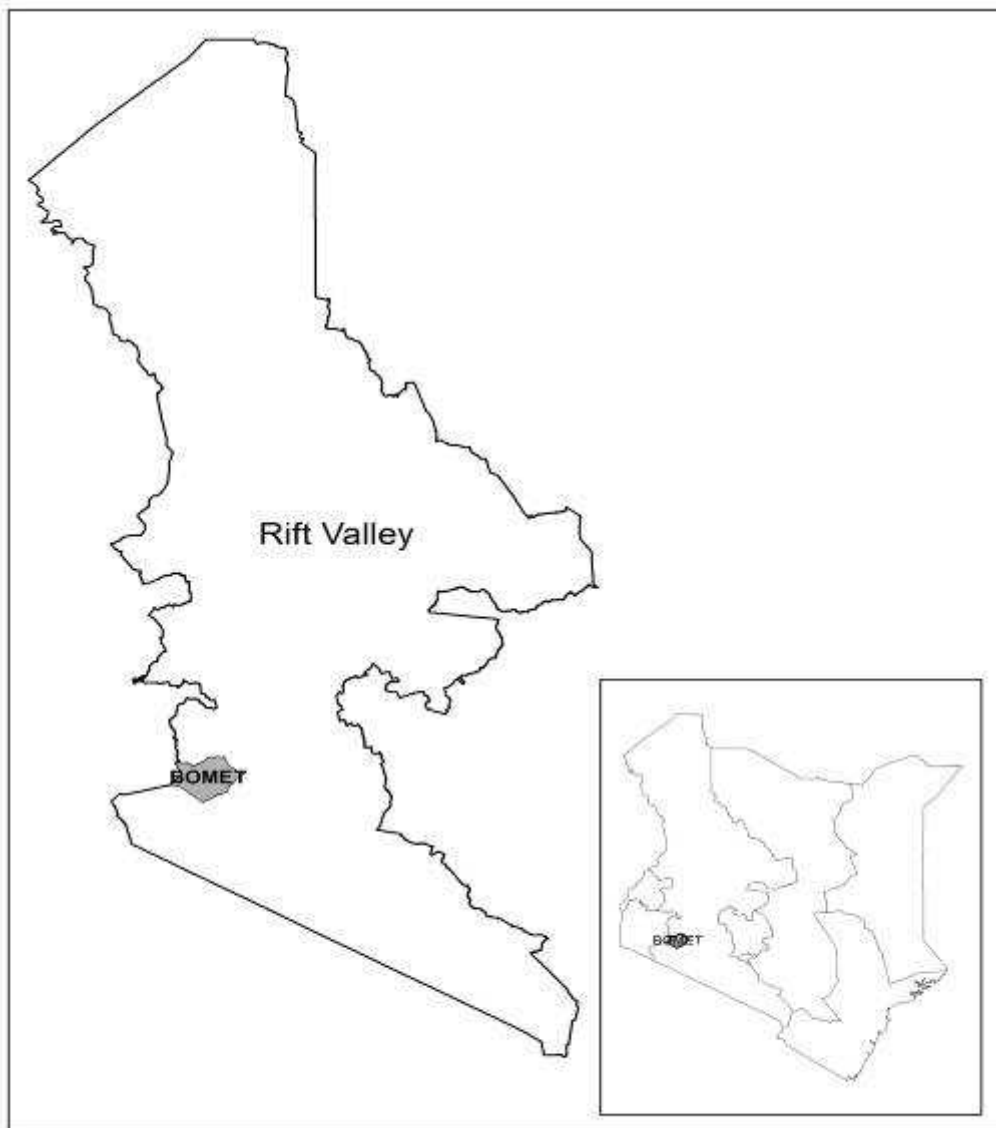




REPUBLIC OF KENYA
MINISTRY OF ENVIRONMENT AND MINERAL RESOURCES
NATIONAL ENVIRONMENT MANAGEMENT



AUTHORITY



BOMET DISTRICT
ENVIRONMENT ACTION PLAN
2009-2013

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LIST OF ACRONYMS

AAK	Agrochemicals Association of Kenya
ADRA	Adventist Development and Relief Agency
AFC	Agricultural Finance Cooperation
BCC	Bomet County Council
BMC	Bomet Municipal Council
CBO	Community Based Organization
CDTF	Community Development Trust Fund
DDO	District Development Officer
DDP	District Development Plan
DDT	Dichlorodiphenyl Trichloroethane
DEAP	District Environment Action Plan
DEC	District Environment Committee
DEO	District Environmental Officer
EA&M	Environmental Audit and Monitoring
EIA	Environmental Impact Assessment
EIMS	Environmental Information Management System
EMCA	Environmental Management and Coordination act
EMP	Environment Management Plan
EMS	Environmental Management System
ERSWEC	Economic Recovery Strategy for Wealth
FOMAWA	Friends of Mau Watershed
FSA	Financial Service Association
GDP	Gross Domestic Products
GTZ	German Agency for Technical Cooperation
GIS	Geographical Information System
HA	Hectares
ICT	Information and Communication Technology
IK	Indigenous Knowledge
JICA	Japanese International Cooperation Agency
KFS	Kenya Forest Service
KCB	Kenya Commercial Bank
KM	Kilometre
KTDA	Kenya Tea Development Authority
LH	Lower Highlands
MDGs	Millennium Development Goals
MEAS	Multilateral Environmental Agreements
MENR	Ministry Of Environment and Natural Resources
MOA	Ministry of Agriculture
MOH	Ministry Of Health
MOLD&F	Ministry of Livestock Development and Fisheries
NEAP	National Environment Action Plan
NEC	National Environmental Council
NEMA	National Environmental Management Authority
NGO	Non Governmental Organization
NET	National Environmental Tribunal
OP	Office of the President
PCB's	Polychlorinated Biphenyls
PCC	Public Complaints Committee
PCPB	Pest Control Products Board
PDE	Provincial Director of Environment

PEAP	Provincial Environment Action Plan
PEC	Provincial Environment Committee
POPs	Persistent Organic Pollutants
PRSP	Poverty Reduction Strategy Paper
RPB	Radiation Protection Board
SEA	Strategic Environment Assessment
SERC	Standard and Enforcement Review Committee
SICODO	Siongiroi Community Development Organization
TAC	Technical Advisory Committee
UH	Upper Highland
UM	Upper Middle
UNCED	United Nation Conference on Environment and Development
VIPs	Ventilated Improved Pits
WHO	World Health Organization
WSSD	World Summit on Sustainable Development
WWF	World Wide Fund

FOREWORD

The international community recognized the importance of Environmental Action Planning during the Earth summit that was held in Rio de Janeiro in 1992 which came up with Agenda 21, a global Environmental Action Plan. The Kenyan Government embraced the noble idea and developed the first National Environment Action Plan (NEAP) in 1994 and provided a provision for the enactment of the environmental management and coordination act (EMCA) in 1999. The act provides the integration of the Environmental concerns in the national district policies, plans, programmes and projects. In line with this EMCA provides for the formulation of national, provincial and district environment action plans after every five years.

District Environment Action Plan aims at integrating environmental concerns into District Development and Planning Process. *Development* and *Environment* are intertwined, hence the importance of planning both at the same time. In addition, environmental issues are cross-cutting and touch on each and every sector and therefore cannot be ignored at any stage of any project. The process of developing this Plan was faced with several challenges which included inadequate resources, insufficient information at the district level, and lack of certain stakeholders as well as low understanding of issues.

It is our wish that this Environment Action Plan for the district will provide a platform for the various development agents to incorporate environmental concerns in their respective projects and programmes with a goal of reducing poverty, enhancing equity of life and generating wealth for inter and intra-generations. This will promote projects sustainability, information sharing and partnership in natural resources management.

The District Environment Action Plan has been prepared in a participatory manner since development and environmental planning complement each other. Therefore this action plan is recommended for use by all development agents in the district to ensure sustainable utilization of existing natural resources.

Benjamin Lenilem
Chairman DEC
District Commissioner
Bomet District

John Mose
Chairman DEAP Committee
DDO – Bomet

ACKNOWLEDGEMENT

This Action Plan has been prepared by a multi-disciplinary and multi-sectoral team with several institutions and individuals contributing immensely. I therefore take this opportunity to acknowledge all those who contributed in one way or the other to see to it that this process succeeded.

I wish to acknowledge the financial support and guidance received from NEMA headquarters during development of this action plan. The district team also had two of its members benefit from one of the regional training workshops on action planning. The District Development Officer provided the necessary guidance on how to incorporate the various issues into actions. The provincial administration through the District Commissioner gave the team moral support throughout the process.

The technical district committee responsible for writing this report contributed immensely and worked hard with the little resources available to ensure that a practical action plan was developed. I therefore acknowledge their efforts with gratitude.

I expect that this action plan will not only be part of many other reports in the district, but will help to contribute effectively to sustainable environmental management by all sectors of the economy. Thank you to all who contributed to the success of this plan indirectly or behind the scenes.

Shieni K. Koiyiet
District Environmental Officer
Bomet District

EXECUTIVE SUMMARY

This is the first District Environment Action Plan (DEAP) for Bomet district prepared in accordance with the provisions of Section 40 of the Environmental Management and Coordination Act (EMCA) of 1999. District Environment Action Plan integrates environmental concerns into district projects and programmes. It is also key in the attainment of Millennium Development Goals (MDG's) and sustainable development.

This action plan has seventeen chapters that cover all the important sectors and states the various issues of concern and proposed interventions. The last chapter covers the implementation matrix by various stakeholders and monitoring and evaluation matrix. The District Environment Committee (DEC) takes the lead role in the implementation of the DEAP.

Bomet district is one of the 28 districts of the Rift valley Province and covers an area of 1450Km². It has a population of 440,842 persons, a density of 304 persons per Km² and 70,769 households. Arable land is approximately 1204 Km², while gazetted forest occupies 50 Km². The district has six divisions, 38 locations, 133 sub-locations, 3 constituencies and 2 local authorities.

The district has formal and informal settlements concentrated around urban centres with dominant housing typology being traditional semi-permanent. There is high demand for housing in urban centers indicating a steady increase in urban population. Available facilities and room size determines the rent of the houses.

The whole district faces a major problem in waste management due to lack of proper facilities. The pit latrines are not proper facilities in urban areas due to the high water table in most areas. The increase of traffic on the roads and use of emerging technologies increase pollution in the district. The district has about three (3) permanent rivers, two (2) seasonal rivers and several water springs and average distance to watering point is about 4 Km.

The primary energy source in the district is firewood and charcoal, which provide energy to about 75% of the population. Only about 1% of the population has access to fuel-efficiency technologies such as wood saving Jikos. The most serious and major threat is the high demand of wood fuel that does not correspond to increase in tree planting. There is also an imbalance in access, ownership and management of energy sources when it comes to equity.

Land topography is undulating to rolling in the upper zones and flatter terrain in the lowlands. With increasing population, poverty levels and demand for land, over-exploitation and land degradation are common in many parts of the district.

Agriculture and livestock rearing are the main livelihoods for the rural population. The two main types of farming systems include subsistence farming which covers over 100,000 ha. and commercial farming that covers about 3,000 ha. Various interventions have been identified for the different environmental issues, which require key stakeholders to implement them.

Although the district borders Maasai Mara in Narok district, wildlife resource has not been documented. Cases of human-wildlife conflict are common. The district has a wide range of biodiversity which needs to be identified and conserved. There are minimal

industrial activities such as tea, milk and coffee processing as well as the informal Jua kali sector. There are minimal cases of pollution from industries. Slaughter slabs may have serious environmental problems with respect to management of their wastes, but due to their operational size the effects are minimal. The type of trade in the district includes wholesale/retail traders, food catering industry, service industries and processors. The sale of counterfeit and sub-standard goods is a concern that needs all stakeholders to discourage.

The district has limited quarrying and sand harvesting activities whereby most of the materials obtained are mainly used locally for construction. Rehabilitation of quarrying sites needs to be given priority. The main types of disaster recorded in the district include flood (El-Nino rains) and droughts which are cyclic in the semi-arid parts of the district. Others in small scale include fires, diseases and road accidents. The district needs to prepare a risk reduction and contingency plan and enhance the capacity of the district's disaster management committee.

The public also needs to participate in environmental conservation measures in order to have a sustained development. Environmental programmes needs to be established in institutions of learning to make the youth have positive attitude towards environmental conservation.

Proper documentation needs to be done to show the actual status of the environment in the district. Environmentally-friendly technologies need to be encouraged in the district. Integration of indigenous knowledge in the management of the environment cannot be underscored in the district. This knowledge needs to be identified and documented for use by various stakeholders in the district.

Environmental Management and Coordination Act, 1999, establish various institutions, each with clear responsibilities in the management of the environment. The Act has also put in place various environmental management tools which include Environmental Impact Assessment (EIA), DEAP, Environmental Audit (EA), research, quality standards, fiscal incentives and penalties.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Kenya participated in the United Nations Conference on Environment and Development (UNCED), in Rio de Janeiro (Brazil) in 1992 and supported the provisions of Agenda 21 and other declarations and statements of principle. Agenda 21 spelt out the guiding principles and a global plan of action for sustainable development and called for improved environmental management and conservation.

The world summit on sustainable development (WSSD), held in Johannesburg in 2002, reaffirmed the commitments of the international community to the principles of sustainable development contained in Agenda 21 and the Millennium Development Goals (MDGs) of 2000. Kenya domesticated the provisions of Agenda 21 through the formulation of the first National Environment Action Plan (NEAP) in 1994. The Plan proposed the enactment of a framework environmental law which led to the enactment of the Environmental Management and Coordination Act (EMCA) in 1999 and the creation of the National Environment Management Authority (NEMA).

Sustainable Development is commonly defined as “***development that meets the needs of the present generation without compromising the ability of the future generations to meet their own needs***”. Development is also sustainable if it meets ecological, economic and social needs. This calls for the integration of environmental considerations at all levels of decision making in development planning and implementation of programmes and projects.

The Government of Kenya is committed to the achievement of sustainable development stated in Agenda 21, the Millennium Development Goals and the Johannesburg Plan of Implementation. This commitment to environmental protection and sustainable use of natural resources is articulated in various Government policy documents including the Sessional Paper No. 6 of 1999 on Environment and Development, the Economic Recovery Strategy for Wealth and Employment Creation (2003 – 2007), National Development Plan (2002 – 2008) and Vision 2030. These policies and plans recognize integration of environmental concerns into national planning and management processes and provide guidelines for achieving sustainable national development.

The 9th National Development Plan (2002 – 2008) states that “The full integration of environmental concerns in the development planning process at all levels of decision making remains a challenge to the country, and the need to integrate environmental concerns in development activities should be given high priority”. The Environmental Management and Coordination Act (EMCA) of 1999 provides for the integration of environmental concerns into the national development process. The National Environment Management Authority (NEMA) is mandated to implement the Act and in particular coordinate the preparation of Environmental Action Plans (EAPs) at the District, Provincial and National levels.

1.2 Challenges to Sustainable Development

1.2.1 Poverty

Perhaps the single most formidable challenge to Sustainable Development in the District is Poverty. According to the District Development Plan (2002 – 2008), rural absolute poverty in the District stands at 62% compared to urban absolute poverty of 25%. The effect of this is continued high dependency on natural resources for livelihoods due to a corresponding lack of access to alternative sources. This effectively leads to environmental degradation.

Poverty often leads to over-use and destruction of the environment where short-term development goals and practices are pursued at the expense of long-term environmental sustainability. Once the resource base is degraded, poverty is aggravated because the capacity of the resource base to support the same population even with unchanged demand will have diminished. Therefore, there exist a close link between poverty and environment.

Sound environmental and natural resources management should therefore aim to contribute to poverty reduction, enhance food security and promote sustainable livelihoods, enhanced environmental quality and health, promotion of sustainable energy production, minimization of pollution and waste, improvement of shelter and habitats, promotion of eco-tourism and improved standards of living.

The District's economy – as is the case countrywide – is heavily dependent on natural resources. About 76% of the population live in rural areas and derive their livelihoods mainly from natural resources. Economic activities derived from the natural resources include Agriculture, Industry, Energy, Water, Trade, Quarrying and Sand Harvesting. It is therefore imperative to diversify sources of livelihoods as a means of attaining sustainable development in the District.

1.2.2 High Population Growth

The environment and natural resources have in the recent years been under threat due to increased dependence on natural resources to meet basic needs. The population growth rate has over time become higher than the economic growth rate, hence the increasing pressure on the natural resources. This has also led to increased in-migration and over-utilization of fragile ecosystems such as semi arid lands and wetlands. The immigration into marginal areas has contributed to unsustainable land use practices often resulting to resource use conflicts especially water and pasture.

1.2.3 Rapid Urbanization

Rapid urbanization and increased migration into urban areas within the District have resulted in urban decay, loss of environmental quality and health deterioration, water pollution, loss of biodiversity and encroachment of fragile ecosystems. In both urban and rural areas, access to safe drinking water and basic sanitation is a critical environmental and health concern. Only about 20% of households in the District have access to piped water mainly concentrated in the municipality.

1.2.4 Lack of Pollution and Waste Management Infrastructure

Local Authorities (Bomet County and Municipal Councils) lack proper solid and effluent waste handling systems and infrastructure. Water and Sewerage System for Bomet Municipality is particularly important given its proximity and potential to pollute River Nyangores, which is a major tributary of the trans-boundary Mara River.

The widespread accumulation of solid wastes and poor disposal of effluents in upcoming urban centers is also a major environmental hazard which culminates in air and water pollution and increased incidences of respiratory and water borne diseases. Figures obtained from the District Development Plan, indicate that Malaria, Respiratory infections and Skin infections, are the three most prevalent diseases in the District.

1.2.5 Encroachment on Fragile Ecosystems

About 20% of the District's land area is classified as semi arid, supporting close to 50% of livestock and about 30% of the population. Climatic variability has reduced the capacity of ASALs to support existing and emerging livelihoods thus aggravating environmental degradation. This is evidenced by increased soil erosion, reduction in pasture and vegetation cover, food insecurity, increased conflicts and insecurity – all contributing to increased poverty.

1.3 Provisions of EMCA, 1999 on Environmental Planning

Prior to the enactment of EMCA, 1999, environmental management in Kenya mainly focused on administrative boundaries with little regard to trans-boundary and shared resource issues. Consequently, management of these resources has not been adequately addressed, including watersheds, wildlife and mountain ecosystems among others. EMCA endeavours to develop integrated management plans for Inter- and Intra-Districts, Provinces, Regional, National and International boundaries.

Indigenous management systems that are sustainable have also been disregarded in the past leading to environmental deterioration. Sectoral regulatory instruments, which have been used to manage the environment before enactment of EMCA, 1999 did not achieve the desired outcomes. This was largely attributed to lack of linkages, sectoral conflicts/overlaps, resource limitations, and inadequate stakeholder involvement hence weak compliance and enforcement.

