source:** Photo by Author, 1999

### Other Commercial Farms in the Study Area

Table: 4.12: Other Large Scale farms Within Laikipia and the surrounding Areas

Name of the farm	Name of River	Storage facility	Location
1 K.H.E	Nanvuki	None	Laikipia
2 Likii River farm	Likii	on process	Laikipia
3 Nturukuma S.H W/P	Likii	-	Laikipia
4 Turaco farm(Homegrown)	Ontuolili	Dam available	Laikipia
5 Ibis farm (Homegrown)	Sirimon	-	Meru
6 Siraji (Homegrown)	Timau	-	Meru
7 Batian Flowers	Timau	-	Meru
8 New Mutaro W/P	Ngobit	-	Laikipia
9 Thome S.H W/P	Naro Mom	-	Laikipia
10 Ex-Web Mwireri	Ontuolili	Not vet	Laikipia/Meru
11 Marania Ltd	Ngushishi	Dam available	Laikipia
12 Oldonvo Ltd.	Ngushishi	-	Meru
13 Muchiri Mbogo	Timau	-	Meru

Source: Field survey, 1999

Many of the farms have no storage facility while for others the records had no information.. Turaco farm was not willing to be interviewed meaning that they are engaged in some practices which they may not wish to reveal for fear of prosecution. It is also evident that monitoring the activities of these farms can be difficult. The water works and the water intake points for a firm like Homegrown are actually fenced off. It should be made compulsory for these farms to construct storage facilities and purchase measuring devices. They should also pay water charges as a measure to enhance efficient use of the same.

#### **4.9 Data Management Institutions-A Case of Natural Resource Monitoring, Modeling and Management (NRM3)**

Water resource management as depicted above can not be successful unless there is data upon which to base decisions. Major policy changes cannot be made if there is no data on water. The study found it extremely necessary to analyse the role of NRM3 in data resource management in the upper Ewaso Ng'iro North Catchment.

This is an organisation that was previously part of the Laikipia Research Programme deals with natural scientific research as opposed to scientific social research. By association, it is a project of University of Nairobi and University of Bern. Its goal is to promote collaborative research on sustainable use and management of water, soil and other natural resources within the catchment.

The project operates within the Upper Ewaso Ng'iro river basin. The region of operation covers more than 1/3 of Laikipia district, parts of Nyeri and Nyandarua districts, the lower parts of Meru and a portion of Isiolo district. It collects and monitors climatic, hydrologic, soils, land use, and water abstraction data. The data is used for modeling to fill data gaps and to help improve productivity of natural resources. The strategy adopted is to involve Master of Science students and PhD Student researchers in on-going research projects

**Collaboration**

The project has been building strong research partnership links with water users, planners, and policy makers of the catchment. ENNDA is an important beneficiary of NRM3 data-base. The district water engineers are both collaborators as well as beneficiaries. No other data management institution has had a collaborative initiative to march NRM3.

**The Role of NRM3****Monitoring**

The project has meteorological stations, river gauging network and small catchment and plot level studies. However, the parameters monitored and the frequency of data collected are determined by data needs. Hence they may not necessarily follow the needs of the government or ministry of water in terms of data needs. Their data may also duplicate what the meteorological department does as indicated earlier. There is no indication as to whether the research institutions meet and harmonise their data. The monitoring networks, (see map3.7) show that facilities are well distributed. However, the readings from various stations belonging to various monitoring institutions are never harmonised. This means that meteorological Department collects their data for their own consumption; and the same applies to MOWD and NRM3.

**Modeling**

NRM3 develops models as analytical tools for research and assistance in planning process especially in Africa highland-lowland system. NRM3 is incorporating the water department in Laikipia for this exercise

**Management**

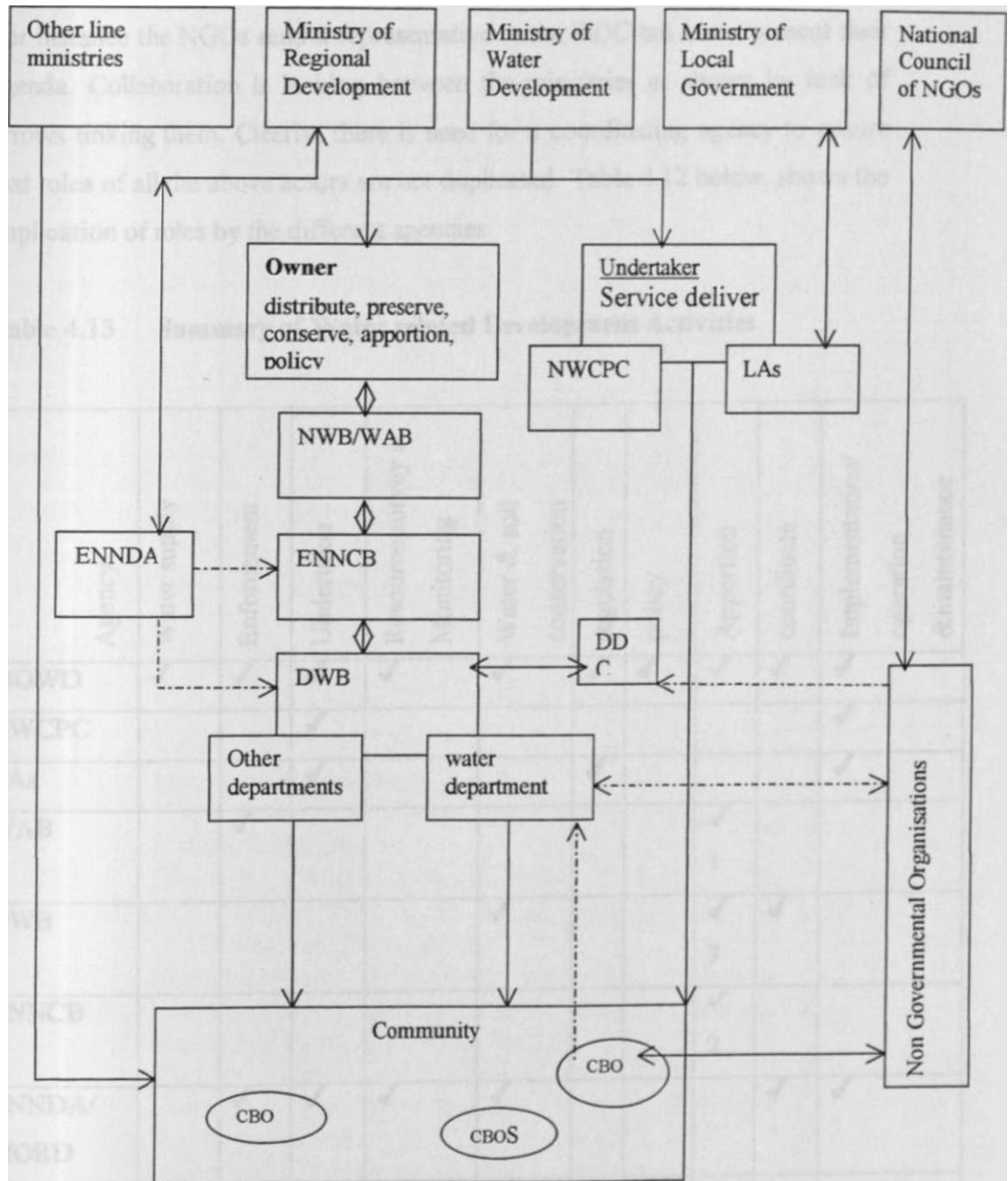
Its contribution to management is in the form establishment of links with existing institutions responsible for management of natural resources including water. The provision of data, its analysis and modeling contributes to sustainable resource management.

Generally NRM3 has created impact on provision of data on available water at different points and thus assist in working out water abstraction levels. Information on water use efficiency will be important particularly for irrigation projects and guard against misuse as seen below on household analysis. Another area they could create impact is coming up with most appropriate land uses in the catchment by coming up with data upon which such decisions can be made. Water saving technologies could also be developed by NRM3

The role of NRM3 in the above activities is a pointer to its proposed role of information networking center for the Upper Ewaso Ng'iro catchment as indicated in Chapter 7.

4.10 Summary of Institutional Elements

Figure 4.1 A Schematic Diagram of the Existing Institutional Structure



Source: Field Survey, 1999

The above figure (Figure 4.1) is a summary of the institutions on the ground. The arrows show the direction of interactions. The dotted arrows show weak interaction between agencies. This means that the actors rarely collaborate in their activities. Most of the activities are undertaken in isolation of other actors. For instance the NGOs send a representative to the DDC but never present their agenda. Collaboration is lacking between the ministries as shown by lack of arrows linking them. Clearly, there is need for a coordinating agency to ensure that roles of all the above actors are not duplicated. Table 4.12 below, shows the duplication of roles by the different agencies.

**Table 4.13 Summary of Water related Development Activities**

Agency	Water supply	Enforcement	Undertaker	Resource survey & Monitoring	Water & soil conservation	regulation	policy	Apportion	coordinate	Implementation/ operation & maintenance
MOWD	•	•	•	•	•	•	•	•	•	•
NWCPC			•							/
LAs			•			•				<b>S</b>
WAB		•						• 1		
DWB					•			• 3	•	
ENNCB								• 2		
ENNDA/ MORD		•	•	•	•				•	<b>V</b>
NRM3				<b>I</b>						



Water Department		•		•		•		•		
Met. Department				•						
MOALDM	•				•					y
MOLS										•
MOCSS										y
MOTW/ KWS	•									•
MOTC	•			•						
MENR						y				
Presidential Comm.						s				
NGOs and community										•

Source: Field Survey, 1999

KEY

MO WD	Ministry of Water Development
NWCPC	National Water Conservation and Pipeline Corporation
DWB	District Water Board
ENNCB	Ewaso Nyiro North Catchment Board
ENNDA/MORD	Ewaso Nyiro North Development Authority/ Ministry of Regional Development
NRM3	Natural Resource Management Monitoring and Modeling
MOALDM	Ministry of Agriculture Livestock Development and Marketing
MOLS	Ministry of Lands and Settlement
MOCSS	Ministry of Culture and Social services
MOTW/KWS	Ministry of Tourism and Wildlife/ Kenya Wildlife Services
MOTC	Ministry of Transport and Communication
MENR	Ministry of Environment and Natural Resources

#### 4.11 Synthesis

In summary Chapter 4 has analysed the water institutions and demonstrated that the many institutions are not collaborating, making management of water difficult, as there are no specific roles for specific institutions. The roles seem to be scattered in many institutions. It is very difficult for example to take remedial measures on one particular actor. For instance conservation of soil and water is scattered in Ministry of Water development, Ministry of Agriculture and Livestock Development, Ministry of Environment and Natural Resources, Ministry of Local government, Ministry of Lands and Settlement to name but a few.

The duplication of roles among various actors also causes conflicts. For instance, in Nyeri, two agencies (an NGO and the water department) allocated one intake point for two different projects. This is a clear case of lack of collaboration.

The relevant actors in both public institutions and private have not been able to play their roles adequately due to lack of collaboration in their various activities, most of which are related. The next chapter (Chapter 5) analyses the households, which is the basic and single largest institution having the power to use and manage water at a local level.

## **CHAPTER FIVE**

### **5.0 WATER MANGEMENT AT THE HOUSEHOLD LEVEL**

#### **5.1 Overview**

Households are the main local actors and their activities influence water resource management. They migrate, cultivate, produce, subdivide land, and form institutions. As already mentioned, majority of households within the study area have migrated from Nyeri, Meru, and other parts of Kenya. More than half i.e. 54% of the landowners purchased the land, and 20% have settled here during the last 20 years, meaning that pressure on land has occurred in the recent past. The immigration is still continuing. This chapter analyses the households' economic activities, migratory lifestyles and how the same has influenced water uses, and water management strategies. Their perceptions on water and natural resources are presented as far as they influence strategies for water management.