Section 38 of EMCA, 1999 provides for the preparation of a National Environment Action Plan every five years. Section 40 provides as follows: ***“every District Environment Committee shall, every five years, prepare a District Environment Action Plan in respect of the District for which it is appointed and shall submit such plan to the chairman of the Provincial Environment Action Plan Committee for incorporation into the Provincial Environment Action Plan Proposed under section 39”***. The current Plan will cover the period 2005 – 2010.

Further, Section 41 outlines the important matters that the District Environment Action Plan shall contain. They are:

- An analysis of the natural resources of the District with an indication as to any pattern of change in their distribution and quantity over time
- An analytical profile of the various uses and value of the natural resources incorporating considerations of inter-generational and intra-generational equity

- Recommendations on the appropriate legal and fiscal incentives that may be used to encourage the business community to incorporate environmental requirements into their planning and operational processes
- Recommendations on methods for enhancing awareness through environmental education on the importance of sustainable use of the environment and natural resources for the District's development
- Setting out operational guidelines for the planning and management of the environment and natural resources
- Identifying actual and likely problems as may affect the natural resources and the broader environmental context in which they exist
- Identifying and appraising trends in the development of urban and rural settlements, their impacts on the environment, and strategies for the amelioration of their negative impacts
- Proposing guidelines for the integration of standards of environmental protection into development planning and management
- Identifying, and recommending policy and legislative approaches for preventing, controlling or mitigating specific as well as general adverse impacts on the environment
- Prioritizing areas of environmental research and outlining methods of using the resultant research findings

1.3.1 Objectives of the District Environment Action Plan

Besides meeting the legal requirement, the District Environment Action Plan aims to fulfill the following objectives:

- To determine the major environmental issues and challenges facing the District
- To identify environmental management opportunities
- To create synergy and harmony in environmental planning
- To integrate environmental concerns into social, economic planning and development
- To formulate appropriate environmental management strategies

1.3.2 Linkages with other Processes

It is generally accepted that the three core pillars of sustainable development are Economic, Social, and Environmental governance. The Kenya government has formulated policies, legislations, plans, and programmes to foster quality environmental values and promote sustainable development. Some of the instruments for guiding the environment and development agenda are the Environmental Management and Coordination Act, Sessional Paper No. 8 of 1999, Economic Recovery Strategy on Employment and Wealth Creation, 2003-2007 and Vision 2030.

Kenya is also party to a number of Multilateral Environmental Agreements (MEAs), including the implementation of the Millennium Development Goals (MDGs). The government is committed to achieving the targets under the MDGs by the year 2015, most of which have a bearing on the environment. Meeting these targets will mean "eradicating extreme poverty and hunger" and "ensuring environmental sustainability" as stipulated in MDGs 1 and 7. This will require careful planning in environmental management and an enhanced level of environmental governance.

The District Environment Action Planning Process is also interlinked with the general District Development Planning Process. The two processes must be mainstreamed so as

to ensure that the overall district development is in line with the set guidelines and standards of environmental sustainability.

CHAPTER TWO

2.0 DISTRICT PROFILE

Bomet is one of the eighteen Districts of Rift Valley Province. It covers an area of 1,450Km². It was created in 1992 out of the larger Kericho District. It lies between latitudes 0°38' and 1° 03' south of the Equator and longitudes 35° 01' and 35° 33' east. The District is bordered by Bureti district to the north, Nyamira district to the west, Transmara district to the southwest and Narok district to the south and southeast. It has 6 administrative divisions, 38 locations and 133 sub-locations, 3 constituencies (Chepalungu, Bomet, and Sotik), and 2 local authorities (Bomet County and Municipal Councils). It has a population of 440,842 (Tables 2.1 & 2.2), a density of 304 persons per Km² (2005 estimates), and 70,769 households with an average farm holding of 5 acres.

Table 2.1 Population Size and Distribution (Density)

Division	Years											
	1962		1969		1979		1989		1999		2005 (Estimate)	
	N o.	D	N o.	D	N o.	D	N o.	D	No.	D	No.	D
Bomet Central	--	--	--	--	--	--	--	--	120,759	359	140,999	418
Longisa	--	--	--	--	--	--	--	--	75,550	294	88,213	342
Sigor	--	--	--	--	--	--	--	--	43,583	210	50,888	245
Ndanai	--	--	--	--	--	--	--	--	37,910	232	44,263	270
Siongiroi	--	--	--	--	--	--	--	--	61,116	246	71,359	286
Mutarakwa	--	--	--	--	--	--	--	--	38,683	191	45,120	223
Total	--	--	--	--	--	--	--	--	377,601	260	440,842	304

D – Density

Sources: Population Census (1999), District Development Plan (2002 – 2008)

Table 2.2: Population Distribution by Gender

Division	Years											
	1962		1969		1979		1989		1999		2005 (Estimate)	
	M	F	M	F	M	F	M	F	M	F	M	F
Bomet Central	--	--	--	--	--	--	--	--	60,251	60,508	69,891	71,108
Longisa	--	--	--	--	--	--	--	--	36,377	39,173	42,197	46,016
Sigor	--	--	--	--	--	--	--	--	20,906	22,677	24,250	26,638
Ndanai	--	--	--	--	--	--	--	--	17,962	19,948	20,835	23,428
Siongiroi	--	--	--	--	--	--	--	--	29,149	31,967	33,812	37,547
Mutarakwa	--	--	--	--	--	--	--	--	18,451	20,232	21,403	23,717
Total	--	--	--	--	--	--	--	--	183,096	194,505	212,388	228,454

M – Male

F - Female

Sources – Population Census (1999), District Development Plan (2002 – 2008)

The district's altitude ranges from 1,689m to 2,328m above sea level, while rainfall ranges between 1,000mm to 1,400mm per annum. Temperatures are in the range of 10°C to 27°C, with a mean monthly temperature of 18°C. The coldest months are July and August with monthly temperatures of 17.6°C and 19.8°C respectively. It has Agro - Ecological zones from UHO to UM5. Arable land is approximately 1204 Km² (83% of the district), while gazetted forest occupies 50 Km².

The major part of the district is characterized by undulating topography that gives way to flatter terrain in the south. The overall slope of the land is towards the south. Consequently, drainage is in that direction. The district receives rainfall throughout the year with the long rains occurring from March to May and the short rains from August to October.

The upper zone that represents the high potential part of the district is suitable for tea, pyrethrum, maize, potatoes, and horticultural crops production, rearing of sheep and dairy cattle. This area is predominantly in the four divisions of Bomet Central, Longisa, Mutarakwa and Ndanai. The lower zone is suitable for rearing of indigenous sheep and goats, bee-keeping, poultry, beef cattle, pigeon peas and cassava production. The area is predominantly in the two divisions of Sigor and Siongiroi.

Sigor and Siongiroi divisions are particularly constraint by persistent prolonged dry spells, high temperatures and high incidence of livestock diseases outbreaks. Certain areas of the lower zones have potential for horticultural crops such as citrus, mangoes, avocados, paw-paws and passion fruits as well as coffee, but the average acreage under these crops is currently very low. The community generally relies on maize and livestock production activities.

Water and Sanitation facilities (Tables 2.2 and 2.3) play a very crucial role in the promotion of human and environmental health. Compared with other districts in the Mara River Basin – Narok, Trans-Mara and Kuria – Bomet has higher coverage of the necessary infrastructure and awareness to sustain a reasonable level of human and environmental health. However, it remains crucial to intensify efforts aimed at consolidating the gains made, in the light of emerging issues and trends in environmental management and conservation and to close the gaps between the prevailing status and national targets of various indicators of improved human and environmental health.

Table 2.3: Percentage of Households with access to Water by Source per Season

Piped		Boreholes		Wells		River		Others	
Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
4.8%	5.9%	1.4%	0.2%	8.9%	3.3%	27.8%	56.4%	45.1%	46.3%

Source: Baseline Survey of the Mara River Basin – Nairobi Rotary Club (2004)

Other Sources – Protected Springs (10.3%, 6.9%), Unprotected Springs (15.5%, 17.6%), Roof Catchment (19.3%, 0.3%), and Dams and Earth Pans (21.5%) for Wet and Dry Seasons respectively

Average Distance to the nearest portable water point = 4KM

Table 2.4: Percentage of Households with access to Sanitation Facilities

Connected to Sewer	Pit Latrines		Flying Toilets	Others
	%Without	%With		
00%	42	56.9	Figures not available	1%

Source: Baseline Survey of the Mara River Basin – Nairobi Rotary Club (2004)

Others = Septic Tanks (0.2%) and V.I.P. Latrines (0.8%)

Reasons for not having Pit Latrine: High Cost (60.1%) Does not see the need (30.4%),

Soil Profile (2.9%),

Others (6.6%)

Table 2.5 Mortality Trends (Infant, Under 5 Years) – District Figures

District	Years											
	1962		1969		1979		1989		1999		2005 (Estimate)	
	I	U5	I	U5	I	U5	I	U5	I	U5	I	U5
Bomet	--	--	--	--	--	--	--	--	0.060	0.094	0.046	0.071

I – Infants U5 – Under 5 Years

Sources – Population Census (1999), District Development Plan (2002 – 2008)

Table 2.6 Migration Trends – District Figures

Table 23 Migration Trends - District Figures												
District	Years											
Bomet	1962		1969		1979		1989		1999		2005 (Estimate)	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
	Figures Not Available											

Table 2.7 Dependency Ratio – District Figures

District	Years					
	1962	1969	1979	1989	1999	2005 (Estimate)
Bomet	--	--	--	--	1:1.3	1:1.2

Sources: Kenya 1999 Population and Housing Census (1999), District Development Plan (2002 – 2008)

Table 2.8 Number of Urban Centers by Actual Population

Population	Years							
	1979		1989		1999		2005 (Estimate)	
	FS	IS	FS	IS	FS	IS	FS	IS
>100,000	--	--	--	--				
20,000 – 99,999	--	--	--	--				
10,000 – 19,999	--	--	--	--				
5,000 – 9,999	--	--	--	--				
2,000 – 4,999	--	--	--	--				
1000 – 1,999	--	--	--	--				
500 - 999	--	--	--	--				

FS – Formal Settlement IS – Informal Settlement

NB: Information on classification of Urban Centers by actual population does not exist currently in the District

CHAPTER THREE

3.0 HUMAN SETTLEMENT AND INFRASTRUCTURE

3.1 Human Population, Distribution and Settlement

Formal and up-coming informal settlements are concentrated around the urban centres. The dominant housing typology is the traditional semi-permanent housing, with or without corrugated iron sheets roofing especially outside the trading centres. Within the urban centres, permanent housing typology dominates.

Table 3.1: Population Density Projections by Divisions (1999 – 2010)

Division	1999	2002	2004	2006	2008	2010
Bomet Central	359	388	409	430	453	477
Longisa	294	317	334	352	371	391
Sigor	210	227	239	252	265	279
Siongiroi	246	265	280	295	310	326
Mutarakwa	191	207	218	229	242	256
Ndanai	232	251	264	278	293	299

Source: District Statistics Office (2004)

The demand for housing within the urban centers is high, showing a steady increase of population within the centers. The rates range from between Kshs.500 – Kshs.1,500 per single room to Kshs.1,500 – Kshs.3,500 for two – roomed family units. The most important determining factors of rent especially within the Municipal Council are water and electricity availability and security. A large percentage of people occupying rented houses within the urban centres are government employees, businessmen and employees of other organizations.

Table 3.2 Land Tenure Systems and Area (Ha)

Tenure Type	Area (Ha)/Years					
	1960	1970	1980	1990	2000	2005
Leasehold	--	--	--	--		
Freehold	--	--	--	--		
Trust land	--	--	--	--	Nil	Nil
Gazetted Forest	--	--	--	5,200 Ha	5,000 Ha	5,000Ha
Ungazetted Forest	--	--	--	--	Nil	Nil
National Park	--	--	--	--	Nil	Nil
National Reserve	--	--	--	--	Nil	Nil
County Council	--	--	--	--	ASND	ASND
Other GoK Land	--	--	--	--	ASND	ASND
Wetlands	--	--	--	--	N/A	N/A
Lakes	--	--	--	--	None	None

N/A – Figures Not Available, ASND – Actual Size Not Determined

Source: Various Departmental Records

Table 3.3 Planned Urban Areas

Local Authority	Local Plans				Regional Plans			
	1980	1990	2000	2005	1980	1990	2000	2005

B.M.C.	--	Master Plan (Not Approved)	--	None
B.C.C.	--	None	--	None

B.M.C. – Bomet Municipal Council, B.C.C. – Bomet County Council

Source: Bomet Municipal Council Records

Table 3.4 Types of Shelter by Location

District	Urban			Rural			Remarks/Comments on Housing Materials For Roof, Walls and Floor
Bomet	P	T	TR	P	T	TR	

P – Permanent, T – Temporary, TR – Traditional (Thatched/Mud)

NB: Although the three classes of housing exist in the District, their Distribution has not been documented

Table 3.5 Percentage of Households with access to Water by Source/Season

Water (By Seasons)									
Piped		Boreholes		Wells		River		Others	
Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
4.8%	5.9%	1.4%	0.2%	8.9%	3.3%	27.8%	56.4%	45.1%	46.3%

Other Sources – Protected Springs (10.3%, 6.9%), Unprotected Springs (15.5%, 17.6%), Roof Catchment (19.3%, 0.3%), and Dams and Earth Pans (21.5%) for Wet and Dry Seasons respectively

Average Distance to the nearest portable water point = 4KM

Source: Baseline Survey of the Mara River Basin – Nairobi Rotary Club (2004)

Table 3.6 Percentage of Households with access to Sanitation Facilities

Sanitation				
Connected to Sewer		Pit Latrines		Flying Toilets
		%Without	%With	Others
0%		42	56.9	1%

Others = Septic Tanks (0.2%) and V.I.P. Latrines (0.8%)

Reasons for not having Pit Latrine: High Cost (60.1%) Does not see the need (30.4%), Soil Profile (2.9%),

Others (6.6%)

Source: Baseline Survey of the Mara River Basin – Nairobi Rotary Club (2004)

Table 3.7 Average Distance (KM) from Household to Services

Distance (KM)	Water (By Seasons)		Markets		Schools			Roads	
	Wet	Dry	Shops	Towns	Nur	Pry	Sec.	Dirt	Tarmac
Within Compound	17%	5%	--	--	--	--	--	--	--
< 1	44%	42%							
1 – 2	18%	29%							
3 – 4	4%	16%							
> 4	0.3%	3%							

Average Distance to nearest Health Center = 6KM (District Development Plan, 2002 – 2008)

ND: There are no records regarding distances covered to access other amenities besides water

Table 3.8 Number of People by Type of Shelter

Permanent			Semi Permanent			Slum			Traditional		
1990	2000	2005	1990	2000	2005	1990	2000	2005	1990	2000	2005
N/A			N/A			N/A			N/A		

N/A – Information Not Available

Table 3.9 Distribution of Households by Roofing Materials

Material	Iron Sheets	Tiles	Concrete	Asbestos	Grass	Makuti	Tins	Others
% Households	40.4	0.1	---	0.3	58.7	0.3	0.2	---

Source: Kenya 1999 Population and Housing Census (Analytical Report on Housing Conditions and Household Amenities – Vol. X)

Table 3.10 Distribution of Households by Wall Materials

Stone	Bricks	Mud/Wood	Mud/Cement	Wood Only	Iron Sheets	Grass	Tins	Others
1.9%	1.8%	87%	2.4%	5.9%	0.6%	0.3%	--	--

Source: Kenya 1999 Population and Housing Census (Analytical Report on Housing Conditions and Household Amenities – Vol. X)

Table 3.11 Distribution of Households by Floor Materials

Cement	Tiles	Wood	Earth	Others
10.2%	0.2%	0.5%	89.1%	0.1%

Source: Kenya 1999 Population and Housing Census (Analytical Report on Housing Conditions and Household Amenities – Vol. X)

Based on a ranking criteria developed during the 1999 Population and Housing Census, households in Bomet district are ranked from 1 to 5 (Table 3.12) based on housing quality. Thus, factors considered include roofing, wall, and floor materials, water sources and quality, human waste disposal methods, cooking fuel source and lighting.

Table 3.12 Distribution of Living Conditions in Bomet

Rank	1	2	3	4	5	6
% Households	0.4	3.1	14.7	71.3	10.5	0

Rank 1 = High Quality, Rank 2 = Good Quality, Rank 3 and 4 = Average Quality, Rank 5 and 6 = Poor Quality

Source: Kenya 1999 Population and Housing Census (Analytical Report on Housing Conditions and Household Amenities – Vol. X)

3.2 Human and Environmental Health

Malaria, respiratory infections, intestinal worms, diarrhea, scabies, eye infections and bilharzia are most prevalent in the district. Malaria affects about 26% of the population across the district. It is followed by respiratory infections (20%), intestinal worms (15%), diarrhea (13%), scabies (9%), eye infections (6%), and bilharzia (1%).

Improved human and environmental health is a function of several factors. Key among them are pollution and waste management, onsite sanitation in human settlements, radiation control, management of chemical pollutants of health significance, proper use of pesticides, monitoring and management of the effects of heavy metals and food safety.

3.2.1 Solid waste

Solid waste is categorized as trade, industrial, municipal, agricultural, institutional, domestic, and construction debris. Bomet Municipality and indeed the entire district are faced with solid waste related problems. Poor planning and coordination of environmental activities coupled with inadequate financial resources in the town and among the community are some of the drivers and pressures giving rise to the current state of continued accumulation of solid waste across the district.

It is estimated that the municipality will generate close to about 45 tonnes of waste per day in 2020. Currently, the Municipal Council collects about 2 tonnes of solid waste per day. This small amount of waste can be explained by the fact that most of the households within the Municipality are rural-based, and are able to manage their waste without having to rely on the Council. But it is important to design an efficient solid waste management system that ensures regular collection, separation, transportation, treatment, and disposal of this waste in a way that will be environmentally friendly and sustainable.

The greatest challenge in terms of solid waste management will come from the fast growing, unplanned shopping centres across the District. The main ones where the pressure is already being felt include, Mulot sunset, Longisa, Kipsorwet, Kapkwen, Siongiroi, Silibwet, Chebunyo, Sigor, Ndanai and Chebole.

It is prudent for the local authorities to expedite the process of planning these centres and enforce the plans with a view to arresting the growing problem of solid waste accumulation. The government should also act fast to address policy issues related to solid waste management, a good example being the policy issue of the production and use of plastic products in the country.

Plate 3.1 Poorly disposed off waste along a street in a residential area



Note also the waste water drain

3.2.2 Onsite Sanitation in Human Settlements

Current levels of access to improved sanitation in the country are 49% in rural areas and 65% in urban areas, giving a national average of 57%. In Bomet, 82% of the population has one form of sanitation or the other. 18% has no form of sanitation whatsoever.