#### **5.2 Land ownership**

The systems of land ownership are freehold (i.e. in Daiga and Naro Moru-Zone 1 and 2), and communal land ownership (IIIMotiek-Zone 3). However, in zone 3 there is discrimination as administrators are allowed to own land individually rather than communally like the rest of the community. This anomaly can in the long run lead to conflicts between and within families. Further Arable farming may not be possible with communal land ownership.

### 5.3 Economic Activities

The types of farming, and crops grown have an impact on amount of water used. Growth of horticultural crops is said to consume a lot of water as indicated in irrigation section in Chapter 4. Irrigation takes place throughout the day and part of the night. The households have no information on the amount of water that they use on their crops, meaning that agriculture department has not sensitised them on appropriate amounts of water for certain crops. Hence flood irrigation is common and often leads to water logging.

**Table 5.1; Categories of farming/ number of households involved**

Category of farming	Average size of holdings	Number of households (%)
Large Scale farming	Over 10 acres of commercial and subsistence farming	5
Small-scale commercial farming	Less than 10 acres of commercial and subsistence farming	37
Peasant farming	Less than 5 acres, crops grown mainly for subsistence	21
Pastoralists	Communal ownership (1000 acres)	37
<b>TOTAL</b>		<b>100</b>

Source:Field Survey. 1999.

As already indicated earlier, small-scale farmers are the majority and previous studies indicate they have majority of portable water pumps and are involved in illegal abstractions. They grow crops both for their own use and for sale meaning that they have to intensify farming to make ends meet. With a family sizes of 7 persons, children to be fed, clothed and taken to school, farmers whose needs are to be met through farming activities are forced to irrigate for 24

hours to ensure sufficient income. Engagement in off farm activities is expected to ease dependence on agriculture and consequently amount of water used. With only 37% of arable farmers engaged in off farm employment, 63% depend solely on farming for food and other domestic needs. Hence irrigation is almost inevitable.

**Plate 5.1:** A farmer in Naro Mom irrigates his farm



**Source:** Photo by author, 1999

The study attempted to establish the relationships between engagement in offfarm activities and the ownership of a water tank. A gamma value of -0.87 reveal that there is a negative relationship. Those engaged in offfarm activities

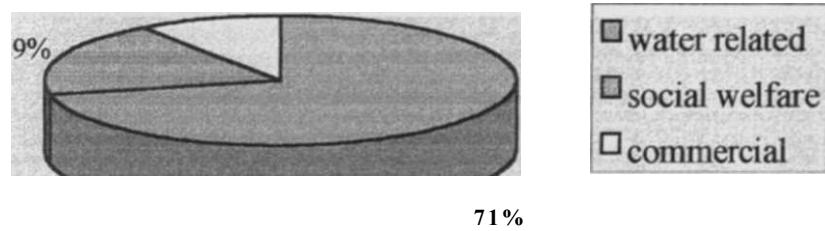
are not likely to construct a storage tank. Therefore target population for construction of tanks should be those engaged in farming because they are more likely to store water than those who are not.

#### **5.4 Involvement in Community Based Organisations**

Community based Organisations are important entry points for deciding actors and even NGOs who wish to contribute to resource management. Given the current participatory approach to development, community involvement mainly through CBOs is seen as a way of empowering the community.

However, the study found out that majority of households in pastoral areas are not in any CBO, and this could be the reason why maintenance of their water projects is poor as compared to the households in Zone 1 and 2. The few who are in CBOs are engaged in sale of livestock and other consumer goods. Therefore community facilities e.g. a bore hole and a rock catchment built by ASAL are maintained and run by the county council rather than the community itself. In addition, their migratory nature does not favour proper maintenance of community projects. Those engaged in CBOs are in the following categories (figure 5.2):

**Figure 5.2**    **Number of Households in CBOs**



Source: Field Survey, 1999

Majority of households are in water based CBOs. The study established that there is a relationship between engagement in CBO on one hand and location/zone, sensitization and likelihood of conflict resolution on the other. By use of Gamma scale the following was established (see page 168)

- 1) that there is a positive relationship between the presence of CBO and availability of resource. The gamma value is 0.49. More people are involved in CBOs as one moves from Zone 3 through Zone 2 to Zone 1; The table below demonstrates the relationship.

Zone	Involvement in CBOs (frequencies)	
	Yes	No
Zone 1	10	2
Zone 2	5	5
Zone 3	6	7

The other relationships are demonstrated in Annex 1.

- 2) people involved in CBOs are more likely able to solve their conflicts than people who are not. There is a positive relationship between involvement in CBO and resolution of conflicts as evidenced by the frequencies of each. The gamma test value is 0.62. Those not in CBOs are less likely to resolve conflicts i.e. a gamma value of 0.16. This means that the CBOs, which are closely linked with NGOs are likely to address their problems by the fact that they are often exposed to the outside agencies who sensitize them on ways of resolving their conflicts, (see Annex 1 No. 2)
- 3) there is a positive relationship between sensitization and resolution of conflicts in water use. The gamma value is 0.32 meaning that sensitisation plays a role in conflict resolution though it is not significant. Communities that are sensitised are more likely to resolve their water conflicts than communities that are not (see Annex 1 No. 3). There are other factors other



than sensitisation that contribute to conflict resolution for instance enforcement of the laid down regulations, conservation measures and collaborative initiatives.

### **5.5 Sources of Water**

Majority of the households use river water including furrow (49%). Bore hole users are 28% while 20% use pipe water. 3% use water from lags. Rain water is rarely stored and when stored it is used both during the wet season and part of the dry season. Hence there is so much pressure on river water and is also subject to conflicts as indicated below. A gamma test value of 0.6 shows that there is a relationship between the amount of water used (domestic) and the source of water (Annex 1 No. 4). Those with access to river water use more water than those without. Hence there is likelihood of conflicts in river water more than any other source of water. The 20% who use pipe water are mostly in zones 1 and 2 and are in community water projects. The most important source of water for zones 1 and 2 for both household and cattle is the rivers. However, the situation changes in zone 3 with river being the most important source of water for cattle while bore holes are a major source of household water. Hence the location of boreholes far from the rivers means that households in zone 3 have to stay away from their cattle especially during the dry period. The study

established that the Morans (Young Maasai men) have to take the cattle to areas where there are rivers for pasture and water leaving the other members of the households behind. This activity causes conflicts in areas of immigration thus requires a government policy to cater for the unique needs of the pastoralists

## **5.6 Water Management**

In the study area, households have no systematic method or none at all of water management. This fact contributes considerably to water shortages. Households can manage water through conserving it by better farming methods, storage, seeking alternative means and adhering to the amount of water they are permitted to abstract. However, the study found out that these methods are not adhered to.

### **5.6.1 Domestic Water**

Half of the households each one on average uses less than 60 litres of water per day. With an average household size of 5, for the whole catchment, each person uses approximately 5 litres per day. The top 30% use over 100 liters per day per household, while the remaining 20 % do not have records on the amount they use. The difference in amount of water used in households depicts inequality in water distribution within the catchment. Storage of water is not popular within

the catchment given that only 20% of the respondents store water of a minimum capacity of 1300 gallons. A household in a relatively high rainfall area like Naro Moru and parts of Laikipia are expected to have this facility. However, problems of finance were cited as reasons, but with sensitization on the need for storage, it is expected that more will construct tanks and store rain or river water for use during the dry period. Over 20% do not view construction of tanks as a priority as they have rainfall most of the year (Those in zone 1 and 2). Those in zone 3 receive little rainfall and, their houses have no corrugated iron sheets. The rock catchments constructed by NGOs are important but unfortunately poorly maintained due to migratory nature of the pastoralist dictated by climatic conditions.

Based on the assumption that with the right incentive, households in zones 1 and 2 will construct tanks, the water can last for 2 months (assuming that each household uses 100 l/day) i.e.

$$1300 \text{ gallons} \times 5 = 6500 \text{ L}$$

$$\frac{6500 \text{ L}}{100 \text{ L/day}} = 65 \text{ days.}$$

Based on the maximum amount of water used per day per household for domestic purposes, the stored water can last 65 days (2 months) as seen above. The same water could be used during the dry period, - January to March. However, the study found out that stored water is used both in the dry and wet

season. 78% of the households who store water use it in both seasons indiscriminately and only 22 % use it in the dry season. The stored water lasts 1-2 months meaning that during the third month illegal abstraction from the river is highest. This is the period when monitoring should be strict so as to discourage wasteful use of water.

### **5.6.2 Water for Irrigation**

All the households from zone one and two abstract water for domestic, irrigation, or both. However, they do not know the amounts they abstract nor the amount they are permitted to abstract. Once they get a permit it becomes blue print to abstract as they wish. Most of them apply for small amounts of water just to get a permit after which they abstract as much as they wish (records at Ewaso Nyiro Catchment Board depict that there is more water for allocation based on those permitted to abstract). A study done by LRP/NRM3 as seen in Chapter 4 reveals that there is over 90% over abstraction in the upper Ewaso Nyiro North catchment. Many of them use sprinklers and the furrow system to irrigate. Although the furrow system is being phased out, no action has been taken by the ministry to implement the policy.

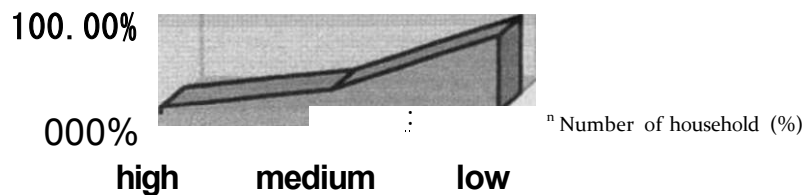
Irrigation is the highest water user and yet efficiency in irrigation is low. A farmer in Naro Moru (see plate 5.1) uses sprinklers to irrigate, though this area

receives high rainfall(see chapter 3). Majority of farmers irrigate for 24 hours a day. A summary of irrigation efficiency is presented below (level of efficiency was determined by the type of irrigation and time of irrigation).

Table.5.2: Irrigation Efficiency

Efficiency	Frequency	% No. of households
<b>High</b>	<b>1</b>	<b>5.6</b>
* <b>Medium</b>	<b>4</b>	<b>22.2</b>
<sup>3</sup> <b>Low</b>	<b>13</b>	<b>72.2</b>
Total	18	100

**Figure 5.2: Irrigation efficiency**



**Source:** Field Survey, 1999

The above table shows that 72% of those irrigating have low irrigation efficiency. Majority of the households have hand pumps and other portable pumps even though they did not admit it. The low irrigation efficiency contributes to problems of water distribution. In addition, it depicts laxity of agriculture department in educating farmers on water conservation methods as seen above in Chapter 4. The introduction of snow peas in addition to other

horticultural crops, all of which require a lot of water has increased demand for water. Irrigation as indicated earlier is not guided by professionals and most farmers end up using too much water in the hope of getting maximum production. According to the Ministry of Water regulations, during the dry season, farmers should only irrigate at night. Enforcement of the laws is inadequate and thus enhances illegal abstractions.

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<sup>1</sup> 1      **Irrigation only done at night; use of. stored water in dry penod: dnp or bucket irrigation.**

2      **Irrigation done throughout the night and pan of the day during the dry period; use of sprinklers.**

3      **Irrigation throughout the day and night: both dry and wet season imgation: use of high power sprinklers.**

The study established a negative relationship between awareness of the law incidence of illegal abstractions. A gamma Test of 0.35 shows that with increased awareness there will be less and less of illegal abstractions (see Annex 1 No. 5).

### **5.6.3 Payment for Water**

The management situation is worsened by the fact that there are no charges for water except those in community water projects (37%). They pay Ksh. 100-300 only for maintenance. Over 70% of the households support the need to pay for water on condition that it is available while the rest view water as a free gift from God and thus no need for payment. Asked which institution they would like to monitor and distribute water, they preferred the committees assisted by the MOWD. The introduction of the Water Users Association as indicated in chapter 4 is meant to take management responsibility back to the people.

### **5.6.4 Conflicts and Conflict Resolution**

As already seen in chapter 3, at household level, there are conflicts at three levels:

- 1 Conflicts between water users: blockage of furrow water by upstream users especially during the dry season and over abstraction by firms like

Homegrown has caused conflicts among the water users in the past.

These are resolved only for a while but no permanent solution so far

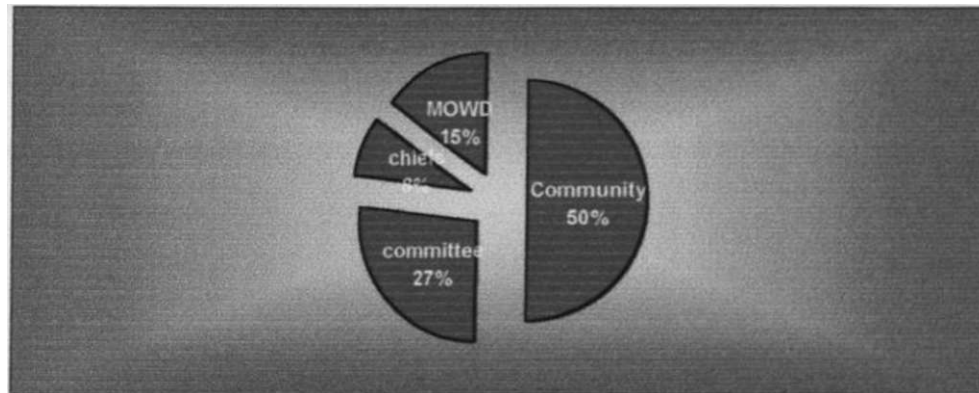
- 2 Conflicts between users and institutions (deciding actors). Households reported cases of corrupt officers who are compromised by other water users in order to allow them to irrigate illegally. Community project committees have been accused of mismanaging funds, the administrators (chiefs) as water committee members have been said to perpetrate illegal irrigation through nepotism. In Naro Moru households are allowed by some institutions to graze cattle at a fee in areas where forest has been cleared. This has led to destruction of vegetation and loss of top soil, thus enhancing soil erosion by storm water run-off.
- 3 Conflicts between users and the legal framework: There is partial application of rules and regulation. This is seen both at the project level in application of the by laws and the districts level in enforcement of water laws. The situation discourages those who wish to abide by the laws, and thus exacerbate illegal abstractions.

The community resolves conflicts through committees, community or the area chief at the local level. At higher levels i.e catchment, MOWD intervenes. Hence administrative or political leaders are involved in conflict resolution therefore depicting the necessity of water courts to handle conflicts



professionally. It is also evident that conflicts can be handled both by local and deciding actors though at different levels. It was reported that ministry of Water Development handles 15% of the water conflicts while the rest are handled by: Community (50%); Committee (27%); Chiefs (8%);

**Figure 5.3: Agencies Involved in Water Conflict Resolution**



Source: field Survey, 1999

It is however interesting to note that the community is more involved in conflict resolution in spite of ignorance of the laws governing water management

### **5.6.5 Interaction with other Organisations**

The community in zones 1 and 2 seem to be more conversant with water issues as compared to those in Zone 3. This can be attributed to the presence of certain organisations that have helped sensitize the water users. These include International Foundation for Agriculture Development, Children's Fund, World Vision, and Community Development agency among others. Through them the community has been encouraged to form Community Based Organisations, which form entry point for involving people in development projects.

## 5.7 Households' Perception and Attitudes

### 5.7.1 Perception of Natural Resources

The study established that people considered natural resources, their distribution, and access to them as God-given. For instance the advantageous location of a plot bordering a perennial river is taken as a blessing but of course one should not deny others access to it. However, presently, the community attitudes have changed due to hard economic times. Given a chance, each household would wish to make maximum use of available water. Hence there is a tendency for one to use water at complete discretion of any other household/user. This is despite the fact that the use may lead to depletion of the resource to the disadvantage of the whole community. This is why some users in zone 1 and 2 excessively use water and the less disadvantaged who are downstream (zone 3) take it upon themselves to search for alternatives without much success.

All over the catchment area, the main perception is that rain comes from God. Households especially in Kimanju in Ill Motiek have accepted the bad years and the good years (i.e. dry spells and the rainy season respectively) as normal. When people believe in divine intervention whenever they have resource problems, they rarely take it upon themselves to look for solutions or

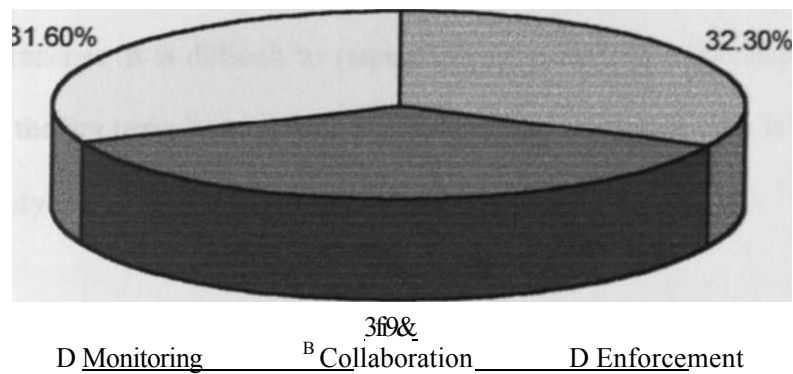
alternatives. The fact that people in zones 1 and 2 know that their activities affect those downstream and yet they make little effort to correct the situation means that they look upon others (including God) to help solve the water problem. The 12.5% who make an effort to address the issue take the following measures: rationing, avoiding using river water for irrigation in the dry period, Storage of water and, following the by laws (for those in community water projects).

From the general discussions in the field, it can be concluded that the pastoralists in Zone 3 rely on divine intervention from God. They, like their counterparts in zones 1 and 2 do not use any conservation measures like planting of trees and protecting the catchment area.

### **5.7.2 Collaboration**

The study found out that 37 % of the household believe that the unequal distribution of water is caused by non-collaboration of the many and disjointed actors in the upper Ewaso Nyiro basin. Their weaknesses are addressed in Chapter 4 above. The other problems are poor monitoring (32%) and Poor Policing (31%) as seen in the table below

**Figure 5.4 Factors that Contribute to Poor Water Distribution**



**Source:** Field Survey, 1999

Lack of collaboration is the leading contributor to poor water distribution, followed by monitoring and then enforcement

### 5.7.3 Immigration

There is a difference in the way the local actors and the deciding actors view immigration. According to the local actors, immigration is a way of solving their problems, while the deciding actors view immigration as a contributory factor of the water problems and loss of vegetation cover. However, a close scrutiny of

the Illmotiek people's way of life, it is more reasonable to move livestock to areas where there are pastures since they have no other means of earning a living. The deciding actors have not on the other hand facilitated development of alternative sources of income but have gone ahead and divided the land into group ranches. It is difficult to respect this form of land ownership especially during the dry periods. Migration of livestock and the young men is therefore a necessary evil that could cause conflicts in future.

#### **5.6.5 Causes of Water Distribution problems**

According to the household survey in Upper Ewaso Nyiro North Catchment, causes of water problems are mostly out of their control. They blame the large irrigators like Homegrown and Kenya Horticultural Exporters for poor water distribution. Others blame the climate and drainage system. The other causes are poor leadership both at the community level and institutional level, landlessness, lack of finance and lack of proper monitoring/ assessment. Others however blame the politics in the area, which compromise ministry policies. Unemployment is also a contributory factor as majority of farmers are school leavers and school drop outs who can not find alternative employment opportunities.

The other cause is the lack of rules on the minimum sizes of land that one can purchase and thus people divided their land up into 2-acre plots or less. The relevant authorities have not been able to prevent extreme fragmentation. Despite efforts towards this, many groups subdivided their farms whether or not government consents was forthcoming. The African culture also dictates that a father has to subdivide land for all his married sons, who in turn may decide to sell the land. Obviously the subdivision has an implication on population density and consequently water demand

Having analyzed the institutions in Chapter 4 together with the households in this chapter, it is clear that although the many institutions contribute to poor water management, the households, especially their perceptions toward resources is another major drawback. The household analysis (chapter 5) has demonstrated that the perceptions of Actors, especially the local Actors has an impact in the decisions made for water conservation. Households for instance perceive water shortages as a problem outside of their own control. Hence they wait upon the other Actors (deciding actors) or God to intervene. This perception makes them not to identify with their problems thereby further contributing to water problems. The next chapter analyses the legal framework with a view of establishing its shortcoming

## **CHAPTER SIX**

### **6.0 ANALYSIS OF WATER RELATED LAWS**

The Kenya law is based both on English law and African customary law. The English law recognizes that water is a public good and is common to anyone having a right to access. The African customary law recognizes that water sources and watering points belong to the community and can be used by everybody. However the water management laws as seen below seem to be scattered in various Acts of parliament. This is because of there being no framework for harmonization of these acts. This chapter analyses the water Act and other important laws for water conservation e.g. Forest Act agriculture Act and Wildlife conservation Act among others.

#### **6.1 The Water Act**

The law governing water resources is currently found in the water Act, cap 372 of the laws of Kenya. The act provides the legal framework within which multiplicity of players may participate in the provision and supply of water. When this act was enacted in 1952, and later revised in 1972, water and sanitation provision was by public departments. However, the Water Act does



not address commercial and private sector participation though these are alternative modes of management water resources.

The Act deals with regulatory issues stating the dos and the don'ts but it lacks planning and priority setting mechanisms. For instance, though it states that water for domestic use should be given priority, there are no mechanisms to ensure that this happens on the ground because as already discussed in chapter 4, provision/allocation of water is based on application and thus demand by users. Unfortunately most of those applying for water are the irrigators. The pastoralists for example do not apply for water and yet water for livestock (according to the Water Act) is a priority. While livestock is the major economic and social activity for pastoralists in Zone 3, there has not been a law or a mechanism of accommodating their needs. The Water Act has therefore not addressed their needs adequately.

In terms of the fines for defaulters, water Act is not deterrent because the penalty for illegal abstraction is only Kshs.200. Cases were reported where two defaulters were taken to court due to over abstraction. They paid the fine and continued with illegal abstraction. It is evident that if this law is not reviewed, illegal abstractions will continue and consequently conflicts among users. In addition, people will resort into unorthodox means of settling the conflicts e.g through the use of arms. It was reported that residents of Nyariginu were at one

time up in arms against a private firm i.e. Homegrown, alleging that they were diverting all the water from river Likii. This clearly depicts the essence of reviewing the Water Act and establishing of local water courts to deal with water conflicts.

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In addition, it is an offence to pollute a source of water supply but only if the water supply is to be used for human consumption. Hence pollution which may have a negative impact on environment is not considered. Kenya's statutory law on pollution has not improved on the English common Law position

Generally, the laws on water do not emphasise on water that is not in defined channel e.g. surface water. This is in spite of the fact that ground water is a major alternative source of water, which could also be subjected to abuse by landowners. Once again, English law, upon which Kenya water laws borrows greatly cannot be very applicable as Britain at that time had abundant surface water, unlike Kenya today.

## **6.2 Water and Land**

There is a very special relationship between water and land, which is not catered for in the Water Act. Basically access to water derives from access to land. The Registered Land Act Cap 300 states that by registration of a person as the

proprietor of land gives the person the absolute ownership of that land together with all rights and privileges belonging or appurtenant thereto. This means that landowners can use water with impunity without making necessary measures to conserve the resource. The landowners can therefore divert, pollute or diminish the river or stream. Under this law as long as there is no riparian owner complaining, the various riparian owners may do as they please. Consequently, the public who are not riparian owners have no equal rights to access of water. Hence as long as this law is not harmonised with the Water Act, equal distribution or access to water will not be possible. In addition, the presence or absence of tenure security determines whether people will take an active role in investing in development of a resource. People are likely to take care of a resource that they own. Communal land ownership amongst the pastoralist is a disincentive to better resource management unless a special mechanism is developed for them.

Land tenure is therefore central to water management, and therefore pastoral areas cannot effectively use or manage water. The study found out that earth dams and other subsurface waters are not well maintained (see plate 6.1). In addition, one can get as much water as they wish from such sources as usage of water is not controlled through issue of control measures such as permits.