Ordinary pit latrines built using local materials and skills are the commonest onsite sanitation facilities in the District at 80%. Ventilated improved pits (VIPs), are used by only 1.1% of the population, while 0.9% use septic tanks. The reasons given for not having any form of sanitation (as noted elsewhere) include high cost (60.1%), not seeing the need (30.4%), poor soil profile (2.9%) and other reasons (6.6%). The alternative methods used for waste disposal include, in the bush (15%), cat method (0.1%), neighbors latrine (2.5%) and in open drains/ditches (0.2%).

With regard to schools in the District, although the actual figures have not been determined, the number of schools with enough sanitary facilities to meet the recommended ratios of 25:1 for girls and 30:1 for boys is small.

3.2.3 Radiation

Radionuclides are commonly used in industries, hospitals, schools, road construction, oil exploration and research institutions. These are mainly sealed (shielded) sources and unsealed radionuclides. There is no isotope production, research reactors, nuclear power or nuclear fuel facilities in Kenya.

Radionuclides enter ecosystems by many pathways and become widely dispersed. Ionizing radiation has a negative impact on biota and both terrestrial and aquatic ecosystems. The main pathways of radiation exposure include external irradiation, plant

uptake from the soil, folia absorption, inhalation of suspended material and gaseous radionuclides, ingestion of plant, animal and microbial material, soil and water.

The radiation protection board (RPB) is mandated to carry out annual calibration tests on all x-ray equipment in the country. The board, established by the Radiation Protection Act (Cap 243), seeks to protect patients, radiation workers, the public and the environment from the harmful effects of ionizing radiation. Specific regulations on the management of radioactive wastes have also been prepared by the board and are awaiting gazette. Further, draft regulations for the safety of transport materials based on the international atomic energy agency regulations for the safe transport of radioactive materials, 2002 have also been prepared. These and other measures are meant to safeguard human and environmental health against the harmful effects of radionuclides.

As a district, Bomet is faced with some of the emerging pressures in this sector. This includes concerns regarding the radiation from mobile phones, computers, transmission masts, magnetic resonance imaging and ultrasound. The District Environment Committee should therefore familiarize itself with these challenges so as to be able to play its role of promoting a clean and healthy environment in the District effectively.

3.2.4 Chemical Pollutants of Health Significance

- (a) *Nitrates and Nitrites*: Nitrate levels in groundwater have increased since the 1960s due to many factors. The factors include changing land uses, increased use of nitrogenous fertilizers and recycling of sewage effluent. Limit for nitrate in drinking water is based on its effect on methaemo globinaemia blood disease in bottle-fed infants. There is also concern about possible effects on the incidence of stomach cancer. World Health Organization (WHO) desired limits are 50 mg/l (as NO₃) but up to 100 mg/l is acceptable if medical authorities are warned about the possible danger.

Table 3.13 Nitrate, Nitrite, Chloride and Fluoride levels in River Nyangores

Month/Year	Station	Levels			
		Nitrate (MgN/ l)	Nitrite (MgN/ l)	Chlorid e (MgC/l)	Fluori de (MgF/ l)
December 2000	Nyangores River -Upstream Tenwek Hospital	----	0.01	1	1.3
	Nyangores River -Downstream Tenwek Hospital	----	1.8	25	0.38
September 2003	Tenwek (0 KM)	1.02	<0.01	<1	0.23
	Bomet (10 KM)	0.70	<0.01	1	0.22
	Olbutyo (20 KM)	0.32	<0.01	3	0.21
	Kaboson (60 KM)	0.28	<0.01	3	0.20
November 2003	Bomet Water Supply (BWS) (0 KM)	0.5	0.01	4	0.3
	Tenwek (10 KM Upstream of BWS)	1.2	0.01	4	0.3
	10 KM Upstream of Tenwek	0.1	0.01	4	0.4
	Ilyo Village (Upstream Tenwek)	0.1	0.01	4	0.4

Source: Ministry of Water and Irrigation Office (2003)

- (b) *Polychlorinated biphenyls* (PCBs): PCBs are chemicals, used as coolants for electrical transformers. They are carcinogens and mutagenic and therefore pose serious health concerns. Vandalism of transformers for these coolants, which are illegally used to treat wounds, exposes the users to chances of developing cancer.

Due to the low coverage of electric power lines in the District, cases of vandalism of transformers are almost non-existent. But it is important to monitor the use of these chemicals, which may originate outside the District, and educate the public about their being in use by unscrupulous people and their harmful effects.

- (c) *Dioxins*: The use of chlorine in the paper making industry introduces dioxins and furans into the environment. These compounds are known to be endocrine disruptors in addition to other adverse properties. This may not be an important concern for the District at the moment, but monitoring and public awareness creation is important.
- (d) *Nicotine*: The tobacco industry promotes cigarette smoking, an activity that is associated with increasing incidents of lung cancer. Advertisements depicting smoking as a trendy way of life are luring the youth. But even of greater concern is the increasing number of passive smokers who are exposed to equally grave dangers as the active smokers.

3.2.5 Pesticides

Pesticides formulated to control notorious pests that attack crops, animals and people may also cause water pollution. Equally, substances known to be carcinogenic, teratogenic and mutagenic are not easily biodegradable. These are being controlled locally through the scrutiny by the Pest Control Products Board (PCPB).

3.2.6 Dichlorodiphenyl trichloroethane (DDT)

DDT is probably carcinogenic to man with effects on the nervous system. It travels long distances from the source of use, release of emission. It degrades in three years in temperate land and three months in tropical lands. Exposure to DDE (a metabolite of DDT) has been linked to precocious puberty and shortened lactation period in breastfeeding mothers.

DDT was introduced in Kenya in 1956 for use in agriculture and public health. However, in 1986 its use in agriculture was banned. Currently, its use is restricted to public health for the control of disease vectors. Concern over its use arose over its toxicity and persistence in the environment. DDT has not been imported in the country since 1989. However, there may be cases of stocks getting into the country illegally.

Kenya is a signatory to the Stockholm convention, which seeks the elimination or restriction of production and use of all internationally produced Persistent Organic Pollutants (POPs) including DDT. Use of less persistent/biodegradable pesticides is recommended for public health purposes only.

DDT and other organochlorines are highly bio-accumulative in the fatty tissues with consequent magnification of environmental concentrations through the food chain. In addition, they have been found in significant quantities in humans, commonly in breast milk. When re-introducing DDT, the factors to be considered include, the possible violation of the Multilateral Environmental Agreements to which Kenya is a signatory and human safety. Additionally, an important concern is the quality of fish and

horticultural produce since detection of DDT traces may exclude such produce from the international market.

3.2.7 Heavy Metals

a) Mercury

Mercury occurs in the environment from natural emissions and from industrial activities such as artisanal mining, metal smelting, cement making, mercury paints, electrodes for certain electrolytic processes, thermometer manufacture, in dental amalgam, in laboratory processes and in cosmetics. There is no policy and proper regulations for mercury in Kenya.

Poverty among the small scale miners, ignorance on the risks and the ways of handling mercury compounds during gold processing, dumping of cheap mercury-containing goods and poor technology are some of the pressures related to the unhealthy use of mercury. Use of mercury has resulted in the pollution of the atmosphere, land and water resources and bioaccumulation in fish. Methyl mercury is the most toxic form of mercury that causes neurological disorders such as Minamata disease, resulting in impaired walking and talking.

As a response, Kenya has ratified the Basel Convention. In addition, the country has made specifications on how mercury is used in industry, for example, dentistry alloys for amalgams mercury not to exceed 50%. Furthermore, mercury use in both cosmetics and paints is banned.

The District Environment Committee will support the national efforts of public awareness raising with the aim of empowering the population to discriminate against products that may contain unhealthy levels of mercury.

b) Lead

Lead is a substance whose toxicity to human health has been established. It is associated with memory loss, reduced IQ and kidney damage. The major sources of lead into the environment include petroleum fuels and car batteries. Lead is released during the recycling process posing health hazards to workers and the environment. WHO standards give an upper limit of lead in drinking water of 100 ug/l.

There are no records of any analysis done in the District to determine levels of lead pollution. But going by the fact that the number of vehicles using leaded fuel has been rising over the years, it would be safe to assume that the level of exposure, especially in the urban areas has also been rising. Presently, there is no petrol station supplying unleaded petrol, even after the expiry of the deadline of 31st December 2005, for the changeover to unleaded petrol.

3.2.8 Food safety

At all stages of the food chain (from the farm to the consumer), the main issues of concern in food safety include basic food microbiology, food borne pathogens, and diseases (Table 3.14). Use of contaminated equipment, infected food handlers, contaminated food ingredients, unhygienic food preparation and poor quality control are other issues of concern.

Table 3.14 Food related diseases for the period 2003 – 2005

Year	Disease	Months/No. of cases recorded											
		Jan.	Feb.	Mar.	Apr.	May	Jun	Jul	Aug.	Sept.	Oct.	Nov.	Dec.
2003	Typhoid	27	0	71	23	0	0	52	0	0	58		
	Diarrhea	748	1,119	2,191	707	951	814	181	586	709	688		
2004	Typhoid												
	Diarrhea												
2005	Typhoid												
	Diarrhea												

Food borne diseases pose a serious threat to public health in Kenya as evidenced by frequent outbreaks of cholera, typhoid and other diarrheal diseases in the country. Besides microbial food safety, pesticide residues, veterinary drugs, lead, zinc, and mercury have been found in foods. Food hawking (especially maize and milk) in Bomet has become a common feature, thus posing danger to the health of the public.

Factors that contribute to poor food safety include poverty, inadequate enforcement of existing laws and regulations, inappropriate storage facilities, poor hygiene practices and use of contaminated food.

The country has moved to address the issue of food safety in various ways. Sanitary and phytosanitary certification of foods is one effective response in addition to the application of existing regulations. Other intervention measures include the Kenya Health Policy Framework of 1994, the Health Strategic Plan 1999-2004, Food, Drugs and Chemical Substances Act (Cap 254), the Meat Control Act (Cap 356), and the Dairy Act (Cap 336). At the District level, the Public health department remains alert to the dangers posed by urbanization, increasing population and lack of proper sanitation facilities.

The prevalence of respiratory diseases may reflect poor living conditions with inadequate ventilation. But in Bomet, the concentration of the cases in the highland parts of the District indicates a strong correlation between upper respiratory tract infections and the cold weather. The high prevalence of intestinal worms, and diarrhea in the district could be linked to poor sanitary facilities and low food hygiene among the community. When water is scarce, it becomes difficult to maintain clean hands, food and the general household environment that are essential in controlling these diseases. Within the

Municipality, the prevalence can be easily linked to lack of a water and sewerage system and poor solid and effluent waste disposal system.

3.3 Pollution and Waste Generated from Human Settlement

Major pollution sources in the district include soil erosion, domestic, municipal sources, and hospitals and other public institutions. The main types of waste are solid and effluent waste from the municipal, residual farm chemicals from farms and household waste. Air and noise pollution are minimal.

The Municipal Council of Bomet has an open dumping site for solid waste and an open effluent disposal pit for effluent municipal waste. It also occasionally provides an exhauster at a cost to exhaust pit latrines within the municipality.

Within the Municipality and local shopping centres across the District, the main types of wastes identified include, effluent waste, household wastes, commercial refuse mainly from markets and shops, and institutional refuse. These need to be managed with the overall aim of attaining an improved quality of living conditions in the District. It is estimated that by the year 2010, the Municipality will generate about 4 tonnes of solid waste per day. Several options for managing these wastes have been proposed. But the one that appears to be most feasible is a decentralized system of storage, collection, transport and disposal. This involves all centers within the municipality being empowered to run independent systems with a disposal site nearby to maximize on equipment and personnel productivity and efficiency.

3.3.1 Proposed interventions

(i) Installation of a Water and Sewerage Handling Infrastructure

The Municipal Council is in the process of developing a Water and Sewerage System to provide a comprehensive Effluent waste management program. This is particularly important to the Municipal because of the high water table that prevails within its jurisdiction. During the rainy season, most Pit Latrines overflow due to this factor, hence causing major health risks across the Municipal and its environs.

A sanitation and sewerage study has already been carried out and a report prepared with the assistance of the World Wide Fund for Nature (WWF). The Municipal is currently sourcing for funds to carry out a comprehensive feasibility study estimated to cost up to two million shillings. Based on figures obtained for the installation of a sewerage system in other municipalities, it is expected to cost the Municipal about two hundred million shillings to realize the first phase of this objective.

(ii) Public Mobilization and Enforcement of Standards and Guidelines

It is imperative to enhance and sustain coordinated community mobilization to promote improved human and environmental health and build capacity at the grassroots for surveillance and enforcement of environmental quality standards and guidelines.

3.4 Communication Networks

The District has 123 KM of road, which is paved. This is mainly on the newly constructed Narok – Kaplong Road. Another 593 KM is under gravel and 354 KM are earth roads (table 3.17). The District has only one airstrip.

Table 3.15 Classification of road network by length and surface type

Class of Road	Surface Type			Total
	Bitumen	Gravel	Earth	
International trunk Road	0.0	0.0	0.0	0.0

(A)				
National trunk Road (B)	62.0	0.0	0.0	62.0
Primary Roads (C)	48.0	86.6	0.0	134.6
Secondary Roads (D)	13.0	151.8	512.4	216.2
Minor Roads (E)	0.0	136.8	191.6	328.4
Rural Access Roads (R)	0.0	198	16	214
Tea Roads (classified)	0.0	20	25.8	45.8
	0.0	0	69.2	69.2
TOTAL	123	593.2	354	1070.2

Source: - District Development Plan (1997-2000)

Both mobile telephone networks of Safaricom and Celtel cover a few parts of the District. About 250 households and 460 private and public organizations within the District have landline telephone connections (Table 3.16). The local post office provides the only Internet linkage in the District. It also has 11 post/sub-post offices spread across the District. 73% of the households have own radios.

Table 3.16 Status of Communication Services

No. of Households with Landline Telephones	250
No. of Private/Public Organizations with Landline Telephones	460
Mobile Telephone Service Coverage	2 Service providers (Safaricom and Celtel)
No. of post/sub-post offices	11
No. of telephone booths	30
No. of Households without radios	19,000
No. of cyber cafes	1 (Post Office)
Railway line	None
No. of ports including inland container depots	Nil
No. of airports and airstrips	1 airstrip
No. of water ways	Nil
No. of public service vehicles	Not determined but it has risen sharply since 2002

Source: State of Environment (2004) report

3.4.1 Priority Issues and Interventions

(i) Vehicular Pollution

Vehicular pollution is becoming a major concern owing to the increased number of vehicles plying the Narok – Kaplong route which was completed in 2005. The main vehicular pollutants are lead and by-products of fuel combustion, which include both visible (smoke) and non-visible emissions. The main emissions are hydrocarbons, carbon monoxide, oxides of nitrogen and particulate matter. The particulate matter consists of soot due to incomplete combustion, oxides of sulphur and phosphorous, soluble organic fractions arising from the thermo cracking of fuels and lubricants and lead oxide from combustion of leaded gasoline. So far, no petrol station in the District has moved to the sale of unleaded gasoline. It is therefore important to continue sensitizing the public on the dangers caused by vehicular pollution and ways of limiting exposure.

(ii) Mobile Phones Sector

Telecommunication is important in facilitating the integration of the domestic economy and contributes to promotion of trade and economic development. The number of people with access to telephone services has been rising steadily over the years in the

country as well as in the District. Of particular concern is the rapid growth of the mobile phone industry. The number of scratch cards used is forever increasing. There is need to manage disposal of the cards as well as the safe disposal of rechargeable batteries. This is particularly so, given the fact that the demand for mobile phones is expected to increase in the coming years. The siting of signal boosters (masts) should also be managed with a view to limiting exposure to radiation.

(iii) Information and Communication Technology (ICT)

Information and Communication Technologies is one of the fastest growing and dynamic sub-sectors in Kenya today. Significant progress has been made in the expansion and modernization of the country's information sector. Although the disparity in the distribution of communications facilities between the rural and urban areas continues to widen, rural areas are being continuously targeted as ICT providers strive to open up new frontiers of business. This means that the relevant capacity needs to be built at the District level to deal with emerging human and environmental challenges posed by the rapid growth of ICT.

3.5 Socio-Economic Services and Infrastructure

3.5.1 Water

The District has several permanent rivers. These are, Amalo River, which flows along the southern boundary of the District, Nyangores River, which flows from Southwestern Mau Forest, and proceeds southwards through Tenwek, Bomet town and joins Amalo River to form Mara River, and Kipsonoi River, which flows along the District's boundary with Buret. It eventually flows into Lake Victoria. Kiptiget/Teбенik River flows along the northern boundary of the District. Sisei and Kagawet Rivers are seasonal. There is no available record of the streams (either seasonal or permanent) in the district.

There are several protected springs. They include, Kiproroget, Uswet, and Kimolwet. Masaibe and Menet springs are in the process of being protected. There are also rehabilitated Dams and water pans. These are, Kapsaiyele, Ngocho, Birirbei, Cheboin, Nyambugo, and Kapcheruse. The ones in the process of being de-silted include, Oldarakwa, Kugunoi, and Kagawet.

According to a baseline survey of the Mara River Basin, on average, households in Bomet get their water at a distance of 4KM. During the wet season, 70.8% of households spend less than one hour to get water, as compared to 47.9% during the dry season. 1.1% of households spend three to four hours to get water during the wet season compared to 7.4% during the dry season. Only a small proportion of households (0.3%) spend more than five hours during the dry season to get water.

3.5.2 Energy

The primary source of energy in the District is firewood, and charcoal. Combined, they provide energy to 75% of the population. Kerosene, gas, and biogas, provide energy to 23% of the population. Solar, and electricity, provide energy to less than 3% of the population in the District. Given the tendency of overlap, firewood and charcoal, could be a source of energy to an even bigger percentage of the population. Wind power has not been exploited as a source of energy in the District. At the same time the potential for hydro electric power generation and geothermal sources of power has not been explored.

(

a) Energy Efficient Technologies

Energy-efficient technologies have been developed over the years by such organizations such as KAWI, and Bellerive Foundation, and promoted mainly by JICA and other organizations. The Nairobi Rotary Club's baseline survey for the Mara River Basin indicates that the level of awareness and adoption of these technologies in the District is very low. Close to 45% of the population is not aware of these technologies. About 50% of the population is aware, but does not see any immediate need to use them. Another 4% feel it is important to use such technologies, but have yet to access them. Only 1% of the population in the district has access to fuel – efficient technologies such as wood saving jikos.

(b) Commercialization of Energy Sources

Commercialization of Energy sources such as wood fuel is gaining popularity in the District due to the market provided by the Tea factories in and around the District. The building of a second Tea factory, (Tirgaga Tea Factory), in the District is expected to spur further growth in this sector. The species of choice is the fast maturing Eucalyptus species. Kenya Tea Development Authority (KTDA) is promoting the planting of these trees by the farmers on a contractual basis.