**Plate 6.1** Poorly maintained earth dam at Kimanju, Ildigri sub location.



Source: Photo by Author, 1999

The Water Act has inadequate provision for assessing activities for example land use activities, which may have adverse impacts on water supply and utilisation. Land use and water policies that will foster co-ordination of land use and water is required to ensure that land subdivisions are in harmony with availability of water. As years go by, land use transcends and this is true especially in Laikipia district, which was under ranches during the colonial period. After independence, (see Chapter 1) land was subdivided and sold to land buying companies, who later subdivided it amongst the members. Some of

the members further subdivided the same into plots of less than 2 acres. These plots are now occupied by farmers whose major source of water is the river Ewaso Ngi'ro.

Registered Land Act regulates the use of land within two metres of water body as a measure of protecting the catchment. However, this law is not respected and land abutting a river is usually cultivated. The agricultural Act contradicts the Registered Land Act by stating that a landowner owns land up to the middle of the river. Clearly, these laws should be harmonised so that rights over water are equal regardless of whether one owns land or not.

### **6.3 The Agricultural Act (Cap 318)**

This Act was enacted to promote and maintain a stable agriculture, to provide for the conservation of the soil and its fertility, and to stimulate the development of agricultural land in accordance with the accepted practices of good land management and good husbandry. Under Section 38 of this Act, the Minister is empowered to make regulations for the conservation of the soil or to prevent adverse effects of soil erosion. He/she may, make rules prohibiting, regulating or controlling and breaking or clearing of land for cultivation, grazing or watering of livestock and the firing, clearing or destruction of vegetation. These activities directly influence water quantity and quality e.g soil erosion leads to silting of

rivers, cultivation and overstocking depletes water and vegetation cover. The main organ under this Act, the district agricultural Committee may exercise its discretion capriciously and alter negatively the water balance of a place e.g. an order compelling owners to use chemical fertilizers may pollute water resources; cultivation of certain crops like snow peas require a lot of water. Drainage of land which includes construction of terraces, trenches, gabions and so forth has an effect on the natural flow of water and some of these activities should be carried out in consultation with water Ministry. However, nowhere in this Act is water conservation mentioned and yet soil and water conservation go hand in hand. Hence this Act together with water and land tenure systems need to be harmonised.

#### **6.4 Irrigation Act Cap 347**

The main organ under the Act is the National Irrigation Board. The board establishes irrigation schemes. Whenever it is carrying out the latter, it is supposed to liaise with MOWD. However, imprudent establishment of irrigation schemes may displace people. It was established that the people of Ewaso Nyiro North catchment were not consulted during the establishment of irrigation schemes. Hence, the establishment of irrigation schemes did not consider the needs of other water users. The present system has no respect to the previous land uses, which could be more sustainable than irrigated farming. No feasibility

study was done to establish the viability of the established schemes in terms of economic, environmental and social sustainability

### **6.5 The Forests Act (Cap 385)**

Just like the health Act, Water Act and Agriculture Act, this Act deals with the conservation, management and utilization of a resource (forests and forest products). Areas which have been declared nature reserves under Section 6 of this Act are declared as such for the purpose of preserving the natural amenities thereof and the flora and fauna therein. Since land tenure and water resource management are linked, most of the policy options governing water also relate to land. Land use is governed by laws and institutions dealing with agriculture, wildlife, forestry, energy, e.t.c Therefore all these sectors affect water resources and review of all of them is a necessary step to improvement of water management. In addition, as more and more land is in private hands, there is need to review the Forests Act so as to compel farmers to conserve forests which are outside the gazetted forest areas

### **6.6 Wildlife (Conservation and Management) Act Cap. 376**

Under this Act, the minister may restrict, regulate or prohibit any particular activities in an area adjacent to any park, national reserve or local sanctuary He

may declare an area to be a protected area and specify the acts that are prohibited or regulated. These acts affect conservation of water catchment areas especially within the parks (most of which are upstream). Activities in these parks, especially tourists activities and overstocking of game, may lead to increased pressure on water leading to reduced flow downstream.

Further, the study established that Kenya has no legislation requiring Environmental Impact Assessment (EIA) for water development projects. Procedures for EIA are yet to be developed and approved. Development of EIA guidelines for application in Kenya is necessary; and probably, the same be computerised. It is gratifying to note that National Environmental Bill has been proposed to provide for coordination of implementation of existing environmental conservation related legislation.

#### **6.7 The Public Health Act (Cap. 242)**

The Public Health Act makes provision for securing and maintaining health. Section 118 lists what constitutes nuisance, which includes effluents and gaseous emissions from factories. The council can impose a fine not exceeding Ksh. 200 to a person causing nuisance which is really not deterrent in the case of factories.



Section 129 of the Act spells out the duty of local authorities as to the protection of water supplies, thus: "It shall be the duty of every local authority to take lawful, necessary and reasonably practicable measures-

- a) For preventing pollution dangerous to health of any supply of water which the public within its district has a right to use and does use for drinking or domestic purposes; and
- b) For purifying any such supply which has become so polluted, and to take measures against any person so polluting any such supply.

Section 130 Empowers the Minister of health to make rules for protection of water supplies but duty to enforce is imposed on local authorities. Thus the Ministry of Health just makes the rules but actual preservation or conservation is by LAs. The Public Health Act (Cap. 242) was last revised in 1972. Further revision especially to provide for stiffer penalty for polluting water resources and harmonisation with Water Act is now necessary. In addition, most local authorities in Kenya may not have the capacity to purify water, prevent its pollution nor supply the same to its residents

### **6.8 The Local Government Act (Cap. 265)**

The local Government Act provide for the establishment of authorities for local government and defines their functions. Sections 168-176 of the Local Government Act provide for Local Authorities to establish and maintain sewerage, drainage and water supply systems. These local authority powers are within their area of jurisdiction, which may also fall within the jurisdiction of a water department. This is a duplication of the mandates especially on water supply, thus requiring formation of synergies

Section 201 of the local Government Act empowers local authorities to make by-laws in respect of all such matters as are necessary or desirable for the maintenance of health, safety and well-being of the inhabitants of its area hence are also supposed to conserve water. However as already indicated in chapter 4 above, most of the local authorities supply water, but are less concerned with conservation of the rivers yet they are the main polluters

### **6.9 The National Water Conservation and Pipeline Corporation Order (Legal Notice No. 270 of June 1988)**

The Legal Notice No. 270 of June 1988 established the Corporation with the following responsibilities:

- a) Plan, manage and procure equipment for construction of dam and water supplies;
- b) Promote efficiency in the operations for existing major water project;
- c) Ensure water projects that are financially viable do actually generate revenue.

Over and above these functions, NWCPC is actively involved in the distribution and retailing of water and has taken over water schemes that were originally run by other water undertakers i.e. MOWD and local authorities. NWCPC has failed to take over management of waste and has left it to local authorities (under the Local Government Act and Ministry Of Health (under the Public Health Act). There are no clear mandates differentiating roles of Local Authorities, NWCPC, and Ministry of Water Development

#### **6.10 Acts that Conflict**

Agricultural Act Cap 318 duplicates the Water Act, which also provides for conservation of soil and water (under section 48 as seen above in the agricultural act and section 141 of the Water Act). The irrigation Act Cap 347 also duplicates in as far as soil and water conservation is concerned. Water undertakers (Local Authorities) are also involved in conservation works (see table 6.1 below). Protection of riverbanks, beds (section 166 of the water Act)

duplicates Agriculture Act (basic land usage rules: regulation 6) on prevention of cutting down of vegetation and depasturing.

The Agriculture Act says that riparians own land up to the middle of the river, while according to the water Act the person has only riparian rights that are not limited to himself. The law regulates the use of land within two metres of water body as a measure of protecting the catchment. Further, land subdivisions do not take into account accessibility to water. In Mukogodo for instance, land is divided into community ranches and is therefore communally owned. This may restrict movement of pastoralists from one ranch to another in search of greener pastures and even water as the season dictate.

The Water Act (Cap 372) as the main Act for water has not specified that it supercedes all the other laws.

**Table 6.1 Summary of legislation on Water use and Management**

<b>The Actors</b>	<b>conservation</b>	<b>Supply</b>	<b>Pollution</b>	<b>distribution</b>	<b>Undertaker</b>
Water Act Cap 372	•	7	•	•	7
Local Government Act cap 265			•		7
ENNDA Act	•		•		
Agriculture Act Cap 318	•				
Irrigation Act Cap 347		•			
Forest Act cap 385	•				
Registered Land act cap 300				•	
Wildlife Conservation Act cap 376	7	7			
NWCPC Act				7	
Lake and rivers Act Cap 409	•				
Environmental bill Cap 318	V				
Chiefs Act Cap 28	•				

Source: Field Survey, 1999

This chapter has demonstrated that there is disharmony in the laws governing water management. They are scattered in various Acts as indicated above. The most critical Acts which need harmonization are: The Water Act, The

Registered Lands Act, the Local government Act, the Forests Act and the Agriculture Act. The next chapter (Chapter 7) addresses the Major findings, gives recommendations and conclusions based on the study problem and the objectives.

## CHAPTER SEVEN

### 7.0 FINDINGS RECOMMENDATIONS AND CONCLUSIONS

#### 7.1 Introduction

This Chapter presents various issues that arose in data analysis upon which conclusions and recommendations are made on how to improve water management. The study focussed on the influence that the institutional and legal framework, have on water resource management in the Upper Ewaso Ng'iro Catchment. This was studied through an examination of both the institutions and the laws governing water.

The study was undertaken within the following assumptions:

1. That agriculture will continue to be a main activity in the area, and that perceptions of local Actors regarding water availability is critical in water conservation.
2. That institutional role of conservation, preservation and allocation together with their collaboration is capable of enhancing equitable distribution of water.
3. That actors' participation in all activities relating to water supply, conservation, enforcement and, general management is an important component of management.

The Upper Ewaso Ng'iro North catchment has three priority challenges: providing access to water to every one, enhancing food production with efficient use of water, protecting catchment areas and developing mechanisms for dealing with conflicts in water use and management. In general terms the study found out that there are many institutions and laws whose activities and provisions are duplicated and scattered respectively. Recommendations are given for promotion of collaboration by having an integrated approach to water management. The study concludes that institutional factors are the major determinants of water management though not the only ones.

The findings broadly fall under the following areas;

- Influence of water institutions and the legal framework on the performance of water sector and recommendations on the same
- Examination of areas of conflict
- Other factors influencing water management within the catchment
- Conclusions of the study

## **7.2 Influence of Water Institutions on Water Management**

The study found out that the existing institutional structure (see figure 4.1-) is not sufficient. This is due to the poor collaboration or none at all. The roles of the different actors are not clearly defined and therefore end up overlapping (see table 4.1 !). This essentially means that some institutions like the Ministry of



Water Development is involved in all water development activities namely supply, enforcement, policy, regulation, coordination and even implementation of community projects. Hence the other actors like community do not have a sense of ownership of water and therefore rely upon external actors to manage the same. The other aspect that directly touches on the institutions is the management approaches adopted that in one way or the other affect availability and distribution of water to all users.

#### **7.2.1 Influence of Lack of Collaboration/Linkages on Water Availability**

To a large extent, lack of collaboration amongst agencies managing water has contributed to water problems. The conflicting roles mean that resources are not being directed to a specific course but are scattered in the many sectors thus losing focus. For instance the conflicts between the water and agriculture department on water and soil conservation and the irrigation policies. Both departments are supposed to conserve water and soil but they do not collaborate to save on resources. In addition, the priorities of the different ministries differ. The Ministry of Water prioritised provision of domestic water but at the same time Ministry of agriculture's priority is food sufficiency through intensifying irrigation. In addition, irrigation engineers use different criteria for design of irrigation schemes, hence ending up with different rates of water application other than those adopted by Ministry of Water development. The irrigation Engineers end up allocating more water leading to low flows in the rivers.

Allocation of resources, planning and development in water sector is on the basis of political/administrative boundaries. This is in spite of the fact that rivers transverse districts e.g. Ontuolili cuts across Meru and Laikipia district. The study found out that there are no consultations when officers from the respective districts submit applications for water allocation from such rivers (see chapter 4). The river balances are not harmonised thus causing unequal water distribution and consequently conflicts.

There are also conflicts between the water department and the water users i.e. the need to enforce the water laws and the need for irrigation as a means of earning a living respectively. It becomes difficult to enforce especially when a farmer has already planted because of the loss that will be incurred on termination of irrigation. The water enforcers should be able to balance the short-term benefits of income from irrigated agriculture and the long term benefits of ecological balance.

There is a conflict in terms of perception of water by local and deciding actors. The local actors view water as a social and an economic good which in itself, is conflicting. How to reconcile these divergent views is a problem difficult for the deciding actors. There is need for a study that will be able to come up with opportunity costs of these views and provide a basis for either adopting one of

the views or both, and inculcating a water ethic (Ecology, Conservation and equity) principle in water management.

The water institutions are fond of incorporating politicians in the water projects thus enhancing conflicts. This in itself is not bad but they should not be allowed to make uninformed decisions. It was noted that the current drilling of bore holes in Ewaso Ng'iro Catchment has not began in priority areas owing to political influence.

#### **7.2.2 Approaches/Strategies adopted for River Water Management**

Various approaches have been adopted but are not sufficient therefore contributing to poor water management. For instance, the study found out that the agencies have adopted a supply-oriented approach to water management but neglected the demand side. They are more interested in supply of water and implementation of water supply projects than in trying to conserve the same water. Their major shortcoming is how to reduce the amount of water required through conservation, enforcement, monitoring and coordination. Issuance of permits as a control measure has failed because of the bureaucracies involved in issuance and lack of enforcement. The permit does not have a conservation clause and once somebody is issued with it, it becomes a blue print to extract as much as possible (see chapters 4 and 5). The utilisation of water is inefficient with flood and sprinkler irrigation as the main type of irrigation as opposed to

drip irrigation. In addition, the users have no measuring devices although the law requires them to have the same. It is recommended that measuring devices be installed for those irrigating and that use of sprinklers and flood irrigation be discouraged. Use of furrow has been found to be inefficient and the policy is against use of furrows, but the same has not been implemented because the government of the day has not provided an alternative.

Secondly, the demand driven approach whereby a community has to take initiative to express demand for water before it is provided is not sustainable in the short run, because majority of the communities are still poor, uninformed, and poorly organised. This approach has led to some communities having access to both domestic and irrigation water at the expense of others who barely have enough for domestic. Zones 1 and 2 have better access to water than Zone 3. The alternative is to have an approach based on the needs of a community i.e. a needs Assessment Programme is required.

Thirdly, planning for water resources is based on administrative boundaries instead of river catchments in spite of the fact that water issues do not respect the administrative boundaries. This factor leads to lack of coordination of allocation by both upstream and downstream agencies. Further, NGOs have been let to operate without control. There is no law governing the sectors they

should operate in. They end up duplicating instead of complementing the existing agencies in different administrative boundaries

The fourth approach has been centralised approach by the MOWD. The Ministry (see table 4.13) is involved right from regulation, policy and even implementation at local level. This situation demotes the sense of ownership of projects by the other local actors

The other approach is sectoral approach, which does not promote an integrated approach to water management. For instance water and land are closely related and yet land use policies are not harmonised with the former's policies. Land use policies lead to increased settlement and ownership of riparian reserves, consequently infringing on amount of water resource and the common water rights.

Last but not least is the issue of conflict resolution. There is no forum for conflict resolution thus leading to unorthodox means of solving problems (see chapter 5). As recommended later, the formation of WUAs and local water law courts will minimise conflicts.

### **7.2.3 Water Resource Monitoring**

One of the main mandates of the Ministry of Water Development is countrywide assessment of surface water resources and its spatial distribution. However, the study found out that issuance of water permits and hence water apportionment was not based on continuously monitored data. Most of the Regular Gauging Systems (RGS) are not working and those working are rarely read due to staff and logistical problems. Further, it was realised that that there are many institutions dealing with data management, enhancing chances of resource duplication. Exchange of information necessary for water management between the agencies is minimal, and so data which could probably be useful with proper networking, is scattered in various institutions. It is recommended that a common data base is maintained at district and catchment level and that NRM3 take the lead role in networking. The District Information Centre could also play the role of backstopping. At national level a data base and information exchange center should be created.

### **7.2.4 Recommendations**

The state ownership and control of such vast natural resource is an impediment to the management of the same resource. This is due to the physical distance between the owners and the users. The state should desist from complete ownership of water resources to just trusteeship that does not override the powers of the public. The state can intervene in case of scarcity of resource or

adverse environmental impacts to ensure equitable access. While politicians should also be involved in resource management, their role should be limited to policy while the people, assisted by technocrats should take decisions. In this regard therefore, majority of board members should be representatives of the community and the technocrats.

It is apparent that both the water users and water managers have emphasised on supply of water but not conservation. Water users have no incentive to conserve water since they do not pay for the same. It is recommended that the water users be made to pay for water as it has an economic value. Given that irrigation is the highest water user (see table 3.2), large and small-scale irrigators should be made to pay and the proceeds be used for conservation and maintenance of water systems. In addition, there is need for augmentation measures i.e. construction of dams, reservoirs for augmentation of flows in the downstream reaches (see figure 3.7 in Chapter 3). Ways of coping with drought should be enhanced through collecting data on duration of drought and its severity. Agriculture, livestock and other programmes that respond to water shortages should be developed e.g.:

1. Provision of employment as an alternative source of income,
2. Relocation of cattle and sheep,
3. Growth of water efficient crops,
4. Use of indigenous methods of dealing with drought.

Management at local level through water Users Association is recommended as a measure of improving water management by participation at local level. The Association should be at the river catchment level and its formation should not be influenced by political boundaries. Training of the WUAs leaders is crucial to better water management. The WUAs should incorporate technical personnel from the districts purely for advisory purposes. Distribution of water will be based on the river catchment and policing will be done by the members of WUAs. The water guards and water bailiffs will give backstopping services. In addition, the district water offices should oversee implementation of water projects within their districts. The District Water Boards should handle inter-catchment relationships so as to safeguard those downstream. The National Water Apportionment Board can handle apportionment at the national level or inter-basin water transfers, otherwise, they should leave catchment matters to the catchment boards.

ENNDA should on the other hand combine efforts with NWCPC and act as an advisor to ENNC board on issues concerning the whole catchment. The Ministry of Water Development should concern itself with policy issues, and also regulations, and leave other activities like supply, distribution, and conservation to other actors.



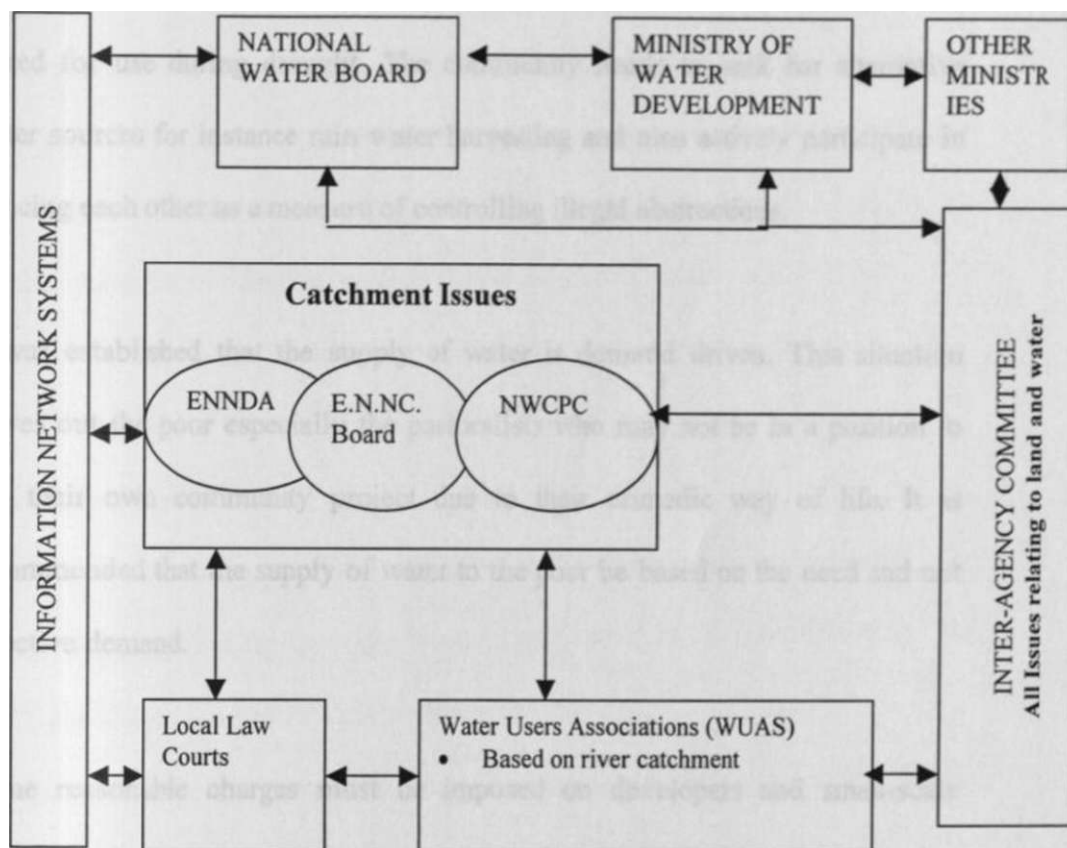
On water undertakership, the Ministry-appointed NWCPC should only deal with bulky projects and leave the small ones to Las and WUAs. The management role should be limited to production systems. The study recommends that the role of the MOWD change from direct provider of services to promoter of service provision. This is based on the fact that there is inefficiency in centralised bureaucratic systems thus limiting property rights in water and consequently sense of ownership (see chapter 6). The local community together with NGOs should implement and manage water schemes. Technical support by the district water offices is necessary, but some of the skills should be imparted to the locals. The government and the NGOs should cheer in where necessary to give financial support in operation and maintenance. The sustainable use of water will depend on how these institutions will relate to each other through the medium of governance. Water is a scarce resource in UENN catchment and hence exclusive ownership either by government or individual may not be suitable. Water therefore should be managed at different levels.

The NGO activities are also not coordinated as seen above. There is need to develop a national sector policy and regulatory framework within which external assistance can be coordinated. Sharing of resources amongst actors should be encouraged e.g. use of same vehicles when working in same area (agriculture and Water departments). In addition, there is no law compelling NGOs to work in certain sectors of the economy. In this regard a law should be enacted to

ensure that NGOs do not duplicate other agencies. To avoid duplication, NGOs should register in their respective districts.

The district-based management of resources is not sustainable because hydrological boundaries do not often coincide with political boundaries. Therefore basin wide planning is essential for sustainability. This approach will require all data for shared catchments. Water use can only be sustainable if the district upstream, i.e. Nyeri, Meru, Nyandarua, and downstream i.e. Laikipia, Isiolo and Samburu apply similar approaches. Hence co-ordination in the whole catchment is a prerequisite to sustainable water management. The study proposes the following institutional framework (figure 7.1).

**Figure 7.1: Proposed River Catchment Approach**



**Source:** Author, 1999.

Note that all the arrows are two-way meaning that collaboration is two way. The approach is based on river catchment or basin and not on administrative boundaries. The new structures on the scene are: the Inter Agency Committee (IAC), the local law courts, and the Information Network System. It is hoped that they will strengthen collaboration, law enforcement, and data management.

Monitoring and enforcement should be continuous to cover both dry and wet season. The water department should ensure that floodwater is conserved or/and stored for use during drought. The community needs to seek for alternative water sources for instance rain water harvesting and also actively participate in policing each other as a measure of controlling illegal abstractions.

It was established that the supply of water is demand driven. This situation leaves out the poor especially the pastoralists who may not be in a position to run their own community project due to their nomadic way of life. It is recommended that the supply of water to the poor be based on the need and not effective demand.