(c) Alternative Sources of Energy

There are several factors determining the type of energy used. Major among them are, accessibility, and affordability. Given the high poverty levels in the District, wood fuel, which is more accessible and affordable, will continue to attract more demand, and less supply in the long run. The present spatial distribution of electricity needs to be expanded so as to improve on accessibility, in the hope that its affordability will improve in the near future to fill the widening gap between demand and supply of wood fuel. Other sources of energy such as wind, whose potential has not been exploited, should be promoted. Efforts towards sustainable energy use should also be intensified.

As noted earlier, the potential for wind, hydro, and geothermal sources of energy has not been explored. However, Tenwek Mission Hospital has shown the way in the area of hydro – power generation. It currently produces 320KW, which is used to run the Hospital. The main constraint in alternative energy exploitation is of course the initial cost of installation, which is beyond the reach of most individuals.

(d) Threats to Energy Sources

The most serious and immediate threat to the main energy source – wood fuel, is the sharp rise in the demand for forest products, without a corresponding increase in supply. This has led to serious deforestation across the District, and even neighbouring Districts.

Gender imbalance on issues of access, ownership, and management of energy sources, is also a threat that is real. Women are the hardest hit by reduced availability of wood fuel. But in most, if not all cases, they do not own the sources of wood fuel. This means that they cannot exercise direct control on the use, and conservation of these sources.

Efforts in place to mitigate these energy threats include, control of dealing in forest products from the district, increased sensitization on the need to enhance reforestation efforts, and addressing gender imbalances through education, and economic empowerment of women.

(e) Energy Based Pollution and Waste

The only source of Energy based pollution in the District that may be of importance is Kapkoros Tea Factory. There is minimal air pollution due to the use of furnace oil for steam generation by the Factory. It also produces low levels of sulfur dioxide due to the high levels of sulfur, which is found in heavy diesel, used in the Factory. The level of household energy based pollution and waste in the District has not been quantified.

3.5.3 Sanitation

Only about 3% of the households in the District have access to piped water (Table 3.17). Two per cent have access to portable water. The number of households with roofed catchment stands at 750 out of a total of 70,769 households. This is just about 1% of all the households in the District.

The District has 3 (three) permanent rivers, 1,040 wells, 30 protected springs, 2 Boreholes, 60 Dams/Water pans, and 200 ponds. The number of V.I.P. Latrines is 200. The average distance to the nearest portable water point is 4KM. There are no markets or urban centres with sewerage facilities in Bomet (Table 3.17).

Table 3.17 Percentage of Households with access to Sanitation Facilities

Sanitation					
Connected to Sewer	WC	Pit Latrines		Flying Toilets	Others
		%Without	%With		
0%		42	56.9	N/A	1%

Others = Septic Tanks (0.2%) and V.I.P. Latrines (0.8%)

Reasons for not having Pit Latrine: High Cost (60.1%), Does not see the need (30.4%), Soil Profile (2.9%),

Others (6.6%)

Source: Baseline Survey of the Mara River Basin – Nairobi Rotary Club (2004)

Table 3.17: Percentage of Households with access to Water by Source per Season

Piped		Boreholes		Wells		River		Others	
Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
4.8%	5.9%	1.4%	0.2%	8.9%	3.3%	27.8%	56.4%	45.1%	46.3%

Source: Baseline Survey of the Mara River Basin – Nairobi Rotary Club (2004)

Other Sources – Protected Springs (10.3%, 6.9%), Unprotected Springs (15.5%, 17.6%), Roof Catchment (19.3%, 0.3%), and Dams and Earth Pans (21.5%) for Wet and Dry Seasons respectively

Average Distance to the nearest portable water point = 4KM

3.5.4 Health Facilities

Table 3.20 Health facilities, Doctor to Patient Ratio, and Access to health facilities

Facilities	Hospitals	Health Centers	Dispensaries	Clinics	Nursing Home
No.	3	11	32	15	1
Doctor to Patient Ratio = 1:37,000			Average distance to the nearest health center = 6KM		
Households with access to health centers = 80%					

Source: District Medical Health Office, Longisa District Hospital (2004)

Box I: Future Outlook on Population Dynamics, Settlements and Poverty**Population Dynamics**

In order to consolidate the gains realized in population and environment programs, more effort should be directed to promoting awareness on interrelationships between population, environmental concerns and development planning

The imbalance between population and environment can be dealt with using a dual approach of a population dimension coupled with one that deals with environment and development issues. More effort should be put to ensure effective implementation of monitoring and evaluation of projects and their sustainability

Human Settlements

The present condition of human settlement demands a pragmatic strategy for implementing existing legal instruments and policy initiatives, especially the Physical Planning Act (Cap 286), Local Government Act (Cap 265), the Water Act, the Roads Act, and the Regional and Local Physical Development Plans

Poverty

The poor rely heavily on natural resources for their livelihood. There is need for building on existing initiatives and strengthening ongoing processes that take into consideration participatory planning and implementation of programs and projects that integrate environmental concerns into development planning and decision-making, while at the same time enhancing sustainability

Actions which are directly relevant to the environment and which are imperative if the District is to reduce poverty are:

Reduction and halting of activities that leads to land degradation;

Conservation and sustainable management of biodiversity;

Reduction of the high rates of deforestation

- Mitigation of the adverse impacts of climatic change and other atmospheric conditions
- Promotion of environmentally sound management and utilization of chemical products
- Improvement of accessibility to quality water and protection of water sources from pollution
- Improvement of living conditions in the urban areas

Source: State of Environment (2003) Report

3.5.5 Education Facilities**Table 3.21 Education Facilities (2004)**

Table 6.21 Education Facilities (2007)

Pre-Primary Schools					
Number = 400	Total Enrolment rates		Total Drop-out rates		No. Of Teachers = 450
	Boys = 36%	Girls = 35%	Boys = 20%	Girls = 23%	Teacher: Pupil ratio = 1:30
Average Years of School Attendance = 5 Years					
Primary Schools					
Number = 320	Total Enrolment rates		Average Years of School Attendance		
	Boys = 52%	Girls = 48%	Boys = 7 Years	Girls = 6 Years	
Number of Teachers = 2,700			Teacher: Pupil ratio = 1:39		
Secondary Schools					
Number = 67	Total Enrolment rates		Total Drop-out rates		Number of Teachers = 500
	Boys = 55%	Girls = 45%	Boys = 15%	Girls = 19%	Teacher: Pupil ratio = 1:20
	Average Years of School Attendance				
	Boys = 4 Years		Girls = 3 Years		
Tertiary Institutions					
Number = 7	Main Types of Institutions are; Youth Polytechnics and School of Nursing at Tenwek Mission Hospital				
Adult Literacy					

Number of Literacy Classes = 61	Total Enrolment rates		Total Drop-out rates	
	Male = 2,800	Female = 12,000	Male = 42.3%	Female = 42.8%
	Literacy Levels			
	Male = 28%	Female = 25%		

Source: District Education Office (2004)

CHAPTER FOUR

4.0 SOILS AND LAND USE

This Chapter provides information on the types, extent, status, and trends of soils and land use. Land is the basic natural resource. It forms the basis for the country's socio-economic development. It supports agriculture, livestock, forests and wildlife.

With increasing population, poverty levels and demand for the resources, instances of over-exploitation and degradation of the natural resources are now common across the country. This chapter therefore seeks to outline the major goods and services derived from soils/land in the District, and establish their utilization patterns. The chapter will also seek to establish uses of soils/land that cause or are likely to lead to resource degradation and propose mitigation measures and monitoring plans.

The topography of the Bomet District exhibits a general undulating to rolling topography in the upper zones in the north and north eastern parts that give way to flatter terrain in the south. The soil in the north/northeastern parts range from high to moderately fertile. Those in the southern tip range from low to very low in fertility. Those in the central part of the District and the south western tip range from moderately/high to variable in their fertility.

CHAPTER FIVE

5.0 AGRICULTURE, LIVESTOCK AND FISHERIES

Agriculture and Livestock are the main sources of livelihoods for rural populations. The three broad agricultural production systems are crop cultivation, livestock rearing, and fisheries. Each of the production system has the potential to significantly affect human and environmental health. This chapter seeks to identify specific activities under each system, status and trends, institutional arrangements, key environmental issues and interventions.

5.1 Agriculture

There is no data on types of farming systems, extent or percentage distribution in the district. However, estimations obtained from various District Agriculture records are presented (Table 5.1).

Table 5.1: Types and status of Farming Systems

Type of Farming System	Extent (Ha)	Distribution (% Area)	Location	Agricultural Products	Status (Kg/Ha)	Potential Production (Kg/Ha)	Proposed Interventions
Subsistence	100,000	69	District wide	Table 5.0	Table 5.0	N/A	
Commercial	3,500	2.4	Mainly Bomet Central Division	Tea, Coffee, Fruits and Vegetables	Table 5.0	N/A	

Source: District Agriculture Office (2004)

Where: N/A – Figures not available

5.1.1 Types of Farming Systems and Extent in the District

The main farming practices/systems in the District are determined by the nature of farm labour that a farmer has at his disposal. This is in turn determined by financial resources available to the farmer, motivation behind the farming (either for commercial or subsistence), and the topography of the farm.

According to the Annual District Agricultural Report (2004), 21% of farmers in the District use Tractors as a source of power, 30% use family/hand labor while 50% use draught power, mainly oxen. 50% Of the farmers in the District (mainly concentrated in the lower, more drier zones) use organic fertilizers (manure) on their farms. The other 50% (mainly concentrated in the upper, wetter, Tea growing areas) use inorganic fertilizers on their farms.

The percentage area coverage of the various crops grown in the District (Table 5.2) indicates Maize, Beans, Tea, Irish Potatoes, and Finger Millet are the most important crops in the District in terms of area coverage.

Table 5.2 Types of crops, Acreage, % area coverage, Yield and Production Levels

No.	Crop	Acreage (Ha)	% Area	Yield (Tones)	Production Tones/Ha
1.	Maize	28,759	19.8	56,942	2.0
2.	Beans	6,658	4.6	3,329	0.5
3.	Finger Millet	580	0.4	174	0.3
4.	Sorghum	145	0.1	66	0.5
5.	Wheat	2	*	3.6	1.8
6.	Irish Potatoes	1,118	0.8	13,416	12
7.	Sweet Potatoes	404	0.3	404,024	1000
8.	Soya Beans	8	*	4	0.5
9.	Bananas	186	0.1	1,860	10
10.	Pyrethrum	N/A	N/A	N/A	N/A
11.	Tea	3,108	2.1	N/A	N/A
12.	Coffee	165	0.1	N/A	N/A
13.	Cassava	3	*	4	1.3
14.	Cabbages	299	0.2	2,994	10
15.	Kales	265	0.1	2,955	11.2
16.	Field Peas	5	*	7.5	1.5
17.	Tomatoes	145	0.1	1,308	9.0
18.	Pigeon Peas	2	*	1.0	0.5
19.	Green grams	1	*	2	2.0
20.	Cow peas	2	*	2	1.0
21.	Groundnuts	2	*	1.0	0.5
22.	Chicken Peas	40	*	20	0.5
23.	Tobacco				

Source: District Agriculture Office (2004)

Note:

N/A – Figures not available, * - % area covered is negligible (< 0.1%)

NB - Other minor crops are pineapples, Garlic, Spinach, Mangoes, Local vegetables, Avocadoes, Garden peas, Pumpkins, Paw paws, Passion fruits, Onions, Macadamia and Citrus fruits.

5.1.2 Crop Production Patterns

The cropping patterns in the District are closely intertwined with the rainfall patterns. During the long season, (November – May) almost 100% of the farm families go into cropping as compared to 50% - 60% of farm families who go into cropping during the short season (June – October).

The community's feeding habits are heavily skewed towards a higher intake of carbohydrates in the form of Maize and its products. Ugali, Porridge, Milk and local vegetables are the main diet components for most households in the District. Because of this, the bulk of annual farm yields and percentage area coverage is taken by Maize at 19.8%.

5.1.3 Status and Trends of Agricultural Development

Agriculture is the most important form of livelihood for a large proportion of the population of Bomet. There are three major agricultural categories, namely Crop Cultivation, Livestock and Fisheries production. Agricultural activities have varied impacts on people and the environment. The factors with potential to significantly affect

human and environmental health and safety include; inappropriate agricultural practices, agro-chemicals, biotechnology and inability to control introduced alien species.

The continued growth in demand for food items due to population increase and accessibility to more markets is expected to drive the demand for more cultivated land and more livestock products. This will of course have an effect on the environment especially in the area of increased use of agro-chemicals, increased encroachment of fragile ecosystems, and increased soil erosion.

5.1.4 Regulatory and Management Arrangements

The Ministries of Agriculture and Livestock and Fisheries Development are responsible for regulating Agriculture and Livestock related issues. Further, the District Environment Committee will exercise an oversight role to mitigate the impacts of Agricultural Activities on human and environmental well being.

5.1.5 Key Environmental Issues

(a) Soil Erosion

Soil erosion is the single most important problem especially as a result of increasing cultivation on steep slopes. Other areas prone to erosion include cattle tracks, road reserves, and gullies. This has increasingly led to reduced soil fertility and a higher incidence of bare hills in the District.

(b) Agro-chemicals and Fertilizers

The other notable environmental issue is the use of Agrochemicals and Fertilizers. The most commonly used chemicals in the District are herbicides, insecticides, fungicides and organic fertilizers. Major fertilizers used are Super ammonium phosphates,

Di-ammonium phosphate (20:20:0 and 17:17:0) – mainly during the maize planting season of January – February, Calcium ammonium nitrate and Urea for top-dressing in maize cultivation. Fungicides and herbicides use is commonly concentrated in the upper, wetter/cooler, Tea-growing areas. The average level of use of fertilizers in the District is low due to the economics and low levels of awareness with regard to the optimum fertilizer levels required for various types of soils.

Most people in the District do not use safe chemical handling techniques. They handle Fertilizers and other chemicals without any proper protection clothing. The chemicals and application equipment (sprayers) are also not stored safely in most cases. It's not uncommon to find chemicals and application equipment stored in Bedrooms.

Empty chemical containers are also poorly disposed off, usually within homesteads. This of course causes major human and environmental health risks, whose impact would be important to document and address.

5.1.6 Proposed and Ongoing Interventions

The Ministry of Agriculture is spearheading the soil conservation efforts in the District. Some of the measures being promoted include, Terracing, putting up of artificial water ways and drains, Agro – forestry, Biological soil and water conservation, tree planting on hilltops, pegging of river banks, conservation of water catchment areas/spring protection, and runoff water harvesting and management (construction of water holes and pans).

The Ministry is also promoting the use of alternative/energy saving technologies through its Home Economics Staff in the District. The SoE Reporting Process (2004) identified and proposed seven interventions that are likely to play a significant role in addressing key environmental issues in the District in the Agricultural sub-sector. These are:

- Encouraging the protection of wetlands by educating farmers on the sustainable Agricultural ways of wetlands' utilization, for example planting of wetland friendly crops such as arrowroots
- Enforcing existing Agricultural legislation to check on encroachment of Riverbanks
- Intensifying soil conservation efforts through farmers' education on proper Agricultural practices, and encouraging the conservation of erosion hotspots such as hilltops.
- Educating farmers on safe use, storage, and disposal of Agro-chemicals.
- Encouraging the Farming Community to adopt organic farming.
- Establishing mechanisms of tracking the use of obsolete, and/or environmentally unfriendly chemicals.
- Encouraging the community to diversify on crops and livestock, especially by adopting the emerging livestock industries.

5.1.7 Pollution and Waste Management

The main pollution sources from agricultural activities in the District are soil erosion and residual fertilizers and other farm chemicals. The residual chemicals from the farms and other agro-industries are eventually washed down into streams and rivers. Soil erosion on farms, either due to water or wind, leads to water pollution and siltation of the dams and water pans. Air pollution as a result of dust blown into the air from exposed/bare farms and other open spaces is also common. This wind and water erosion could be greatly reduced through intensified reforestation efforts.

5.2 Livestock

The actual livestock numbers in the District cannot be ascertained since no animal census has been carried out in recent years. However, the Ministry of Livestock and Fisheries Development has done a fairly reliable extrapolation. Table 5.3 shows numbers of various classes of livestock per division.

Table 5.3 Livestock Numbers/Distribution by Divisions

Type Of Livestock		Division						
		Bome t Centr al	Longis a	Siongir oi	Ndanai	Sigor	Mutarak wa	Total
Dairy Cattle		6,800	8,700	18,500	6,800	1,750	9,900	52,450
Beef Cattle		28,500	26,500	18,500	10,300	24,700	17,000	137,700
Sheep (Crosses)		9,000	7,000	14,000	4,650	10,100	6,200	50,950
Wool Sheep		4,500	6,000	3,100	3,500	2,880	6,000	25,980
Meat Goats		7,600	5,330	11,500	6,310	11,970	1,000	43,710
Dairy Goats		80	22	919	20	105	0	1,146
Poultry	Local	43,000	59,800	75,000	45,000	55,000	41,000	318,000

	Exotic	2,950	800	1,350	300	0	900	6,300
Pigs		2	0	0	0	0	0	2
Donkeys		2,150	7,200	10,000	850	2,000	400	22,600
Rabbits		170	250	360	125	120	240	1,265
Log Hives		4,700	2,600	4,000	2,500	2,500	700	17,000
KTBHs		437	495	468	580	347	579	2,906
Langstroth		10	542	500	476	3	390	1,921

Source: District Livestock Production Office (2004)

KTBHs - Kenya Top Bar Hives

With regard to the Livestock sub-sector, key interventions identified and proposed through the SoE report (2004) are:

- Improving on infrastructure within the District, so as to improve on market accessibility and profitability in Agriculture.
- Encouraging the improvement of the Livestock genetic resource, and improve accessibility to targeted credit, with special considerations to Women.
- Encouraging fodder conservation and livestock feed production in the District.
- Addressing issues of insecurity in the District.
- Encouraging farmers to adopt proper stocking rates so as to maximize on productivity and reduce Environmental degradation.
- Improving on the distribution of livestock watering points to reduce the concentration of animals around a few watering points, which increases soil erosion.
- Encouraging farmers to adopt such Agricultural based technologies as the use of Biogas and other alternative/energy saving technologies.

5.3 Fisheries Resources

The main fish products in the District are, Fish itself, Fish Cakes, Omena dust (mainly used in the Animal Feeds Industry), and Fish Oil. Fish Cakes and Fish Oil are usually from outside the District.

There are generally two classes of fish stock. These are, Capture Species and Culture Species. The main Capture Species in the District are Tilapia, Catfish, *labeo victorinus*, and Barbus. The culture species are *tilapia niloticus*, *tilapia zillii*, African sharp-toothed catfish, and Trout.

Fishponds are currently concentrated towards the upper parts of the District that include, Bomet Central, parts of Longisa, and Mutarakwa. Currently, there are about 80 fish farmers in the District, owning 85 ponds of average size of about 67m² (Table 5.4). Though the number of farmers has been declining over the years, total production has increased to stand at 400kg in 2004. This reflects intensification and specialization of the few farmers who are targeting quality rather than quantity and improved profitability (Table 5.5).

Table 5.4 Fish Species, Number of Farmers and Ponds, Production and Average Pond Size

Main Fish Species	No. of Farmers	No. of Ponds	Production (KG)	Average Pond Size
Berbs, Clarias, <i>O. variables</i> , <i>O. niloticus</i> , <i>T. niloticus</i> , <i>T. zillii</i>	80	85	443	67M ²

Source: District Fisheries Office (2004)

Table 5.5 Types and Status of Fisheries Production Systems

Type of Production System	Location	Status	Challenges	Proposed Interventions
Earthen ponds	District wide	Operational	Poaching, stunted growth, inbreeding	Surveillance, polyculture, monosex culture, Nursery ponds in Bomet

Source: Ministry of Fisheries Bomet

The four main marketing channels for fish in the District are, on-farm to neighboring households mainly for cultured fish species, local market centers for both captured and cultured fish species, Municipal and County Council Markets and hotels, mainly for fish from outside the District.

There are several efforts being promoted by the Fisheries Department in the District. These include, stocking and re-stocking of resource bases such as Rivers, and Dams/Water Pans, enhancement of the productivity from the present Dams/Water Pans and Rivers, and use of effective and recommended fishing gears such as gill nets of 4 inches mesh size. Environmental conservation is also an important component of the Fisheries' Department extension programme. Emphasis is put on the use of organic feeds (which are environmentally friendly), preservation of endemic species and controlled introduction of new stocks, and soil conservation through reforestation and improved vegetation cover to check on Dam siltation.

There are only a few fishing methods that have been tried and are in use in the district. They are rod and line method, use of traditional traps, and use of gill nets in very few dams. Use of seine nets has also been used in a few pond cultures.

Some of the resource use conflicts noted in the District includes:

- Most of the dams were originally constructed for domestic purposes other than Fish farming. Fish farming is therefore not a priority in most of the stocked dams. It therefore competes for water with other domestic needs, which end up having an upper hand. Inadequate water amounts especially in the lower parts of the District, affects fish farming activities negatively. Other stocked Dams/Ponds are invaded during dry spells and used in watering animals and other domestic purposes.
- Aquaculture potential areas also compete with other economic activities such as brick making and crop cultivation.

Most of the roads in the District are earth roads dominated by heavy black cotton soils. They become impassable during rain seasons hence making accessibility to the fish producers or markets very difficult. There are no cold storage facilities or fish landing sites in the District.

There are four marketing channels which include:

- On farm/farm gate – for culture pond fish
- Local market centres – for capture and culture fish
- Municipal and county council markets – for capture fish from other districts
- Hotels

Components for environmental conservation in the programme include:

- Use of organic feeds
- Preservation of endemic species
- Controlled introduction of new fish species
- Soil conservation through reforestation and improved vegetation cover

Table 5.6 Priority issues and interventions

N o.	Priority issues/Challenges	Current interventions	Proposed interventions in the plan period (2006 – 2010)	Responsible Institutions	Remarks
	Extension package Quality seeds Marketing Lean staff	Increase mobility, Establish contact farmers, Demonstration ponds, Explore local markets,	Renovate stationed vehicle, Establish contact farmers, Establish demo farms Recruit extension staff	Fisheries Department	Fisheries resources in the district remain under- exploited though can support a semi- commercial fisheries

Source: Fisheries department, Bomet

CHAPTER SIX

6.0 WATER RESOURCES

Kenya is classified as a water deficit area yet water is vital for the sustenance of all life. Adequate quantity and quality of water is recognized as a basic requirement for economic development.

This chapter will outline key Water sources and Uses, Main catchments, Major drainage patterns, Status and trends of Water resources, Regulatory and management arrangements, key Environmental issues in the Management and Utilization of Water resources and Proposed interventions in the District.

Bomet District has three permanent rivers. These are, Amalo River, which flows along the southern boundary of the district, Nyangores River, flowing through Bomet town and joining Amalo River to form Mara River, and Kipsonoi River, which flows along the northern boundary of the district. Sisei and Kagawet Rivers are seasonal. There's no available record of the streams (either seasonal or permanent) in the District.

There are several protected springs. They include, Kiproroget, Uswet, and Kimolwet. Masaibei and Menet springs are in the process of being protected. There are also rehabilitated Dams and water pans. These are, Kapsaiyelel, Ngocho, Birirbei, Cheboin, Nyambugo, and Kapcheruse. The ones in the process of being de-silted include, Oldarakwa, Kugunoi, and Kagawet. The lower, drier divisions of Sigor and Siongiroi are heavily dependent on Dams/Water Pans for their water requirements.

6.1 Water Sources

The main water sources in the District are, piver, piped water, protected springs, unprotected springs, open wells, protected wells, roof catchment, dams and earth pans, and boreholes. Table 6.1 shows the distribution of households by source of water.

Table 6.1 Distribution of Households by Source of Water

River	Piped	Protected Springs	Unprotected Springs	Open Wells	Protected Wells	Roof Catchment	Dams & Earth Pans	Boreholes
56.4%	5.9%	6.9%	17.6%	2.2%	1.1%	0.3%	21.5%	0.2%

Source: Baseline Survey of the Mara River Basin (2004)

NB: The figures are for the dry season only. Some sources of water overlap for some households

6.2 Main Catchments

The main catchment for the three permanent rivers is the Mau Natural Forest Complex that lies administratively in Narok District. As elsewhere in this plan, the indiscriminate deforestation of the Mau Forest Complex is considered to be the main cause of wide river flow fluctuations in these three rivers.

6.3 Drainage

The main drainage area is the Lake Victoria Basin. The Mara River drainage basin, which lies within the Lake Victoria South drainage area, is the dominant drainage area in the District. It forms part of the wider Lake Victoria Basin.

6.4 Status and Trends of Water Resources

Although there is no reliable data available, most stakeholders in the water sector in the District have observed declining water flows in the three main rivers, drying up of some streams and wells and non-appearance of seasonal streams even in the rainy seasons. The indiscriminate deforestation of the Mau Forest Complex is considered to be the main cause of wide river flow fluctuations. The quality of water flowing in the rivers has also been adversely affected. Sediment loads are increasing, as are other forms of pollution. The sources of sediment are mainly cultivated agriculture and poor drainage resulting from structural works in the upper catchment areas (roads, tracks, and footpaths). Data on sediment load is scarce, however combined estimates for Amalo and Nyangores rivers vary between 113 and 432 tones/day (Ongwenyi 1979). Forest clearing in the upper, high potential agricultural areas, cultivation along the banks of rivers, monocultures, and lack of appropriate soil conservation measures and overgrazing has increased soil erosion in the District and subsequently the sediment load and nutrient runoff into the rivers.

Plate 6.1 Nyangores River



Note: Brown colour of the water due to massive soil erosion upstream

According to a baseline survey of the Mara River Basin (2004), 76% of households in Bomet have adequate water throughout the year, while 24% of households have inadequate water at one time or the other during the year. However, the quality of the water they access was not determined. Going by increasing incidences of water born diseases in the District and barring other circumstances, it would be easy to conclude that the quality of water has been declining over time. According to the same survey, only 36% of households in Bomet treat their water in some form or the other. The other 64% does not treat their water in any way.

6.5 Regulatory and Management Arrangements

The recent reforms in the water sector and the enactment of the Water Act 2002, has brought into effect various regulatory and management arrangements. Various institutions have also been created to oversee the sustainable management of water resources in the country. These institutions include the Water Resources Management Authority, Catchment Area Advisory Committees, Water Services Boards and Water Services Providers, Water Services Trust Fund, and the Water Appeals Board.

The transition from the previous centralized water regulatory and management arrangements to the envisaged structure is on going in the District. Already, an office for the Water Resources Management Authority District Coordinator has been opened. The greatest challenge will be in the building of capacity for local institutions to be able to adequately take up the responsibility of providing water services.

6.6 Main Water Uses

The main water uses in the District are domestic, livestock watering, agriculture, irrigation, and industrial in that order. There are no large-scale irrigation farms or many industries in the District, hence the amount of water that goes into these sectors is limited. The specific amounts for each sector have not been estimated.

6.7 Water Accessibility

Table 6.2 Water accessibility and resources

No. of households with access to piped water	2,200 (3.1%)
No. of households with access to portable water	1,500 (2.1%)
No. of permanent rivers	3
No. of wells	1,040
No. of protected springs	30
No. of boreholes	1
No. of Dams	59
No. of ponds	200
No. of households with roofed catchments	750 (1.1%)
Average distance to the nearest portable water point	4Km

Source: State of Environment (2004) Report

The baseline survey cited earlier also indicates that 11% of households access water within their compounds during the dry seasons, as compared to 37% during the wet seasons. 42% of households access water from less than 1Km during the dry seasons as compared to 44% during the wet seasons. The percentage households accessing water within 1 – 2Km during the dry and wet seasons is 29% and 18% respectively. Those that access water within 3 – 4Km during the dry and wet seasons account for 16% and 4% respectively. Only 0.3% and 3% of households have to walk for over 5Km to access water during the wet and dry seasons respectively.

Majority of households (70.8% and 47.9%) in Bomet spend less than one hour to get water during the wet and dry seasons, respectively. The rest, (7.4% and 1.1%) spend between 3 – 4 hours to get water during the dry and wet seasons, respectively.

The responsibility of drawing water, according to the Kipsigis customs, lies with women and children. Subsequently, the distances they walk, and the time taken to access water are important variables that determines the availability of these groups to participate in

other more productive activities. Carrying of heavy loads over long distances, besides being an arduous task, also exposes women to health hazards such as skeletal problems, leading to deformities and disabilities. It also requires large amounts of energy, which may compromise their nutritional status if adequate food supply is not available. But the community seems to be going around the problem by adopting alternative methods of water conveyance. Only 7.6% of households convey their water on foot and carrying water containers on their backs. 34.6% of households use oxen and/or donkeys, while 57.8% use other means.

Table 6.3 Sources and status of water resources

Source	Status		Usage	Management Systems	Challenges/Threats	Proposed Interventions
	Quantity	Quality				
River	56.4%	Requiring treatment	Domestic, Livestock watering Agriculture, and Industrial	Regulation by Ministry of Water and Irrigation	Cultivation along river banks and Pollution	Community mobilization and enforcement of existing laws
Piped	5.9%	Safe	-do-	-do-	Limited coverage	Expansion of the water supply system
Protected Springs	6.9%	Safe	Domestic, and Livestock Watering	Communal Management Systems	Few protected spring	Improvement of coverage
Unprotected Springs	17.6%	Requiring treatment	-do-	-do-	Exposed to pollution	Encourage protection by relevant stakeholders
Open Wells	2.2%	Requiring treatment	-do-	-do-	Exposed to pollution	Encourage protection by relevant stakeholders
Protected Wells	1.1%	Relatively Safe	-do-	Mainly Privately Owned	Limited coverage	Community mobilization
Roof Catchment	0.3%	Relatively Safe	-do-	Privately Owned	Limited coverage	Community mobilization
Dams/Earth Pans	21.5%	Requiring treatment	Domestic, Livestock watering, and Agriculture	Communal Management Systems, with the assistance of Ministry of Water	Exposed to pollution	Incorporate systems to limit pollution
Boreholes	0.2%	Safe	Domestic and Industrial	Privately Owned	Limited coverage	Improvement of coverage

Source: Various Departmental Records (2004)

6.8 Prioritization of Key Environmental Issues (Table 6.4)**Table 6.4 Priority issues and interventions**

N o.	Priority issues/Challen ges	Current Interventio ns	Proposed Interventions in the plan period (2006 – 2010)	Responsible Institutions	Remarks
1.	Water Pollution	Enforcemen t of relevant legislation	Enhanced surveillance and building of capacity at the grassroots to protect water sources	Water Resources Management Authority and all other relevant stakeholders	
2.	Reduced Water Quantities	Encouraging efficient water use and diversificatio n of sources	Improved regulation of abstraction, enhanced conservation of catchments, and exploitation of alternative sources of water	Water Resources Management Authority and all other relevant stakeholders	Riverbank protection, soil conservation and restoration of degraded water catchments is particularly important for Bomet District

CHAPTER SEVEN

7.0 FORESTRY AND WILDLIFE RESOURCES

7.1 Forestry

7.1.1 Forest Type and Area under Forests

Forests are ranked among the country's most important natural resources. They conserve water, and soils, regulate gaseous balance in the air, and serve as reservoirs of biological diversity.

Sustainable forest management is therefore an integral component of the overall National development. The overall goal of a sustainable forest management plan is to increase the quality of life of communities through employment creation and provision of raw forest products for both domestic and industrial use.

The District has only one gazetted forest, – Chepalungu Forest – that is managed by the District Forest Office. It has an estimated area of 5,000ha. It consists of exotic plantations and indigenous forest of various species on a relatively flat terrain in Siongiroi and Ndanai divisions. The forest is home to such animals as Monkeys, Antelopes and abundant bird life. The indigenous forest cover is estimated to cover an area of 4,700ha, while the rest is covered by an Exotic/Established plantation of mainly *cuppressus lusitanica* (Common Cypress), *pinus radiata*, and *eucalyptus saligna* among others (Table 7.1).

Table 7.1 Types and Status of Forests

Type	Extent (Ha)	% of Total	Status				Proposed Interventions
			Gazetted	Trus t land	Private	% Degradation	
Natural	4,700 Ha	3.24	Yes	Nil	Nil	N/A	Involvement of the community in conservation through formation of Forest Users Association
Exotic	300Ha	0.21	Yes	Nil	Nil	N/A	Encourage establishment of woodlots and Agro forestry

N/A – Figures not available

Source: District Forest Office (2004)

7.1.2 Status and Trends of Forest Resources

The gazetted Chepalungu forest is managed by the District Forest Office. A forester and forest guards are stationed at the forest to protect it from threats of logging, or any other uncontrolled exploitation. Due to a general increase in population in the district, the pressure to settle people in the forest has been increasing. Already, 134ha of the forest has been used to settle some people and put up amenities, though their settlement has not been formalized.

Like most other Districts in the country, Bomet's forest cover is very low. Although there has been no survey carried out to establish the exact forest cover in the District, the

overall national estimate of 1.7% or thereabout would apply in the District. The District Environment Committee is currently exploring ways of encouraging the community to conserve the little forest cover and intensify efforts in tree planting. The District's Forest Service office has been undertaking replanting programs in the past. These have concentrated mainly in the gazetted forest, but a few other areas have been covered as well. It is estimated that a total of 100Ha have been replanted in the last five years (2000 – 2005).

A major hindrance to effective establishment of the trees has been grazing animals. In the 2004 planting season, none of the trees replanted in a 10ha plot in Siongiroi survived due to this problem. The District Forest Office has therefore taken steps to ensure an improved survival rate of the trees replanted in 2005. The steps include, increased community mobilization and awareness creation, and increased surveillance by the forest guards.

The Kenya Forest Service has also introduced an aspect of participatory forest management where farmers living next to the forest are involved in the management and protection of the forests through the formation of community forest associations (CFA) for one forest (Chepalungu). They will require applying to the service for friendly user rights such as grazing, bee keeping, shamba system, eco-tourism but activities such as charcoal burning will not be allowed.

The green zone development support project (GZDSP) funded by the African Development Bank (ADB), earmarked 9.3 million for the District in the year 2006-2007 financial year. The project will run for six years and among the activities to be undertaken are; Hill top restoration, water catchment conservation, natural forest rehabilitation, agro-forestry, wood lots establishment and participatory forest management.

The District Forest Department has also intensified its efforts towards raising more Tree seedlings in its nurseries to bridge the widening gap between demand and supply. At the close of the year (2005), the department had close to 60,000 tree seedlings ready for planting during the April planting season. The main species available were, *cupressus lusitanica* (common cypress) – 45,500 seedlings, and *eucalyptus saligna* – 14,000 seedlings, *casuarina equisetifolia* – 30,000 seedlings, *gravellea robusta* – 36,200 seedlings, *prunas africanus* – 7,800 seedlings and others 7,000 seedlings, making a total of 140,000 seedlings.

The District Environment Committee has also targeted improved private sector participation in afforestation. Awareness creation through Community based organizations, Non-governmental organizations operating in the District and the business community is already on going. Schools, Churches and other institutions have also been targeted. Towards this end, a community based organization in Mulot, – Mara River Water Users Association – has already distributed close to 40,000 tree seedlings to its members in the last two years (2004 and 2005). A further 5,000 seedlings were distributed and planted in 5 schools in Longisa division in 2005. The association also planted 1,000 seedlings along the main road in Mulot shopping center.

Other organizations that have been involved in reforestation in the District include the Worldwide Fund for Nature (WWF), Action Aid – Kenya, and Friends of the Mau Watershed (FOMAWA). A new entrant in the District is the Adventist Development and Relief Agency (ADRA) – Kenya, which is implementing a Project funded by the Community Development Trust Fund (CDTF) called the Mau South West Conservation Project. The project is supporting the establishment of Tree nurseries, Beekeeping, Agro-forestry, and Water Resources Development.

7.1.3 Regulatory and Management Arrangements

The ban on logging in gazetted forests imposed by the government in 1999, and which is still in force, has greatly assisted in curbing deforestation in the District. But a few cases of charcoal burning, timber production and illegal grazing in the forest have been recorded and dealt with administratively. Measures taken to curb the situation include increased patrols by the forest guards.

A further control of deforestation in the District (particularly in individual farms), is being enforced by the District Environment Committee through the provincial administration. The chiefs and sub-chiefs have been mobilized to control felling of trees in the farms. Of particular concern is the cutting of trees along the rivers and streams, which the committee does not approve.

7.1.4 Exploitation of Forest Resources

There are broadly two types of forest products. These are, the Tangible products and the Intangible products. The Tangible products include, Timber, Fuel wood/Charcoal, Grass, and Poles. They are therefore referred to as direct benefits of the forest. Tree species mainly used for direct benefits in the District include, *Cupressus lusitanica* (common cypress), *eucalyptus saligna* (blue gum), and *Pinus patula* (pine), *Fagara macrophylla* (sagawaita), *Olea africana*, and *Prunus africana*, among others.

The intangible products are those that are not gained directly from the forest and have no commercial value attached to them. They are no different from products of any other forest in the country. They include climate amelioration, shade, windbreaks, and eco-tourism. Both exotic and indigenous tree species provide almost the same quality of the said products.

Since the imposition of a government ban on forest exploitation in 1999, logging has not been a major issue in the District. However, farmers have continued to harvest their mature trees for sale especially to the Tea factories in the District or neighboring Districts. The sale of timber has earned the farmers Kshs 15.6m.