Some reasonable charges must be imposed on developers and small-scale irrigators who use public water for free (records at the ENNC board depicts that only 5% of abstractor have storage facilities). Water charges were introduced in 1995, but among those who defied payment were politicians who own some of the large irrigation farms. Water undertakers and major abstractors should be made to pay for water as a control measure and the proceeds used for catchment protection as already mentioned above.

There is need to change the conveyance from furrow to piped system. Furrow systems were meant for cattle and sheep and a small population, but now serve a

larger population and is multi purpose. The furrows are not lined and are exposed to evaporation and seepage. With the increased demand for water, it is unsustainable to continue using the furrow as a conveyor system. The furrow at Nyariginu has caused a lot of conflicts because it no longer serve people downstream. The furrow initially served people on a stretch of 3 kms before joining the river, but presently, it barely serves people on a stretch of 500m.

### **7.3 The Water Laws and the Recommended Changes**

#### **7.3.1 The Water Laws**

The water laws are supposed to be the main instruments of conservation. The study found out that the laws are fragmented in many Acts (see table 6.1). The main act-Water Act cap 372 has not been able to:

- promote efficient sustainable, and beneficial use of water in the public interest;
- provide equitable access to water as the ministry has the mandate of determining which areas the water undertaker should operate,
- promote partnership and liberation of water services

The study established that the fragmented roles of different government agencies is due to the fragmented legislation as already seen in Chapter 6.

Apart from the Water Act being lenient to offenders the households are not aware of the provisions of the water Act and they need to be educated

It was also established that there are many acts rules regulations and by-laws with regard to water supply, sewerage and pollution, and therefore multiplicity of agencies involved in their implementation and enforcement. The reasons for low level of enforcement and consequently poor water distribution are:

- i. Responsibilities are divided among many agencies with little coordination. There are procedural difficulty i. e. requiring a clearance certificate from the district agricultural officer in addition to meeting the conditions of MOWD, and Ministry of regional development before issuance of permits.
- ii. Too many laws involved may be difficult to understand and correlate especially for the subordinate officers concerned.
- iii. Differences in social status can make regulatory agencies reluctant to prosecute. Agencies tend to process high status offenders by administrative rather than legal measures.
- iv. Staff shortages and poor means of communication.

The study established that some acts of parliament e.g. ENNDA Act give too much powers to agencies i.e. ENNDA The authority has no technical capacity to undertake coordination activities in the whole catchment. These legal provisions need to focus on what the institution is capable of doing without overburdening it. However, it is beyond the capacity of this study to go into every detail of these provisions.

### **7.3.2 Recommendations**

It is recommended therefore that the laws be harmonised. Inter-ministerial meetings should be called in an effort to revise the Acts and assign roles to the different Actors respectively. Roles should only be given to actors on the basis of capacity to undertake the obligations of the specified Act.

The Water Act Cap 372 should be harmonised with all the other acts dealing with conservation (see table 6.1). For instance the Agriculture Act Cap 318, Lake and Rivers Act Cap 409, (which regulates dredging and use of vessels on certain lakes and rivers), Lands Act cap 300 on rivers and streams river line reserve, e.t.c. On catchment protection, Environmental bill Cap 318, Forests Act Cap 385, Wildlife conservation Act Cap 376, and Chiefs Act Cap 28, should be harmonized with Water Act Cap 372. In addition enforcement need to be done at river basin level and not district level.

A law should be enacted compelling the NGOs to operate in certain sectors and not others and to fit into the respective catchments' plans. In addition, people and more especially the proposed WUAs should be educated on the laws of water and the need to observe them. Finally, establishment of Water courts as proposed will require an Act of Parliament, and it is recommended that the same be enacted.

## **7.4 Other Factors**

### **7.4.1 Land and Water**

The study found out that land and water resources are interrelated. For instance, land use change due to immigration has contributed to increased demand for water as seen below. Land use is governed by laws and institutions established to deal with agriculture, forestry, transportation, energy and trust lands. All these sectors affect water resources. There is need therefore for water policy to be integrated with land policy. In addition land tenure and therefore land subdivisions should reflect the social and ecological links between land and water.

The study established that the prevailing land tenure system contribute to lack of interest to undertake environmental conservation. Pastoralists in zone 3 have no individual right over land, and therefore do not take conservation measures like planting of trees (which are likely to take a longer time to produce any benefits) seriously.

### **7.4.2 Water demand**

It is clear from the analysis in chapter 4 and 5 above that water resource demand has been increasing, and the same is attributed to increased immigration, which in itself is caused by lack of harmonisation of land and water policies. Further, the introduction of horticultural crops like snow peas has increased land under



irrigated agriculture (which is the largest water user) especially in a semi arid area like Laikipia. The demand exceeds supply and the same is worsened by the unauthorized abstractions as discussed earlier.

The unauthorized abstraction has been attributed to:

- a) The lack of an effective abstraction monitoring programme;
- b) High financial return from irrigated agriculture and low fines;.
- c) Lack of flood water storage facilities;
- d) Low water use efficiency of irrigation schemes and;
- e) High possibility of lack of political good will and poor water ethic amongst the people.

The study proposes that land and water policies be harmonised so that people's settlement pattern is based on the availability of water resource. There should be a clear policy controlling immigration especially in ASAL regions.

#### **7.4.3 Ethics**

Traditionally, resource utilisation was approached by physical and psychological tools. The physical ones were stones, wood, and metal. Spiritual tools were reflected in myths and religion. The modern industrial age has translated the physical tools to intellectual tools but does not have spiritual tools, which are valuable towards developing conservation approach towards natural resources. A water ethic can only be developed if perceptions towards management of water resources change.

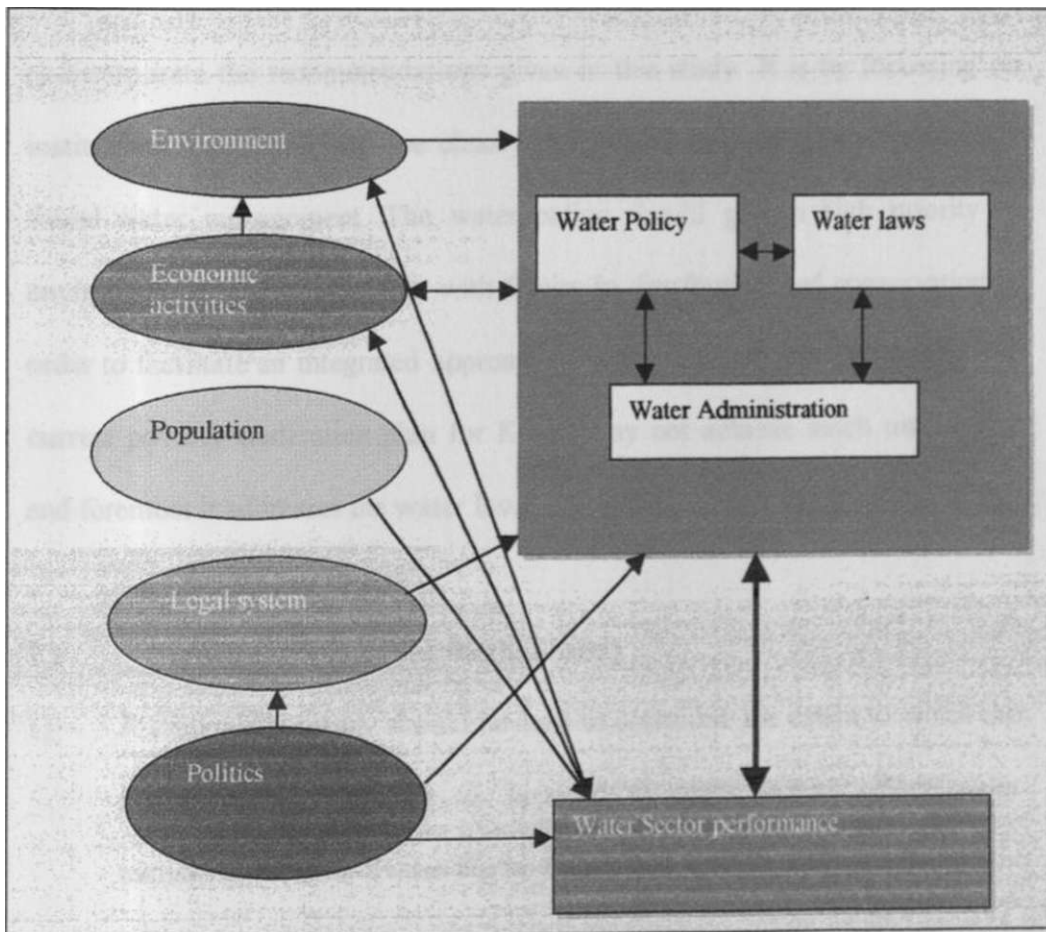
#### **7.4.4 Perceptions**

According to the study, people's perceptions of the causes of water problems influence actions taken to address the same. The actors accept that there is a problem of water and vegetation cover, but they link these problems not to their land use activities and immigration but the climatic environments in combination with strong belief in ultimate divine responsibility and benevolence. The already mentioned attitudes among households are particularly relevant in this respect. There is need for sensitization so as to instill a sense of responsibility in use of water. There should be a deeper recognition that humans are part of a larger system and are obliged to conserve natural resource for their own good as well as good of the future generations. The principle of conservation demands that the advantages and disadvantages of every water use be carefully weighed.

In summary the conceptual framework developed in chapter 1 is actually supported by the findings. Although the water institutions play an important role in water sector performance, there are other factors like legal system, population changes leading to changes in demand, economic development (economic activities or land use changes), and socio-political factors that have to be taken into consideration. The performance linkages are presented in figure 7.2 below. The figure depicts two main aspects i.e. the nature of institution performance interaction within water sector and the general context within which the

interaction occurs. There is a two-way arrow linking water institution and water sector performance hence the causation works both ways. The general context within which institution performance interaction occurs is the environment, economic system, population, legal system and political system. The political system is a new addition from the field. This, together with the legal system influence the structure of institutions and thus water management, whereas the others affect and are affected by water sector performance.

**Figure 7.2: Water sector performance Linkages**



**Source:** Field Survey, 1999

## **7.5 Conclusion**

The existing institutions cannot ensure sustainable management of resources in the Upper Ewaso Ng'iro north catchment. This is because there is no coordinating agency, while activities are duplicated. In addition the water related laws are conflicting and therefore require harmonisation. On the other hand local and deciding actors are not making adequate efforts to conserve water thus enhancing the water conflicts. The immediate action required is to re-orientate these actors towards conservation measures. This should be guided by the fact that water is an economic good that need to be conserved. This action will not be possible with the current institutional setup, which seriously needs to be revised to incorporate the recommendations given in this study. It is by focussing on institutions that Kenya will see clearly the political and policy implications of sound water management. The water policy should give a high priority to environmental concern together with Equity in distribution and conservation in order to facilitate an integrated approach to water management. In addition the current poverty eradication plan for Kenya may not achieve much unless first and foremost it addresses the water Issue.

## **7.6 Recommendations for further Study**

- 1) A comparative study should be done to determine the extent to which the institutional weaknesses as opposed to other factors affect water management in the Ewaso Ng'iro Catchment.

- 2) A study should be carried out to determine the role of the informal institutions in the management of water
- 3) The role of social scientists in water resource management This is based on the fact that water management has been the domain of Engineers and its high time social sciences are incorporated in the panels to be able to articulate societal issues which are pertinent to the water resource management
- 4) Establishment of the reasons why Agencies do not collaborate
- 5) Development of mechanisms for water costing in Rural areas

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## **APPENDICES**

## ANNEX 1

### RELATIONSHIPS BETWEEN VARIOUS VARIABLES

#### 1 Presence of CBO and Availability of Resources i.e. Water

Water resources tend to diminish as you move from zone 1 to 3 and the same applies to formation of Community Based Organisations. A gamma Measure of 0.49 is illustrated below

Zone	Presence of CBO (Frequencies)	
	Yes	No
Zone 1	10	2
Zone 2	5	5
Zone 3	6	7

$$\text{Gamma Measure} = \frac{(Ax D) - (BxC)}{(Ax D) + (BxC)}$$

$AxD = 10 \times 13$  (13 being the sum of all cells which are to the right and lower than the initial cell) = 130

$$5 \times 7 \text{ (is another lower cell)} = 35$$

So,  $AxD$  for this table is  $130 + 35 = 165$

$BxC = 2 \times 11$  (11 being the sum of cells which are to the left and lower than the initial cell) = 22

$$5 \times 6 \text{ (is another lower cell)} = 30$$

So,  $BxC$  for this table is  $22 + 30 = 52$

$$\frac{165 - 52}{165 + 52} = \frac{113}{217} = 0.49$$

#### 2 Relationship Between involvement in CBOs and Conflict Resolution

Conflict resolution	Involvement in CBOs (frequencies)	
	Yes	No
Yes	16	6
No	5	8

$$\text{i.e. } \frac{(16 \times 8) - (5 \times 6)}{(16 \times 8) + (5 \times 6)} = 0.62$$

The same method is used to calculate the Gamma measure for the rest of the variables

Relationship between Sensitization and Resolution of Conflicts

Sensitization	Resolution of conflicts	
	Yes	No
<b>Yes</b>	11	2
<b>No</b>	17	6

Relationship Between Amount of Water used and Source of Water

Amount in Litres	Source			
	River	Borehole	Laga	Piped
20	1	4	-	-
40	2	3	-	-
60	2	1	-	1
80	1	-	-	-

Relationship Between Awareness of water Laws and Incidence of Illegal Abstractions

Aware of Laws	Incidence of Illegal Abstractions	
	Yes	No
<b>Yes</b>	8	10
<b>No</b>	7	6

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WATER RESOURCE MANAGEMENT IN UPPER EWASO NYIRO NORTH CATCHMENT (UPPER EJSJN.G)

**HOUSEHOLD QUESTIONNAIRE**

Declaration: The data collected will be used for the sole purpose of this research and will not be diverged to any other authority.

**Date of Interview**    /    /99  
**Name of Interviewer** \_\_\_\_\_  
**Name of Interviewee** \_\_\_\_\_ (optional)

SECTION I GENERAL HOUSEHOLD INFORMATION

1. Present Area of Residence

a) **Location**

	Name	Code
<b>District</b>		
: <b>Division</b>		
<b>Location</b>		
<b>SLocation</b>		
<b>Village</b>		

b) **Family Head: 1 Male 2 Female**

Sex	Number/ Size
<b>1 Male</b>	
<b>2 Female</b>	

2 Settlement History

a) **What is your district of origin?**

b) **Why did you migrate to this area?**

c) **How did you acquire this land**

System of acquisition	code
<b>Inheritance</b>	<b>1</b>
<b>Purchase</b>	<b>2</b>
<b>Squatter</b>	<b>3</b>
<b>Other (specify)</b>	<b>4</b>

d) **When did you acquire the land ?** \_\_\_\_\_ (year)

e) When did you settle in the fann? \_\_\_\_\_(year)

3. Land Tenure

a) Type of land tenure

Type	Code
Freehold, own title	1
No title	2
Communal land	3
Leasehold	4
Informal hire	5
Squatter	0
Other (specify)	7

b) If your answer to the above includes communal land, what is your opinion about it?

c) What is the size of your farm? \_\_\_\_\_acres

4 Economic Activities

a) Category of farming activities

Category of farming	No. of animals	rank	Code
Large Scale Farming			1
Small scale/farming			2
Ranching			3
Peasant farming (subsistence)			4
Other	1		5

(b) Crops and Livestock

(i) What types of crops do you grow"?

(ii) <u>What type of livestock do you keep (list in order of importance)?</u>	
Type	Code
Grade cattle	1
: Cross-breed (mixture)	2
Zebu	3
Boran	4
Other	5

c) What other off farm occupation are you engaged in?

5.0 Community Interactions

a) Do you belong to any CBO

YES	1
NO	2

b) If the answer to the above is YES, name the types of CBO

- 1 Water related
- 2 Social welfare
- 3 Other (Specify)

c) Number of members

SECTION 11: WATER RESOURCES, USES & MANAGEMENT

6 Water Sources /Uses

a) **Where do you get your water from (rank in order of importance)**

Water source	code
<b>River</b>	<b>1</b>
<b>Bore hole</b>	<b>2</b>
<b>Rain</b>	<b>3</b>
<b>Spring/well</b>	<b>4</b>
<b>other</b>	<b>5</b>

b) **What are your three major uses of water?**

c) **How much water do you use as a family per day?                      litres per day**

d) **How far away is the water/source?                                      Metres**

7 Water Storage

a)

<b>YES</b>	<b>1</b>
<b>NO</b>	<b>2</b>

b) **If YES, What is its capacity                                      m M /or litres**

c) **If NO, give reasons.**

d) **When is the water in storage tank used (tick)**

1. **During wet season**
2. **During dry season**
3. **Both seasons**

e) **How long does the water last?                                      Months**

8 Abstractions of Water

a) **If in 6 a), your answer included river, then how much water do you extract?**

- 1) **Not known**
- 2) **m<sup>3</sup> per day/month/year**

b) **State the amount of water you are permitted to extract                      m<sup>3</sup> per day/month/year**

c) **What do you use the abstracted water for?**

<b>Uses of the water</b>	<b>Code</b>
<b>Domestic</b>	<b>1</b>
<b>Irrigation</b>	<b>2</b>
<b>Both domestic and irrigation</b>	<b>3</b>
<b>Other (specify)</b>	<b>4</b>

d) **If your answer includes irrigation, what method of irrigation do you use?**

method	code
<b>Surface with furrow or basins</b>	<b>1</b>
<b>Surface with horse pine</b>	<b>2</b>



Sprinkles, low pressure/high pressure	3
Dnp irrigation	4
Bucket irrigation	5
Other (specify)	6

e) Irrigation efficiency on plot low/ medium/ high (To be determined from above)

Irrigation efficiency	(ode
High	1
Medium	2
low	3

**Do you use water pumps ?**

YES	1
NO	2

If YES,

0 of what capacity is the pump. m3/s

ii) What are the average pumping hours per day hrs

## 9 Water Payment and Management

a)

YES	1
NO	2

b) If YES, how much? Ksh.\_

c) If NO, Why\_

**b) What is your opinion about paying for water<sup>0</sup>**

<b>Who in your opinion is responsible for the following</b>	
Responsibility	Name of Institution
<b>1 Distribution</b>	
<b>2 Monitoring</b>	
<b>3 Enforcement</b>	

f) Which institution would you prefer to manage water?

Institution	Proposed Role	Reasons for your answer
Government		
Community		
NGOs		
Other (specify)		

g) Who controls the amount of water used < authonty)

SECTION 111 HOUSEHOLD PERCEPTIONS ON WATER RESOURCE/ISES

10 Perceptions on water use and management

a)

perception	code
<b>Social good- God given. Free to be utilised without caution</b>	<b>1</b>
<b>An economic good to use for purposes that can benefit me and mv family</b>	<b>2</b>
<b>A scarce resource that requires careful utilisation</b>	<b>3</b>
<b>Other (specify</b>	<b>4</b>

b) What is your personal opinion in regard to water use and distribution?

c) **Do your actions affect people /users downstream? YES/NO**

YES	1
NO	2

i. If YES, what action have you taken to ensure that they get water?

ii. If NO, why?

d) (i) Do you get any complaints from other water users?

YES	1
NO	2

(ii) If YES, How are these complaints resolved?

e) What in your opinion are the causes (if any) of water problems in this place?

f) **Some of the water problems have been attributed to the weak institutions that manage the same What is your feeling about this?**

Feeling	Code
<b>Very strongly</b>	<b>1</b>
<b>Strongly</b>	<b>2</b>
<b>Average</b>	<b>3</b>
<b>No relationship</b>	<b>4</b>

g) **Has anyone sensitized you on water management? YES/NO**

YES	1
NO	2

If YES,

i) Name of organisation

ii) What did you learn and how have you implemented it?

SECTION: IV PERCEPTION ON ENFORCEMENT AND CONFLICT RESOLUTION

11 Enforcement

a) **In this area, do you feel there is equitable distribution of water?**

YES	1
NO	2

b) **As you answered in No. 9 (e) of the institutions dealing with the following, How do you rate their performance?**

Responsibility	Rank
<b>1 Distribution/supply</b>	1 good
	2 fair
	3 poor
<b>2 Monitoring</b>	1 good
	2 fair
	3 poor
<b>3 Enforcement</b>	1 good
	2 fair
	3 poor

12 Conflict Resolution

a) **Are there any conflicts in water use?**

YES	1
NO	2

b) **If YES, What conflicts arise out of water use:**

**Q Between yourself and other water users**

i) **Between yourself and the institutions (deciding actors)**

iii) **Between yourself and the legal requirement**

c) **How are the above conflicts resolved:**

**0 Between yourself and other water users?**

n) **Between yourself and the institutions (deciding actors)?**

m) **Between yourself and the legal requirement?**

d) **Who is the arbitrator?**

e) **How have the existing institutions helped resolve the conflicting demands of water? Give examples**

**f) To what extent have the conflicts been resolved?**

**g) How do you think water problems can be resolved?**

**h) Are you aware of any law governing water management<sup>0</sup>**

<b>YES</b>	<b>1</b>
<b>NO</b>	<b>2</b>

**(i) What are the community rules and regulations (if any)?**

**(ii) What Government water rules/ Statutes/ Acts of parliament are you aware of?**

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 (UPPER EJS.N.C.)

***GUIDELINES FOR DISCUSSION***

Declaration: **The data collected will be used for the sole purpose of this research and will not be diverged to any other authority.**

SECTION ONE

- A**      **NANYUKI MINICIPAL COUNCIL**
- B**      **LAIFIPLA COUNTY COUNCIL**
  
- a)      **Area of jurisdiction**
- b)      **Source of water**
- c)      **Number of residents served by the water**
- d)      **Major uses of water e.g domestic, commercial, industrial**
- e)      **Water charges/payments**
- o)      **Their role in water management: Supply, conservation, allocation**
- g)      **Collaborating water agents**
- h)      **Enforcement of water regulations**
- o)      **Laws governing enforcement**
- j)      **Areas of conflict with other undertakers or water managers**
- k)      **Methods of resolving conflicts**
- D**      **Problems experienced in water management and suggested solutions**

SECTION TWO

- A**      **WATER RESOURCES ASSESSMENT & PLANNING (WRAP)**
- B**      **NATURAL REOURCES MANAGEMENT, MEASUREMENT\*. MONITORING (NRM<sup>3</sup>)**
  
- a)      **What amount of water does river Ewaso Nyiro provide?**
- b)      **How is the available data disseminated to the relevant institutions?**
- c)      **In what areas are you collaborating with water management institutions?**

AGENCY	AREA OF COLLABORATION

**SECTION THREE**  
**NGOs**

**The number of NGOs dealing with water within the catchment**

**Its role in river water management**

**Nature of collaboration with**

- a) Government agencies**
- b) Other NGOs**
- c) Local community organisations**

<b>AGENCY</b>	<b>AREA OF COLLABORATION</b>
<b>Government agencies</b>	
<b>Other NGOs</b>	
<b>Local community organisations</b>	

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**WATER RESOURCE MANAGEMENT IN UPPER EWASO NYIRO NORTH CATCHMENT  
(UPPER E.N.N.C.)**

***QUESTIONNAIRE FOR PRIVATE WATER USERS (COMMERCIAL FIRMS)***

**Declaration:** The data collected will be used for the sole purpose of this research and will not be diverged to any other authority.