7.2 Wildlife

The District's Wildlife Resource status has not been documented. However, there are no National Parks, or other Conservation areas in the District. The District Borders the Mau Natural Forest Complex to the Southwest. Cases of Wild Animals from the sprawling Maasai Mara game reserve in the neighboring Narok District, invading farms in the lower parts of the District have occasionally been reported, hence causing Human – Wildlife conflicts. The Kenya Wildlife Service (K.W.S.) – Kericho office has posted officers who patrol the affected areas in Sigor Division to minimize on these cases.

7.3 Prioritization of Key Environmental Issues (Table 7.2)**Table 7.2 Priority issues and interventions**

N o.	Priority issues/Challenges	Current interventions	Proposed interventions in the plan period (2006 – 2010)	Responsible institution	Remarks
1.	Encroachment of the Gazetted Chepalungu Forest	Surveillance by Forest department staff and provincial administration	Involvement of community in its rehabilitation and conservation	Forest Department	The Forest Act (2005) will convert the Forest Department into the Kenya Forest Service
2.	Establishment of more tree nurseries and woodlots	Forest Department is supporting this through provision of technical advice and a few materials	Build capacity of communities, institutions and private sector to establish and manage tree nurseries and private woodlots	Forest Department, and all other relevant stakeholders	The rising demand for tree seedlings is pushing private enterprises, individuals and communities to take up tree nursery establishment as an income earning option

Source: District Forest Office (2004)

CHAPTER EIGHT

8.0 BIODIVERSITY CONSERVATION

8.1 Biodiversity Data and Information

Some information on biodiversity has been provided in previous chapters on Forestry, wildlife, agriculture, livestock and fisheries. However, it is important to consider other forms of biodiversity such as dryland biodiversity, aquatic biodiversity, and biodiversity below ground (Table 8.1). Environmentally significant areas such as hilltops, hill slopes, and wetlands should also be considered here.

Table 8.1 Types and Status of Biological Resources

Ecosystems		Size (Ha)	Key Species	Threats	Status			Proposed Interventions
					R	T	V	
Gazetted Forests	Indigenous	4,700	Various	Illegal extraction		**		Intensified surveillance and Community Mobilization
	Plantation	300	Pinus/Cypresses	Illegal extraction		**		Intensified surveillance and Community Mobilization
County Forests		Nil	The County Council does not own any Forest					
Community Forests		Nil	There are no Community Forests in the District					
Private Forests		N/A	Individuals own woodlots whose combined size has not been estimated					
Agricultural		N/A						
Wildlife Areas		None						
Marine		None						
Inland Waters		None						
Drylands		N/A	Two Divisions (Sigor and Siongiroi) are predominantly Semi arid					

Source: Various Departmental Records

N/A – Information not available

8.1.1 Agricultural Biodiversity

Agro-Biodiversity is important because it provides security against such occurrences as drought or crops and animal diseases outbreaks. Different crops and animals resist such occurrences to varying degrees. Therefore it enhances food Security. The dominant agricultural crop in the district is maize. Unfortunately, farmers tend to hold on to maize cultivation even in areas where its growth is greatly disadvantaged. In areas such as the dry, lower zones of the District, the Ministry of Agriculture is encouraging farmers to diversify to more drought resistant crops such as finger millet, sorghum, pigeon pea etc, to boost the food security situation of the area (Table 8.2). It is also clear that the threat to loss of Agricultural Biodiversity in terms of traditional food crops is very real in the District.

8.1.2 Dryland Biodiversity

The extent and status of the dryland biodiversity in the District has also not been documented. It is important to carry out a survey in the dry, lower zones of the District to establish and document the prevailing status so as to be able to plan for effective management.

Table 8.2 Extent of Agricultural (Crop) Biodiversity

N o.	Crop	Acreage (Ha)	No.	Crop	Acreage (Ha)
1.	Maize	28,759	12.	Bananas	186
2.	Beans	6,658	13.	Pyrethrum	N/A
3.	Finger Millet	580	14.	Tea	3,108
4.	Sorghum	145	15.	Coffee	165
5.	Wheat	2	16.	Cassava	3
6.	Irish Potatoes	1,118	17.	Cabbages	299
7.	Sweet Potatoes	404	18.	Kales	265
8.	Pigeon Peas	2	19.	Field Peas	5
9.	Green grams	1	20.	Tomatoes	145
10.	Cow peas	2	21.	Chicken Peas	40
11.	Groundnuts	2	22.	Soya Beans	8

Source: District Agricultural Office (2004)

N/A – Figures not available

Other minor crops are pineapples, Garlic, Spinach, Mangoes, Local vegetables, Avocadoes, Garden peas, Pumpkins, Paw paws, Passion fruits, Onions, Macadamia and Citrus fruits.

Table 8.3 Agricultural (Livestock) Biodiversity

Livestock	No.	Livestock	No.
Dairy Cattle	52,450	Dairy Goats	1,146
Beef Cattle	137,700	Pigs	2
Sheep (Crosses)	50,950	Donkeys	22,600
Wool Sheep	25,980	Rabbits	1,265
Meat Goats	43,710	Bees	22,000 Hives

Source: District Agricultural Office (2004)

NB: The extent of Biodiversity of the wild relatives of Crops and Animals in the District has not been documented.

8.1.3 Aquatic Ecosystems' Biodiversity

The only forms of Aquatic Ecosystems in the District are the permanent rivers. The other water bodies in the district are the dams and water pans, which are fairly new man-made features, which may not yet qualify to be referred to as ecosystems. The status of the few wetlands available has not been established, though it is fairly obvious that most of them are threatened by continuous encroachment, planting of water draining plant species like Eucalyptus and accelerated soil erosion. The rivers are also generally polluted especially through poor waste disposal and increased soil erosion.

8.1.4 Biodiversity below Ground

The extent and status of the Biodiversity below ground in the District has not been documented. However, the role of such organisms as microorganism in the soils has been fully appreciated in soil formation, driving of both the detritus, and herbivorous food chains, and soil fertility enhancement. Threats to this Biodiversity are real, given the high levels of soil erosion prevalent in the District.

8.2 Access and Benefit Sharing

The issues of Access to genetic resources and Knowledge, Mechanisms of benefit sharing, bio-prospecting, and intellectual property rights, trade agreement to property rights, prior informed consent, and Bio-piracy, are not every day issues at the district level. However, the various government departments should maintain vigilance to identify these issues and give the necessary guidance. There has been no identified case of Bio-prospecting in the District so far.

8.3 Regulatory and Institutional Arrangements

There are no clear-cut structures or management systems at the district level to effectively manage biodiversity issues.

8.4 Threats to Biodiversity Conservation

The main threats include overexploitation, loss of habitats, climate change and change of lifestyles among local communities, which exerts undue pressure on the various components of biodiversity.

8.5 Key Environmental Issues

The key environmental issue with regard to biodiversity management and conservation is the continuing loss of biodiversity through encroachment of fragile ecosystems like riverbanks, wetlands and hilltops, opening up of more cultivation land, and pollution of existing ecosystems especially aquatic ecosystems.

8.6 Proposed Interventions

Various interventions are proposed so as to attain a sustainable level of Biodiversity Management and Conservation. They include:

- Intensification of efforts to curb soil erosion, and therefore protect the Biodiversity below ground
- Intensify Reforestation, and Forest conservation efforts
- Intensify efforts to reduce Human-wildlife conflicts
- Encourage the community to diversify on Agricultural crops to enhance Agricultural Biodiversity. This will promote food security in the District.
- Establish and document the exact status, and extent of indigenous knowledge and technologies
- Establish detection and regulatory mechanisms against Bio-piracy and related issues
- Establish and document the District's wildlife resource potential
- Domesticate the important international agreements on Biodiversity at the District level
- Awareness on the biodiversity and incorporate the indigenous traditional knowledge (ITK) which the local community has.

Table 8.4 Type, status and impact of invasive species

N o.	Name of invasive species	Ecosystem Affected	Area affected (Ha)	Environment al impact	Proposed Interventions
	None	None	Nil	None	None

NB: No Invasive species has been reported in the District so far

8.7 Prioritization of Key Environmental Issues (Table 8.5)**Table 8.5 Priority issues and interventions**

N o.	Priority issues/Challenges	Current interventions	Proposed interventions in the plan period (2006 – 2010)	Responsible Institution	Remarks
1.	Establishment of the exact extent and status of Biodiversity in the District	Various sectors (Agriculture, Livestock, Forest etc) have records indicating estimates of extent of Biodiversity in their respective Sub-sectors	Carry out a comprehensive survey and documentation of all components of Biodiversity	District Environment Committee and other relevant stakeholders	
2.	Establish structures for Biodiversity Management	None	Build capacity at the community level to manage Biodiversity	District Environment Committee and other relevant stakeholders	
3.	Encroachment of fragile ecosystems e.g riverbanks, hill tops and wetlands	Awareness creation and enforcement of legislation	Capacity building and rehabilitation works	MOA, KFS, WRMA, NEMA	
4.	Opening of more lands for cultivation	Surveillance and policing	Incorporate the community in forest conservation	KFS	Has started the community forest Association
5.	Pollution of existing ecosystems	Awareness and enforcement of existing legislation	Capacity building and enforcement of waste management regulations	WRMA, NEMA, NGOs	Most work being done through DEC.

CHAPTER NINE

9.0 ENERGY SECTOR

Kenya relies on two forms of energy namely, renewable and non-renewable. The raw materials for energy include biomass, fossil fuel, and radioactive minerals. Other sources of energy include hydro, geothermal, solar and wind.

The Government recognizes that alternative renewable energy sources hold tremendous potential, especially for reducing heavy dependence on woody biomass. Exploitation of these energy sources creates opportunities for income and employment generation, both of which have a positive impact on improving the quality of life while reducing poverty.

9.1 Types and Status of Energy Sources

The primary source of energy in the District is firewood, and charcoal. Combined, they provide energy to 75% of the population. Kerosene, gas, and biogas, provide energy to 22.3% of the population. Solar, and electricity, provide energy to less than 3% of the population in the District. Given the tendency of overlap, firewood and charcoal, could be a source of energy to an even bigger percentage of the population. Wind power has not been exploited as a source of energy in the District. At the same time, the potential for hydro electric and geothermal sources of power has not been explored. Tenwek Mission Hospital has a 320KW hydroelectric power station that is now threatened due heavy siltation of their dam as a result of massive soil in the upper catchment of Nyangores River (Table 9.1).

Table 9.1 Status of various types and sources of Energy

% Households using electricity		0.7%
No. Of trading centers with electricity		7
% Rural households using solar power		2%
% Households using firewood/charcoal		75%
% Households using kerosene, gas or biogas		22.3%
Hydro electric power	Only Tenwek Mission Hospital is generating 320 KW for its use	
Crop residue	Numbers not available but the level of use can only be very low and seasonal	
% Households using wind energy		0%
% Households using steam energy		0%
% Households using energy generated from waste systems		0%

Source: State of Environment (2004) report – Bomet District

9.2 Trends in Energy production, consumption, costs, and projections

There are several factors determining the type of energy used. Major among them are, accessibility, and affordability. Given the high poverty levels in the District (62% in the rural areas), wood fuel, which is more accessible and affordable, will continue to attract more demand, and less supply in the long run (Table 9.2 & 9.3). The present spatial distribution of electricity needs to be expanded so as to improve on accessibility, in the hope that its affordability will improve in the near future to fill the widening gap between demand and supply of wood fuel. Other sources of energy such as wind, whose potential has not been exploited, should be promoted. Efforts towards sustainable energy use should also be intensified.

Table 9.2 Trends in Energy Production and Projections

N o.	Source of Energy	Years						Projections for 2010	Remarks
		1980	1985	1990	1995	2000	2005		
1.									
	There are no records to show the trends in energy production. But as noted elsewhere, fuel wood is the primary source of energy in the District. Sources of wood have not been growing at the same pace with demand, hence the increasing loss of forest cover								

Table 9.3 Energy Consumption and Costs

N o.	Source of Energy	Point of Production	Point of Consumption	Per Capita Consumption	Unit Cost (Kshs.)	Environmental Impacts
1.	Electricity	Without	Within	N/A	1.55	None in the District
2.	Charcoal	Within	Within & Without	N/A	N/A	Deforestation
3.	Wood Fuel	Within	Within	N/A	N/A	Deforestation
4.	Gas	Without	Within	N/A	125/Kg	None in the District
5.	Solar	Within	Within	N/A	N/A	None in the District

N/A – Figures not available

Fuel-efficient technologies have been developed over the years by various organizations such as Bellerive Foundation and promoted mainly by the Japanese International Cooperation Agency (JICA) and other organizations. However, the level of awareness and adoption of these technologies in the District is very low. Close to 45% of the population is not aware of these technologies. About 50% of the population is aware, but does not see any immediate need to use them. Further 4% feel it is important to use such technologies, but have yet to access them. Only 1% of the population in the district has access to fuel efficient technologies such as wood saving jikos.

Commercialization of energy sources such as wood fuel is gaining popularity in the District due to the market provided by the Tea factories in and around the District. The building of a second Tea factory, (Tirgaga Tea Factory), in the District is expected to spur further growth in this sector. The species of choice is the fast maturing Eucalyptus species (*eucalyptus saligna*, and *eucalyptus grandis*). Kenya Tea Development Authority (KTDA) is promoting the planting of these trees by the farmers on contractual basis.

As noted earlier, the potential for wind, hydro, and geothermal sources of Energy has not been explored. However, Tenwek Mission Hospital has shown the way in the area of hydro power generation. It currently produces 320KW, which is used to run the Hospital. The main constraint in alternative energy exploitation is of course the initial cost of installation, which is beyond the reach of most individuals.

9.3 Key Environmental Issues in the Energy Sector

9.3.1 Deforestation

The prevailing extent of deforestation in the District poses a serious threat to sustainable energy supply, especially considering that wood fuel is the primary source of energy in the District. It requires increased efforts towards reforestation. The increasing number of tree nurseries, especially individually owned tree nurseries, is a good indicator that the base for accelerated reforestation is slowly being set. It's estimated that more than 100 tree nurseries are operational across the District.

9.3.2 Low Coverage of Fuel-efficient Technologies

Although fuel-efficient technologies have been developed and promoted by several agencies including JICA, GTZ and others, level of awareness and adoption rate is still low.

9.3.3 Commercialization of Energy Sources

Wood fuel is gaining popularity in the District due to the ready market provided by the tea factories in and around the District. The additional tea factory (Tirgaga Tea Factory), is likely to spur further growth in this sector. The species of choice is the fast maturing Eucalyptus species. It is therefore important to direct the interest positively so as to cater for the needs of the market and those of the community without compromising the environmental status of the District any further.

9.4 Proposed Interventions (Table 9.4)

- Intensification of re-forestation efforts through community mobilization and support. It is also important to encourage more private sector participation in environmental conservation.
- Address gender constraints in fuel wood access, ownership, and conservation.
- Encourage the community to adopt more energy saving technologies

Table 9.4 Intervention Matrix

No.	Prioritized Issue/Challenge	Current Intervention	Proposed Intervention in the plan period 2008 - 2012	Remarks
1.	Reforestation	Encouragement of private sector involvement in reforestation ongoing	Enhanced mobilization of private sector involvement and capacity building	The increasing demand for wood fuel is expected to spur more participation by the private sector
2.	Promotion of Energy saving technologies	Home Economics department within the Ministry of Agriculture has been involved in the promotion	Involvement of more stakeholders e.g. CBOs, NGOs, Institutions, and Factories	Already GTZ has started a project to promote Liners for use by households and institutions
3.	Address gender constraints in wood fuel access, ownership and conservation	Mainstreaming of gender issues into development programs and projects	Continued support for community mobilization on gender issues	

Source:

CHAPTER 10

10.0 INDUSTRY, TRADE AND SERVICES

Industries, Trade, and Services can benefit a lot by adopting environmental management systems that not only address production processes but also promote waste minimization, treatment and disposal.

10.1 Industrial Sector

There are only minimal industrial activities in the District. They are classified into four clusters. These are, Tea Processing – Kapkoros Tea Factory and the yet to be operational Tirgaga Tea Factory, Milk Processing – Siongiroi cooling plant, coffee processing (hand pulpers) – Sotik east, Nyabuko, Emityot, Ndanai, and Maroba areas, and finally informal (jua kali) sector – metal fabrication, apiaries, posho mills, wood workshops, blacksmiths, and motor vehicle repairs (Table 10.1).

Table 10.1 Type and trends in industrial development

No.	Type of Industry	1990	1995	2000	2005	Projections for 2010	Remarks
1.	Tea Industry (Factories)	---	---	1	2		
2.	Milk Processing	---	---	1	1		
3.	Maize Processing	---	---	---	---	1	The Proposed Korokwony Women Maize Miller may be functional by 2010
4.	Coffee Processing (Pulpers)	---	---				
5.	Informal Enterprises	Metal Fabricators					
		Apiaries (Hives)					
		Posho Mills					
		Wood Workshops					
		Blacksmiths					
		Garages					
6.	Manufacturing Industries	---	---	Nil	Nil	Nil	Potential for Manufacturing industries is low
7.	Mining	---	---	Nil	Nil	Nil	Potential for mining is low

Source: Various Departmental Records (2004)

Most of the products produced in the District are consumed locally. However, tea, which is a major cash crop in the District, is marketed through the Mombasa tea auction to the

international market as part of the national export of tea. A small percentage of the tea is sold at factory gate to the locals who are members of the Kenya Tea Development Authority (KTDA) - owned Kapkoros Tea Factory.

Key environmental issues in the industrial sector

Industrial pollution in the District is minimal due to the small number of industries operating from the District. The main potential sources of pollution include, Oil Spills from Kapkoros Tea Factory Workshops, Process Waste Water, Sanitary Waste, Paper waste and Wood chippings from the Factory itself. Air pollution is minimal due to the use of furnace oil as fuel for steam generation by the Tea Factory. Sulfur dioxide is produced in small quantities due to the high levels of sulfur found in the diesel used. This eventually leads to acidification of rainwater (Table 10.2).