Date of interview \_\_\_/\_\_\_/99

Name of Interviewer \_\_\_\_\_

Name of the firm \_\_\_\_\_

Name of respondent \_\_\_\_\_

Position held \_\_\_\_\_

**1 GENERAL INFORMATION**

a) Location \_\_\_\_\_

[District  
Division  
Location  
Sub-location  
Village/estate

b) primary raw water source \_\_\_\_\_

**2 DETAILS OF THE FIRM**

Size of the farm \_\_\_\_\_ acres

When the firm located here \_\_\_\_\_

Previous location \_\_\_\_\_

Reasons for locating \_\_\_\_\_

**3 WATER USES**

What do you use the water for?

How many acres do you irrigate?

When do you irrigate \_\_\_\_\_

Day time \_\_\_\_\_ Hrs\_

At Night \_\_\_\_\_ Hrs\_

Day and Night \_\_\_\_\_ Hrs\_

**4 WATER PERMIT**

Do you have a water permit? YES/NO

Actual abstraction      Normal      flow \_\_\_\_\_ m<sup>3</sup>/s  
   Flood      flow \_\_\_\_\_ m<sup>3</sup>/s

Permit obtained from \_\_\_\_\_

Year permit issued      19\_\_

Amount of money paid for the permit Ksh. \_\_\_\_\_

Authorised abstraction: Normal flow m<sup>3</sup>/s  
 Flood flow \_ m<sup>3</sup>/s  
 Purpose of permit\_

**What flow regulation structures have been built**

**Who regulates the amount of water used?**

What other payments are made for water use?

5 STRUCTURES

Which structures have been constructed?

Permanent weir of length \_\_\_\_\_ Width \_\_\_\_\_ height \_\_\_\_\_ (m)

Temporary weir of length \_\_\_\_\_ Width \_\_\_\_\_ height \_\_\_\_\_ (m)

**Constructed Canals (Earthen Or Lined)**

TYPE	DEPTH	LENGTH

**Constructed Pipelines**

	DIAMETER	LENGTH
GI		
PVC		

Do you have a storage tank YES/NO

Number of tanks \_\_\_\_\_ total \_\_\_\_\_ -volume

Other storage facilities

6 METHOD OF IRRIGATION (tick which irrigation was mentioned in 3 above)

Surface with furrows or basins

Surface with horse pipe

Sprinkler: low pressure/high pressure

Drip irrigation

Bucket irrigation

**Why do you use this method**

7 WATER AVAILABILITY CONSTRAINTS AND PROBLEMS

a) **Is there unequal water distribution in this area? YES/NO Why?**

b) Are you **aware of any downstream users problems? YES/NO (tick one)**

c) **If YES, How do you think their problems should be solved?**

8 PERCEPTIONS

**What is your perception about water?**

**How do you manage water to ensure that downstream users get water?**



**In your opinion. What do you consider a priority? (rank in order of importance)**

- a) Increase of agricultural production for local consumption and surplus for export**
- b) Provision of employment opportunities so as to improve the living standards of the people**
- c) Provision of domestic water /livestock for the local people**
- d) Promotion of tourism as it is one of the major foreign exchange earner.**

9 \_\_\_\_\_ Comment on the role of the various Institutions managing water

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WATER RESOURCE MANAGEMENT IN UPPER EWASO NYIRO NORTH CATCHMENT  
(UPPER EJS.N.C)

***DISTRICT WATER BOARD- DISCUSSION***

Declaration: **The data collected will be used for the sole purpose of this research and will not be diverged to any other authority.**

**Name of interviewer**

**Name of respondent**

**Date of Interview**        /        /99

1            ROLE OF THE BOARD

**Discuss the role of the board in water management?**

2            CONFLICTS

**Does your role conflict with any other institution? YES/NO**

**If YES, With Which institutions and which roles conflict?**

**How are the conflicts resolved?**

**Who arbitrates on water use conflicts within the district? Is there a court set aside for for this purpose?**

**Who co-ordinates water institutions in the district?**

J            COLLABORATION

AGENCY	NATURE OF COLLABORATION

**How does ENNDA influence your allocations?**

**4 ENFORCEMENT**

**How do you ensure that the district water department follows the regulations of water allocation/apportionment? Do you enforce?**

**What happens if the allocation/ apportionment rules are not followed? Is that up to you or the District Water Department?**

**5 WATER NEEDS**

**How do you rank water needs in the district and why?**

- Fisheries**
- Domestic/livestock**
- Industrial**
- Wildlife**
- HEP production**
- Irrigation**

**Who provides data for your allocation of water?**

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 (UPPER EJS.N.C.)

***DISTRICT WATER ENGINEER-INTER MEW***

Declaration: **The data collected will be used for the sole purpose of this research and will not be diverged to any other authority.**

Name of interviewer \_\_\_\_\_  
 Name of respondent \_\_\_\_\_  
 Date of Interview        /\_\_\_/99  
 Name of District \_\_\_\_\_

1        THE ROLE IN WATER MANAGEMENT

a) What activities are you involved in?

ACTIVITY	AREA

b) What strategies of water management have you employed?

L        Supply oriented principle

i        Conservation/ecological principle

iii.      Equity principle

iv       Involvement of community/collaborative strategies

v.       other

c)       How do you make decisions?/Project cycle. How much power do special interest groups exercise in water decisions?

d)       How do your decisions influence the decisions of the District Water Board?

**2 COLLABORATION**

a) Which agencies do you collaborate with and in which areas?

COLLABORATING AGENCY	NATURE OF COLLABORATION
Other departments	
Other districts	
Local authorities	
NWCPC	
DWB	
ENNDA	
ENNCB	
NGOs	
CBOs & WUAs	

b) What is your opinion on the role of ENNDA in relationship to the Catchment board?

**3 ENFORCEMENT**

a) Most water problems are due to lack of proper enforcement. What are the difficulties of enforcing water regulations?

b) What measures have you taken to solve the above problems? Give evidence of enforcement

c) How long do the enforcement staff stay in one place before transfer? \_\_\_\_\_ Yrs.

d) Who are the registered water undertakers within the district?

e) Have they installed measuring device as stipulated in the water Act Cap 372? If No Why?

f) Can water use control by the measuring device be practical in communal supply points?

**4 LEGAL FRAMEWORK**

a) Is there a problem with the laws governing the use of water? YES/NO  
If YES, What are the problems

b) Are the Water users aware of the water statutes? YES/NO

c) Do the Acts of parliament conflict with the traditional laws of water management<sup>0</sup>  
Explain

5 WATER ASSESSMENT

Continuous assessment of water quality and quantity is essential as it generates data for planning and thus management of water resource,

a) What programmes exist to this effect?

---

b) Does the Ministry have a data base?

---

c) What is the role of WRAP in water management and planning?

---

6 CONFLICTS

a) What conflicts arise: e.g. in terms of roles and others  
Between you and other agencies? e.g. county councils, other departments e.tc.

---

Between you and the water users?

---

Between the water users themselves?

---

b) How do you resolve them?

---

---

7 WATER DISTRIBUTION

a) How do you resolve the issue of water distribution being the technical staff who have first hand information?

---

b) Suggest ways and means of reducing water distribution disparities

---

8 PERCEPTIONS

a) How do you perceive water

---

i. Social good- God given Free to be utilised without caution

---

ii. An economic good to use for purposes that can benefit me and my family

---

iii. A scarce resource that requires careful utilisation

---

9 NATIONAL WATER POLICY

Comment on the national water policy and its contribution to enhancing good management practices

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WATER RESOURCE MANAGEMENT IN UPPER EWASO NYIRO NORTH CATCHMENT  
(UPPER EJVJS.C)

**COMMUNITY PROJECT QUESTIONNAIRE**

**This is a communal water supply project. The person responsible in project organization and management will provide information**

Declaration: **The data collected will be used for the sole purpose of this research and will not be diverged to any other authority**

**Date of Interview     /     /99**

**Name of Interviewer,**

**Name of project**

**Name of respondent**

**Position in the project**

**1        General Information**

**a)        Location**

**District**

**Division**

**Location**

**Sub-location**

**Village**

**Agro-ecological zone**

**b)        No of households covered by the project**

**c)        Average cattle per household**

2        What were your objectives of setting up this project?

3        How far have you achieved the set objectives?

4        What constraints do you face?

5        What conservation measure have you taken to ensure water supply

6        Water Permit

**a)        Do you have a water permit? YES/NO**

**If YES,**

**i) What is your actual abstraction during:**

**Normal flow,**

**m<sup>3</sup>/s**

**Flood flow,**

**m<sup>3</sup>/s**

**ii) Permit obtained from\_**

**iii) Year permit issued     19\_**

iv) Amount of money paid for the permit Ksh. \_\_\_\_\_

v) Authorized abstraction: Normal flow \_\_\_\_\_ m<sup>3</sup>/s  
Flood flow \_\_\_\_\_ m<sup>3</sup>/s  
vi) Purpose of permit  
domestic to include livestock,  
Minor irrigation < 2 acres,  
Major irrigation > 2 acres,  
Other, \_\_\_\_\_

b) What flow regulation structures have been built?

c) If answer to (a) is NO, Please explain

7 Who controls the amount of water used?

8 What payments are made for water use?

8 Collaboration

Who do you collaborate with?

: AGENCY	NATURE OF COLLABORATION

9 Structures

Which structures have been constructed?

Permanent weir of length \_\_\_\_\_ Width \_\_\_\_\_ height \_\_\_\_\_ (m)

Temporary weir of length \_\_\_\_\_ Width \_\_\_\_\_ height \_\_\_\_\_ (m)

Constructed Canals (Earthen Or Lined)

TYPE	DEPTH	LENGTH

Constructed Pipelines

	DIAMETER	LENGTH
GI		
PVC		

Do you have a storage tank? YES/NO

Number of tanks \_\_\_\_\_ total \_\_\_\_\_ -volume

10 Distribution

a) How is water distribution between the project members?



b) How do you ensure that every person gets water?

11 Participation

How do you rate the farmers in relation to the following"<sup>1</sup>

	<u>(tick one)</u>		
	low	medium,	high
Attendance in meetings			
Participation in elections			
Participation in maintenance			
Adherence to rules			
Ability to deal with disputes			
Financial contribution			

12 Perceptions

a) How does the project perceive water?

b) How do you perceive your contribution to water management as compared to the other government institutions?

c) Water is becoming very scarce and there has been increasing degradation. Consequently costs of water development has escalated. What is your opinion of the user pays approach?

13 Enforcement

a) Who is responsible of enforcement of the internal set rules?

b) How often do the enforcers visit you?

**UNIVERSITY OF NAIROBI**  
**Department Of Urban & Regional Planning**  
&  
LAIKIPIA RESEARCH PROGRAMME

WATER RESOURCE MANAGEMENT IN UPPER EWASO NYIRO NORTH CATCHMENT  
(UPPER E.N.N.C.)

***EWASO NYIRO NORTH CA TCMET BOARD- DISCISSION***

Declaration: **The data collected will be used for the sole purpose of this research and will not be diverged to any other authority.**

**Name of interviewer:**

**Name of respondent/Provincial water engineer**

**Date of Interview        /        /99**

**1            ROLE OF THE CATCHMENT BOARD**

**Discuss the role of the catchment in water management?**

**2            CONFLICTS**

**Does your role conflict with any other institution? YES/NO**

**If YES, With Which institutions and which roles conflict?**

**How are the conflicts resolved?**

**Who arbitrates on water use conflicts within the catchment? Is there a court set aside for for this purpose?**

**3            COLLABORATION**

<b>AGENCY</b>	<b>NATURE OF COLLABORATION</b>

**How does ENNDA influence your allocations?**

**4 ENFORCEMENT**

**How do you ensure that the district water Boards follow the regulations of water allocation/apportionment"  
Do you enforce?**

**What happens if the allocation/ apportionment rules are not followed?**

**5 WATER NEEDS**

**Do you have data on the water needs of all the districts within the catchment?**

**What are your guiding principles for water allocation?**

**How do you rank water needs in the catchment and what is your basis?**

**A Between different uses**

- 1. Fishenes**
- 2. Domestic/livestock**
- 3. Industrial**
- 4. Wildlife**
- 5. HEP production**
- 6. Irrigation**

**B Between different districts**

**C Between city and country/rural needs**