Table 10.2 Key Environmental issues for Kapkoros Tea Factory

N o.	Item	Issue/s	Anticipated interventions
1.	Water	No Meters to measure the amount of water extracted	Installation of meters to measure the amount of water extracted from spring
2.	Energy	Wood Fuel storage	Prior to building of shed, the woodlot should be covered with tarpaulin to reduce adverse effects of weather.
3.	Fire Preparedness	<ul style="list-style-type: none"> ▪ Furnace Oil boiler has leakages ▪ Lack of adequate fire fighting equipment 	<ul style="list-style-type: none"> ▪ Improved Housekeeping ▪ The stacked wood should have spacing in-between ▪ Installation of a inceptor or sump to collect waste furnace oil ▪ Separate flammable & inflammable materials ▪ General maintenance of electrical wiring and insulation of electric wires ▪ Setting up procedures for fire fighting and training employees
4.	Signage	Inadequate signage and lack of regular maintenance of those posted	Install all necessary signs through out the Factory and regularly renew & update signs to avoid undue mistakes or accidents
5.	Air Pollution	Levels of gas emissions from the Factory not determined	<ul style="list-style-type: none"> ▪ Enhance use of protective equipment as well as suitable stacks to disperse emissions ▪ Install gas analyzers to determine levels of sulfur dioxide emissions from the Factory
6.	Solid Waste	No set targets to reduce, reuse and recycle solid waste	<ul style="list-style-type: none"> ▪ Establish an effective system to reduce amount of solid waste including reducing, reusing and recycling. ▪ Solid waste pit to be fenced off to avoid accidents. ▪ Relocate the solid waste pit in the log run
7.	Liquid Waste	Factory waste water and	<ul style="list-style-type: none"> ▪ Improve the soak pit to increase

		storm water run-off are mixed during the rainy seasons	efficiency
8.	Housekeeping	Factory floor is messy at the sorting and drying area due to spillages	<ul style="list-style-type: none"> Improve general housekeeping of the Factory especially at the packing area where much tea litters the ground
9.	Asbestos Roofing	Decommissioning	To follow company outlined procedures during decommissioning

Source: Kapkoros Tea Factory Environmental Audit Report (2004)

10.1.1 Tea Industry

The Environmental Audit (2004) for the Factory identified the following environmental concerns for the Factory.

- Lack of an overall policy stance on all issues such as health and safety, environment (wood fuel), and social reporting. It suggested that the management agent, KTDA, develop this.
- Lack of an Environmental Management Plan (EMP). This was developed and outlined in the Audit report.
- Lack of a clear policy on sources of firewood to safeguard the environment from degradation. It recommended that the Factory management monitors and registers only suppliers with sustainable woodlots.
- Inadequate means of monitoring productivity and efficiency capacity of the factory machinery such as boilers, and the steam system. Such monitoring would cut costs of production as well as reduce pressure on the natural resources used in tea processing.
- The health and safety procedures and training need to be improved to meet the needs of the workforce.

10.1.2 Dairy Industry

Environmental concerns associated with milk processing at the Siongiroi dairy plant (Table 10.3) identified by the 2004 Audit report include:

- Management of liquid waste, especially the wastewater. Currently, the wastewater collects into a shallow wetland instead of a proper septic tank. The management is in the process of constructing two septic tanks.
- The landfill for the solid waste is exposed and shallow.
- Need to tarmac the parking bay to cope with the anticipated higher traffic flow when the plant finally turns into a fully-fledged processing plant in the next five years.

Table 10.3 Key Environmental issue for Siongiroi Dairy Plant Ltd

N o.	Item	Issue/s	Anticipated interventions
1.	Air	Increased air pollution due to dust and engine fumes as a result of increased traffic flow.	<ul style="list-style-type: none"> Tarmacking the parking area in the short term. Tarmacking the main Siongiroi – Chebole road in the long run.
2.	Solid Waste	Shallow landfill hence the waste is sometimes blown off to adjacent areas	<ul style="list-style-type: none"> Putting up a deeper landfill Acquisition/Installation of an incinerator
3.	Liquid	Wastewater is disposed	<ul style="list-style-type: none"> Putting up of proper septic tanks

	Waste	off into a shallow wetland in the compound. This water is usually contaminated with detergents and spilt Milk	<ul style="list-style-type: none"> for wastewater disposal ▪ Determination of the Biological Oxygen Demand of the treated wastewater to ascertain if it conforms to set standards
4.	Fire Hazards & Other Accidents	There's very limited capacity and Training to handle/forestall fire incidents	<ul style="list-style-type: none"> ▪ Installation of adequate fire fighting equipment and procedures ▪ Training of staff on fire fighting skills
5.	Occupational Health & Safety	No set standards and procedures of ensuring occupational health and safety	<ul style="list-style-type: none"> ▪ Ensure proper dressing (Aprons, Uniforms, Hand gloves, Gumboots etc) of staff working in the Plant ▪ Ensure all staff working in the plant have Medical Certificates
6.	Chemical Handling & Storage	No standard procedures of storage and handling of Chemicals in the Plant	<ul style="list-style-type: none"> ▪ Ensuring Chemicals used in the Plant are only stored in the laboratory, which must adhere to standard practice in the handling and storage of Chemicals

Source: Siongiroi Dairy Plant Ltd Environmental Audit report (2004).

10.1.3 Slaughter Slabs

The Municipality and the County Council of Bomet operate slaughter slabs that may have serious environmental problems with respect to the management of their solid waste, effluents, and gaseous emissions. But given the operational sizes of the slaughter slabs and the numbers of animals they process (Tables 10.4, 10.5 & Plate 10.1), their effects on the environment would be comparatively minimal.

Table 10.4 Slaughter numbers by type of animals

Division	Bovines	Ovines	Caprine	Poultry	Pigs	Rabbits
B/Central	3,070	927	2,108	4,050	0	30
Longisa	1,027	380	1,020	800	0	5
Siongiroi	2,230	104	1,150	300	0	0
Ndanai	1,050	150	950	120	0	0
Sigor	956	169	1,087	420	0	0
Mutarakwa	700	486	149	101	0	0
Total	9,033	2,216	6,464	5,791	0	35

Source: District Livestock Office (2004)

Nevertheless, based on existing practices, the following environmental liability factors should be addressed:

- Hygiene standards for treating, handling and storage of animals and meat in all stages of the production process.
- Regular hygiene and animal checks should be carried out before slaughter.
- Collection of residues arising from the slaughter of animals.
- Burning of waste and recovering fats and oils.

Plate 10.1 Bomet Municipal's Slaughter Slab



Slaughter slabs produce effluents, which generate pollution problems due to the high content of animal fat, waste, blood and cleaning agents. The effluent may need to be treated and usually requires hot water spraying to dislodge fats that have accumulated in the on-site drainage system. The main sources of atmospheric odour are animal wastes (skins, hides, and hooves), unprocessed materials and other wastes. Odour control is of particular concern to the Municipal's slaughter slab located right inside the town and near residential houses.

Table 10.5 Slaughter Slabs and their location in Bomet

No .	Owner	Location of the Slaughter slab	Remarks
1.	Bomet Municipal Council	<ul style="list-style-type: none"> ▪ Merigi ▪ Longisa ▪ Kapkwen ▪ Silibwet ▪ Tenwek ▪ Bomet Town 	<ul style="list-style-type: none"> ▪ The one in Bomet town is right in the middle of town and near a residential area. The odour it produces is becoming a menace in the adjacent areas
2.	Bomet County Council	<ul style="list-style-type: none"> ▪ Kapkoros ▪ Mulot ▪ Chebunyo ▪ Ndanai ▪ Siongiroi 	<ul style="list-style-type: none"> ▪ These are small slaughter slabs. Their main limitation would be water, which may compromise hygiene standards if not well supervised.
3.	Private	<ul style="list-style-type: none"> ▪ Chebole 	

Source: District Veterinary Office (2004)

10.1.4 Transport Industry

Kenya's transport system comprises of five major modes, namely: road, railway, marine, air, and pipeline. The transport modes integrate the various productions, population centers and facilitate mobility in both rural and urban centers.

The District is entirely served by road transport only. Most of the roads are unpaved (Table 10.6). Vehicular pollution is becoming a major concern, especially with the sharp increase of the number of vehicles plying the Narok – Kaplong route, after the completion of the tarmacking of the road in 2005.

Table 10.6 Status on modes of Transport

Total KM of road	Murram	Earth roads	Paved
	600	200	75
Railway line	None		
No. Of ports including inland container depots	Nil		
No. Of airports and airstrips	1 airstrip		
No. Of water ways	Nil		
No. Of public service vehicles	Not determined but it has risen sharply since 2002		

Source: State of Environment (2004) report

The main vehicular pollutants are lead and by-products of fuel combustion, which include both visible (smoke) and non-visible emissions. The main emissions are hydrocarbons, carbon monoxide, oxides of nitrogen and particulate matter. The particulate matter consists of soot due to incomplete combustion, oxides of sulphur and phosphorous, soluble organic fractions arising from the thermo cracking of fuels and lubricants and lead oxide from combustion of leaded gasoline. So far, no petrol station in the District has moved to the sale of unleaded gasoline.

10.1.5 Telecommunication

Telecommunication is important in facilitating the integration of the domestic economy and contributes to promotion of trade and economic development. The number of

people with access to telephone services has been rising steadily over the years in the country as well as in the District. Of particular concern is the rapid growth of the mobile phone industry (Table 10.7). The number of scratch cards used is on the increase. There is need to manage disposal of the cards as well as the safe disposal of rechargeable batteries. This is particularly so, given the fact that the demand for mobile phones is expected to increase in the coming years.

Table 10.7 Status of Communication Services

No. of Households with Landline Telephones	250
No. of Private/Public Organizations with Landline Telephones	460
Mobile Telephone Service Coverage	2 Service providers (Safaricom and Celtel)
No. of post/sub-post offices	11
No. of telephone booths	30
No. of Households without radios	19,000
No. of cyber cafes	1 (Post Office)

Source: State of Environment (2004) report

The location of signal boosters (masts) should also be managed with a view to limiting exposure to radiation.

10.1.6 Information and Communication Technologies (ICT)

Information and Communication Technologies is one of the fastest growing and dynamic sub-sectors in Kenya today. Significant progress has been made in the expansion and modernization of the country's information sector. Although the disparity in the distribution of communications facilities between the rural and urban areas continues to widen, rural areas are being continuously targeted as ICT providers strive to open up new frontiers of business. This means that the relevant capacity needs to be built at the District level to deal with emerging human and environmental challenges posed by the rapid growth of ICT.

10.1.7 The Charcoal Burning Industry

Approximately 80% of the total quantity of energy consumed in Kenya is provided by woody biomass. The industry employs about 200,000 people countrywide, either on part time (49%) or full time (51%) basis. In Bomet, firewood, and charcoal form the primary sources of energy (Plate 10.2). Combined, they provide energy to 75% of the population.

Plate 10.2 A Charcoal vendor in Bomet



The importance of wood to air pollution cannot be underestimated. For households, dispersion of combustion gases is not controlled. Carbon monoxide is widely generated indoors by heating and cooking appliances in poorly ventilated rooms. Its affinity to haemoglobin makes it a very toxic gas. Over reliance on firewood and charcoal is mainly responsible for the deforestation of most parts of Kenyan forests with serious consequences on flooding and soil erosion. Chepalungu Forest, which is the only gazetted forest in the District, is under intense pressure as a result of firewood extraction and charcoal production.

Whereas charcoal burning is illegal, its sale is legal and is done in the open. There is need therefore for the government to remove the apparent conflict between the two activities, while at the same time finding alternative and affordable energy sources for the rural and urban poor. A solution to this problem is very urgent because of the sharp increase in demand as evidenced by the 47.3% national increase in fuel-wood/charcoal demand in 2003 compared to 2001.

Table 10.8 Type and impact of industries on environment

N o.	Type of Industry	Raw Material /s	Product /s	People Employed	Waste s	Key Environmental Impacts	Mitigation
1.	Tea Factories	Tea	Processed Tea	N/A	Solid and Effluent	Pollution and Deforestation	Enforcement of their EMP
2.	Dairy		Fresh Milk	N/A	Effluent	Pollution	Enforcement of regulatory standards
3.	Slaughters		Meat	N/A	Solid and Effluent	Pollution	Enforcement of regulatory standards
4.	Transport		Services	N/A	Emissions	Pollution	Eliminating leaded gasoline

5.	Telecommunication		Services	N/A	Radiation and Used scratch cards	Exposure to Radiation, and Pollution	Public Education
6.	ICT		Services	N/A	Radiation	Exposure to Radiation	Public Education
7.	Charcoal		Fuel	N/A	Dust, Emissions	Pollution and Deforestation	Regulating Charcoal Production and Sale

Table 10.9 Priority issues and interventions

Prioritized issue/Challenge	Current intervention	Proposed intervention in the plan period 2006 - 2010
KAPKOROS TEA FACTORY		
Fire Preparedness	<ul style="list-style-type: none"> Daily, Weekly and Annual maintenance of equipment Fire extinguishers provided throughout the premises Fire fighting and First Aid Training Regular (Quarterly) fire drills 	<ul style="list-style-type: none"> Embark on a comprehensive fire safety program Mandatory house keeping initiative to maintain a clean working environment
Solid Waste	<ul style="list-style-type: none"> Collection & burning of all waste in designated waste pit 	<ul style="list-style-type: none"> Compost biodegradable materials
Waste water	<ul style="list-style-type: none"> Factory wastewater drains into the soak pit 	<ul style="list-style-type: none"> Improve the soak pit to include filtering of large particles from soak pit Designate a different system to divert storm water to the drainage system

Table 10.9 contd.

Prioritized issue/Challenge		Current intervention	Proposed intervention in the plan period 2006 - 2010
Air pollution		<ul style="list-style-type: none"> Use of suitable stacks to disperse emissions 	<ul style="list-style-type: none"> Install flue gas analyzers to determine levels of sulfur dioxide emissions
Energy	Boiler room	<ul style="list-style-type: none"> Office paper waste reused in the boilers 	<ul style="list-style-type: none"> Build storage sheds for firewood to reduce the effects of weathering
	Furnace Oil room	<ul style="list-style-type: none"> Drainage around the room 	<ul style="list-style-type: none"> Build a sump and interceptor Maintain the machine regularly to avoid spillage Have a spill kit
Congestion		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Expand the property to facilitate improved development
SIONGIROI DAIRY PLANT LTD			
Liquid Waste		<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Putting up of proper septic tanks for wastewater disposal Determination of the Biological Oxygen Demand of the treated wastewater to ascertain if it conforms to set standards
Solid Waste		<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Putting up a deeper landfill
Occupational Health & Safety		<ul style="list-style-type: none"> Ensuring proper dressing (Aprons, Uniforms, Hand gloves, Gumboots etc) of staff working in the Plant Ensuring all staff working in the plant have Medical Certificates 	<ul style="list-style-type: none">
Fire Hazards & Other Accidents		<ul style="list-style-type: none"> Installation of fire extinguishers 	<ul style="list-style-type: none"> Installation of adequate fire fighting equipment and procedures Training of staff on fire fighting skills
Air		<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Tarmac the parking area
Chemical Handling & Storage		<ul style="list-style-type: none"> Ensuring Chemicals used in the Plant are only stored in the laboratory. Which must 	<ul style="list-style-type: none"> Develop standard procedures of storage and handling of Chemicals in the Plant. Improve the laboratory to adhere to standard practice in the handling and storage of Chemicals.

Source: Kapkoros Tea Factory and Siongiroi Dairy Plant Ltd Environmental Audit reports (2004).

10.2 Types of Trade

The types of trade in the District are classified into seven main formal categories. These are wholesale businesses, retail traders; motor vehicle garages; hotel/catering services; manufacturers/processors; bars and restaurants, including lodgings and distributors.

There are also informal categories of trade for example Jua Kali sheds and all forms of Hawking, which are controlled by the Municipal/County councils.

10.2.1 Products Traded

The main categories of products traded (Table 10.10) include:

- Unprocessed Farm products, which include tea, milk, coffee, potatoes, vegetables and livestock and their products.
- Processed farm products mainly tea which is procured from the tea factories
- All other forms of products for domestic use, including farm implements
- Petroleum products for vehicles' and domestic use.
- Other motor vehicle related products like spare parts.
- Refreshments and accompaniments
- Hardware and other building materials
- Schools equipment and related products
- Pharmaceuticals and agrochemicals

Table 10.10 Table of Farm Products Marketed

Marketing Route		Amount (Litre)		Average Price/Litre (Kshs.)		Total Value
K.C.C. Sotik		5,563,869		14.75		82,067,006
Siongiroi Dairy Plant Ltd		3,066,736		13.75		54,542,620
Hawking		3,812,242		13.50		51,465,267
Total		13,342,847		14.10		188,084,954
Animals Slaughtered	Bovines	Ovines	Caprine	Poultry	Pigs	Rabbits
Numbers	9,033	2,216	6,464	5,791	0	35
Other Marketed Farm Products are:						
	Product		Acreage (Ha)		Yield (Tones)	
1.	Maize		28,759		56,942	
2.	Beans		6,658		3,329	
3.	Finger Millet		580		174	
4.	Sorghum		145		66	
5.	Wheat		2		3.6	
6.	Irish Potatoes		1,118		13,416	
7.	Sweet Potatoes		404		404,024	
8.	Soya Beans		8		4	
9.	Bananas		186		1,860	
10.	Pyrethrum		----		----	
11.	Tea		3,108		----	
12.	Coffee		165		----	
13.	Cassava		3		4	
14.	Cabbages		299		2,994	
15.	Kales		265		2,955	
16.	Field Peas		5		7.5	
17.	Tomatoes		145		1,308	
18.	Pigeon Peas		2		1.0	
19.	Green grams		1		2	
20.	Cow peas		2		2	
21.	Groundnuts		2		1.0	
22.	Chicken Peas		40		20	

NB: The value of most of the products was not available

Source: District Agriculture Office (2004)

10.2.2 Regulatory Framework

The only form of regulatory framework in Trade in the District is the licensing requirements of the Ministry of Trade and Industry and the Municipal/County councils. Only the formal, enclosed business enterprises, subject themselves to the regulations of the Licensing Authorities. But most informal traders for example hawkers are extremely hard to regulate despite the fact that their share of trade is fast increasing and the effects of Hawking to the Environment are fast being realized.

10.2.3 Counterfeit and Substandard Goods

There are no records in the District of the status of Dumping, Counterfeit and Substandard goods. However, the department of weights and measures in the Ministry of Trade and Industry has recorded a few cases of use of faulty weights and measures in the District.

There are also no records on the status of Trade in Genetically Modified Organisms/Products.

10.2.4 Pollutants and Waste Generated by Trading Services

Table 10.11 summarizes the important pollutants and wastes generated in the service sector, key issues, indicators, and present status in the District.

Table 10.14 Service Waste and Pollution and key issues

Issue	Indicator	Status	Remarks
Communication	<ul style="list-style-type: none"> ▪ Radiation ▪ Wet batteries (heavy metals) ▪ High levels of radiation and radioactive materials in the environment ▪ Presence of used batteries ▪ Increase in number of mobile phones, computers, base stations (masts) ▪ Increase in high voltage power transmission lines 	<ul style="list-style-type: none"> ▪ The level of radiation and heavy metal exposure has not been determined for the District ▪ There has been a sharp increase in the number of computers, mobile phones and base stations since 2000 	<ul style="list-style-type: none"> ▪
Health	<ul style="list-style-type: none"> ▪ Presence of sharps and used linen ▪ Expired drugs ▪ Used condoms 	<ul style="list-style-type: none"> ▪ Sources of sharps and used linen are few and usually dispose their wastes adequately ▪ No cases of poorly disposed expired drugs have been reported ▪ Poorly disposed used condoms are increasing especially in main shopping centers 	
Transport	<ul style="list-style-type: none"> ▪ Presence of leaded gasoline 	<ul style="list-style-type: none"> ▪ All petrol stations in the District have not started 	<ul style="list-style-type: none"> ▪ Due to the rural setting

	<ul style="list-style-type: none"> Increased incidences of lead related illnesses (retardation, lead poisoning, death) High number of haulage tracks High incidences of respiratory diseases High percentage of old vehicles Increased incidence of skin cancer 	<ul style="list-style-type: none"> selling un-leaded gasoline Cases of lead related illnesses, lead related respiratory diseases, or lead related skin cancer, have not been determined Haulage tracks are uncommon Old vehicles are common, but their percentage relative to new ones is unknown 	of the District, exposure to lead from the Transport sector (Vehicles), would be minimal at the moment
Hospitality	<ul style="list-style-type: none"> Lack of sewage system Presence of chemicals and detergents in effluents Increase in human population Increased number of laundries/dry cleaners Increasing quantities of non-biodegradable packaging materials in the environment Increased number of tourists 	<ul style="list-style-type: none"> The District has no public sewerage system Cases of the public bathing and washing in rivers and streams are rampant, polluting waters with detergents Polythene papers and other non-biodegradable materials litter every shopping center 	
Tourism	<ul style="list-style-type: none"> Environmental degradation Presence of human settlements in wild habitats Migration of birds 	<ul style="list-style-type: none"> The District has no tourist facilities, hence pollution from tourism is negligible There are no habitats for migratory birds nor human settlements in wild habitats in the District 	<ul style="list-style-type: none"> The tourism potential for the District is low
Trade	<ul style="list-style-type: none"> Accumulation of garbage at trading centers 	<ul style="list-style-type: none"> This is a common feature in shopping centers across the District. Particularly affected are the fast growing shopping centers along the main highway (Kaplong – Narok Road) 	<ul style="list-style-type: none"> The shopping centers are Chebole, Kapkwen, Bomet town, Kipsarwet, Longisa, and Mulot

Table 10.14 contd.

Issue	Indicator	Status	Remarks
Noise	<ul style="list-style-type: none"> Public transport aerodromes 	<ul style="list-style-type: none"> There is only one airstrip in the District, which is not busy 	<ul style="list-style-type: none"> Main user of the airstrip is Tenwek Mission Hospital, for their supplies
Emissions	<ul style="list-style-type: none"> Chimneys and stakes 	<ul style="list-style-type: none"> Tenwek Mission Hospital has a stake for their incinerator. Kapkoros Tea Factory has chimneys for their boilers and furnace. The others are farm-based chimneys for tobacco drying kilns in Sigor, Siongiroi and Ndanai Divisions 	<ul style="list-style-type: none"> Overall, emissions in the District are minimal Tenwek Mission Hospital are modifying their stake to meet the specifications set out through the improvement orders issued in 2005 by N.E.M.A.
Effluent	<ul style="list-style-type: none"> Presence of Laundry Hotels 	<ul style="list-style-type: none"> Most of the small laundry and hotel (eating houses) enterprises, direct their effluent into ordinary pits. 	<ul style="list-style-type: none"> Very few of these enterprises have soak pits
Radiation	<ul style="list-style-type: none"> Increased cancer cases 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">
Sharps, linen, bandages, and blood	<ul style="list-style-type: none"> Hospitals Morgues Surgeries Blood banks 	<ul style="list-style-type: none"> Most health facilities dispose their waste in pits within their compounds. Only Tenwek Mission Hospital has an incinerator 	<ul style="list-style-type: none">
Expired drugs	<ul style="list-style-type: none"> Pharmacies Agro-vets 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">
Plastics	<ul style="list-style-type: none"> Laundries Industries Sales outlets 	<ul style="list-style-type: none"> These are a common phenomenon. They mainly originate from sales outlets like retail shops and wholesales 	<ul style="list-style-type: none">
Used Oil	<ul style="list-style-type: none"> Garages Machines Petrol stations 	<ul style="list-style-type: none"> The major source is the jua kali garages. The petrol stations are few and thinly spread 	<ul style="list-style-type: none"> The volumes generated have not been

			quantified, but they would be relatively small
Exhaust Gases	<ul style="list-style-type: none"> Motor vehicles Other engines 	<ul style="list-style-type: none"> These would be common within Bomet town, which has the highest concentration of vehicles in the District. 	<ul style="list-style-type: none"> Relative to other major towns, the level of exhaust gases in the town will be negligible
Chemicals	<ul style="list-style-type: none"> Laboratories Pharmacies Industries 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">
Laboratory Wastes	<ul style="list-style-type: none"> Research Institutions 	<ul style="list-style-type: none"> There are no research institutions in the District. 	<ul style="list-style-type: none"> Waste from schools' laboratories is small and is disposed off at the school level, mainly in pits
Used Batteries	<ul style="list-style-type: none"> Motor Vehicles Lack of electricity 	<ul style="list-style-type: none"> Only about 3% of the population in the District use solar or electricity as a source of energy The number of vehicles has increased tremendously between 2000 and 2005 	<ul style="list-style-type: none">
Packaging Materials	<ul style="list-style-type: none"> Markets Shops (retail & wholesales) 	<ul style="list-style-type: none"> The most prevalent form of waste from packaging materials is plastic (polythene & plastic bottles) 	<ul style="list-style-type: none">
Waste from GMO Products	<ul style="list-style-type: none"> Presence of GMO products in the market 	<ul style="list-style-type: none"> There are no records of GMO products being sold in the markets or in shops 	<ul style="list-style-type: none">
Garage Waste (Other than Used Oil)	<ul style="list-style-type: none"> Presence of garages 	<ul style="list-style-type: none"> This is common especially in shopping centers 	<ul style="list-style-type: none"> The waste is normally of scrap metal
Old Tyres	<ul style="list-style-type: none"> Moving motor vehicles Presence of makers of Tyre Sandals 	<ul style="list-style-type: none"> Tyre Sandals makers are few in the District, mainly in the Market Centers 	<ul style="list-style-type: none"> The number of disposed old tyres is negligible

10.3 Services Sector

The services sector plays an important role in creating and supporting an enabling environment that facilitates private sector investment, growth and job creation. The provision of adequate services, coupled with macro-economic stability and a long-term development strategy, are essential preconditions for sustainable economic and social development. But also the services sector greatly contributes to the degradation of the nation's environment. Therefore, to be able to adequately address environmental challenges posed by each service sector, it is important to establish all linkages to environmental degradation for each service sector, and to propose possible interventions for each.

The Key services that have a bearing on the environment in general include telecommunication, transport (air, road, and railway), port services, water, sewerage and health services.

10.3.1 Telecommunication

Kenya has a fairly developed postal and telecommunication network. Fixed telephone lines connection have been declining since 2003 as more people are preferring mobile phones mainly due to the convenience they offer. Although there are no figures of the number of people with access to mobile phones in the District, it is obvious that more and more people are getting connected to mobile phone networks with time. This means that the District will have to deal with the emerging effects of non-biodegradable wastes resulting from the mobile phone industry such as used airtime cards consisting of aluminium covers, and rechargeable batteries.

Box 2. Mobile Phone base stations investigated by the Public Complaints Committee (PCC)

The Committee received numerous complaints resulting from increased number of mobile phone base transmission

Stations (BTS) installations mainly in urban areas due to the increase in mobile phone users. The major concern was the effects of the radiations emitted by the base stations on human health.

The Committee established that there is no conclusive scientific evidence on their exact effects on human health. It therefore recommends to NEMA in consultation with the Communication Commission of Kenya and other relevant lead agencies should formulate standards and guidelines to regulate this fast growing sector, as the existing standards and regulations appear inadequate. In addition, mobile phone services providers should adhere to health-based guidelines and should apply precautionary measures to protect people from unknown effects of radio frequencies.

10.3.2 Water, Sewerage and Health Services

The overall goal of the government is to ensure that all Kenyans have access to safe drinking water within a reasonable distance. Current estimates indicate that nearly 75% of the country's urban population has access to safe drinking water, while 50% of the rural population has access to portable water.

About 3% and 2% of households in the District have access to piped and portable water respectively. According to a baseline survey of the Mara River Basin, on average, households in the District get their water at a distance of 4Km. During the wet season, 70.8% of households spend less than one hour to get water, as compared to 47.9% during the dry season. 1.1% of households spend three to four hours to get water during the wet season compared to 7.4% during the dry season. Only a small proportion of households (0.3%) spend more than five hours during the dry season to get water.

Domestic and industrial waste management has remained a serious environmental problem in most urban areas in the country. As noted elsewhere, Bomet has no sewerage system. Solid waste management is also not adequate. Efforts are underway to mobilize the necessary resources to put up a water and sewerage system. It is advisable that in the long run, the local authorities (Bomet Municipal and County Council), explore the option of privatizing solid waste management to make it more effective and efficient.

10.3.3 Road Transport

The present road transport network in country range from tracks to multi-lane urban and sub-urban highways. The system is divided into classified and unclassified roads. In Bomet, a total of 123 Km are paved, 5,932 Km are graveled and 354 Km are earth roads (Table 10.15).

Table 10.15 Classification of road network by length and surface type

Class of Road	Surface Type			Total
	Bitumen	Gravel	Earth	
International trunk Road (A)	0.0	0.0	0.0	0.0
National trunk Roads (B)	62.0	0.0	0.0	62.0
Primary Roads (C)	48.0	86.6	0.0	134.6
Secondary Roads (D)	13.0	151.8	512.4	216.2
Minor Roads (E)	0.0	136.8	191.6	328.4
Rural Access Roads (R)	0.0	198	16	214
Tea Roads (classified)	0.0	20	25.8	45.8
	0.0	0	69.2	69.2
TOTAL	123	593.2	354	1070.2

Source: - District Development Plan (1997-2000)

Road transport has the potential to cause environmental damage if appropriate mitigative measures are not embraced. These include increasing noise pollution and clearance of vegetation and prime agricultural land to make room for road construction. Increased number of vehicles further compromises environmental human and health due to increased air pollution.

10.3.4 Air Transport

Air transport has the potential to cause negative environmental impacts through emission of gaseous pollutants, utilization of large tracks of land for the construction of airports/airstrips and solid waste disposal.

Bomet has one airstrip that is not busy. It is occasionally used by small aircrafts mainly delivering drug supplies to Tenwek Mission Hospital. This mode of transport is therefore not of major concern to the District with regard to pollution and waste management.

10.3.5 The Financial Sector and Business Support Services

Bomet is served by only one bank, Kenya Commercial Bank. There are several other micro-finance institutions, which include the Kipsigis Teachers' Front Office Service Operations, Post Bank, rural-based financial services associations (FSAs), FAULU-K, Kenya Women Finance Trust and Agricultural Finance Corporation (AFC). There are also several insurance brokerage offices. The impacts of these institutions on the environment are minimal.

10.3.6 Hotels

There are no tourist class hotels in Bomet. The smaller and more numerous eating-places and lodgings across the District are of more concern environmentally because cumulatively and collectively, they generate a lot of waste whose management needs to be planned for.

Hotels generate solid wastes some of which may lack appropriate treatment facilities. The disposal of effluents, detergents, and solid wastes contribute to degradation of natural habitats especially when it leads to contamination of rivers and other water bodies. In this regard, Bomet town is of major environmental importance, given that it lies along Nyangores River, which is a major tributary to the trans-boundary Mara River.

10.3.7 Laundry Services

This is one of the fastest growing businesses with high use of chemical detergents. The sector offers numerous employment opportunities in the detergent and laundry industries and is therefore of national importance. However, laundry services impact negatively on the environment through the release of effluents into natural water systems.

Laundry services are a major source of chemical pollutants countrywide, especially those dumped into the environment through discharge of effluents. Although this sector is still at its infancy stages in Bomet, it could prove to be of great concern given the fact that the Municipality lacks a sewerage and effluent treatment facility so far.

10.3.8 Hawking

Since Kenya liberalized her economy in the 1980s, hawking has increased significantly in all the urban centers. There are three main categories of hawking, namely hawkers of local and imported products, vegetables and fruit hawkers, and street traders with specific areas of operation.

Hawking is associated with littering of streets in towns. In Bomet, like other towns, inadequate infrastructure for effective waste collection and disposal has lead to accumulation of solid waste. The Municipality should be encouraged to control and manage street hawking through allocation of alternative sites to registered hawkers. This will greatly enhance waste collection efficiency and reduce littering within the Municipality.

Table 10.16 Summary of Service Industry

Transportation (Total KM of Road)			
Murram (Gravel) = 600	Earth Roads = 200	Paved = 75	No. of Public Service Vehicles = 300
Railway Transport and Ports			
Total KM of Railway Line = Nil		No. of Ports, including inland container depots = Nil	
Air and Water Transport			
No. of Water Ways = Nil		No. of Airstrips = 1	
Communication			
% Households with Landline Telephones = 0.4		No. of Private/Public Organizations with Landline Telephones = 500	
Mobile Telephone Coverage = 2 service providers (Safaricom and Celtel), covering almost the entire District			
No. of Post/Sub-Post Offices = 11		No. of Telephone Booths = 30	
No. of Cyber Cafes = 1 (Post Office – Bomet)		% Households Using Radios = 75	
Trade, Tourism and Commerce			
No. of Trading Centers = 10		No. of Licensed Businesses = 1,500	
No. of Informal Sector Enterprises = 260		No. of Hotels = 20	No. of Tourist Class Hotels = Nil
Banks and Other Financial Institutions			
No. Of Banks = 1 (K.C.B.)	No. Of Mobile Banks = 1	No. of Micro-Finance Institutions = 6	

Source: District Development Plan (2002 – 2008), and S.O.E. (2004)

CHAPTER ELEVEN

11.0 TOURISM

The tourism industry is heavily dependent on the vast and abundant natural resources in the country. These include: wildlife, beaches, landscapes, and diversity of cultural, historical and archeological resources.

Since the natural and cultural resources are unique, fixed in location and often irreplaceable, it is important to control the degree and manner in which they are exploited and to anticipate the effect on the sustainability of tourism by different methods of exploitation. Tourism, if properly planned will contribute to the conservation and management of the environment. For better management of this sector, such information as the type and potential for tourism, expected trends in tourism development, key environmental issues in the sector, institutional and regulatory arrangements, management challenges, and possible interventions are important to document.

CHAPTER TWELVE

12.0 MINING AND QUARRYING

Kenya has great potential for mineral resources exploration and exploitation for economic development. Mining methods involve some disturbance of the earth surface and the underlying strata including aquifers. Some potential adverse impacts on the environment from mining and quarrying activities are likely to occur.

Mining in Kenya is regulated by the Mining Act (Cap 306), which was enacted in the 1940s together with the accompanying regulations. The Act is presently being reviewed in order to promote mineral resources development through private sector participation.

The relevant local authorities under the Local Government Act regulate Quarrying and Sand Harvesting activities. However, the Mines and Geology Department intervenes where commercial explosives are used in the extraction of building and construction materials and where environmental reconstruction is concerned.

Bomet District has limited Quarrying, and Sand Harvesting Activities. There is no known potential for any minerals, and the contribution to the District's income from Quarrying, and Sand-Harvesting activities has not been established. Rehabilitation of Quarrying and Sand-Harvesting sites is virtually non-existent.

12.1 Mining

It is worth-noting that there are no minerals mined in the District and therefore no environmental issues associated with mining in the District.

12.2 Quarrying

There are only limited quarrying and sand harvesting activities in the District (Table 12.1 & Plate 12.1). The contribution to the District's income from quarrying, and sand-harvesting activities has not been established although it is thought to be minimal, given that most of the quarried building stones come from the neighbouring district of Narok. Bricks are also used widely in the local construction industry. Rehabilitation of quarrying and sand-harvesting sites is virtually non-existent (Table 12.2).

Table 12.1 Inventory of Quarries

Quarry	Location	Owner	Materials Extracted	Status	Remarks
Bomet	Bomet Town, near St. Michaels Secondary	Bomet Municipal Council	Construction stones	Still in use	Municipal Council uses it as a temporary dumping site for solid waste
Kanusin	Off Chebole-Siongiroi road	Excavated by TM-AM Company on Private Land	Ballast	Extraction of Materials Complete	Could be turned into a Water Pan/Fish Pond
Sisei	Near Sisei bridge along Bomet – Kaplong road	Excavated by TM-AM Company on Private Land	Ballast	Extraction of Materials Complete	Presently used as a Community Water Point
Kapchelug et I	Off Longisa-Kapkimolwo	Excavated by TM-AM	Ballast	Extraction of	Presently used as a Community Water

	road	Company on Private Land		Materials Complete	Point
Kapchelug et II	Off Longisa-Kapkimolwo road	Excavated by Njuca Company on Private Land	Ballast	Still in use	To be turned into a water pan by the company as per the terms of the contract

Plate 12.1 A Section of Bomet Quarry (Also used a temporary dumping site by the Municipal)



12.2.1 Trends in Extent of Quarries

Table 12.2 Trends in extent of quarries

Type of quarry	Cumulative Size of un-rehabilitated quarries in Ha				Mitigation Measures
	1991 – 1995	1996 – 2000	2001 – 2005	Projection for 2010	
The extent of the few quarries in the District has been slowly increasing, driven by the rising demand of construction materials. There are no projections done, but it is expected that this trend of increasing extent will continue for the foreseeable future, and specifically in the plan period					

12.2.2 Key Environmental Issues in Quarrying Sector

Table 12.7 Priority issues and interventions

Priority issues/challenges	Current interventions	Proposed interventions	Responsible institution	Remarks
Environmental Audit for the quarries in use	District Environment Office sensitizing the owners of the	Enhancement of capacity to regulate quarrying activities	Relevant Local Authorities	

	quarries to undertake EA			
Rehabilitation of abandoned quarries	Inventory of quarries prepared and possible options for rehabilitation and/or use identified	Enforcement of existing legislation on Rehabilitation of quarries	Relevant Local Authorities, N.E.M.A., and other government agencies	Most of the quarries not in use could be put to alternative use e.g. fish ponds and communal water points

12.3 Sand Harvesting

Table 12.8 Status of sand harvesting

Source of sand	Method of sand harvesting	Name of site/location	Size of site (Ha)	Quantity extracted (Annual)	Regulatory agency	Environmental impacts
Most of the sand used in Bomet comes from Narok or Kisumu. There is only one sand-harvesting site but the sand that is produced there is considered to be low quality. The site is on private land at Kyogong village, off Bomet – Sigor road. It is likely to be in use for long and expand given the rising demand for sand.						

Table 12.9 Trends in extent of sand harvesting sites

Source of sand	Cumulative Size of un-rehabilitated harvesting sites in (Ha)				Mitigation Measures
	1991 – 1995	1996 – 2000	2001 – 2005	Projection for 2010	
The demand for sand has been rising, but quality sand harvesting sites are not common in Bomet. The one site in use has been expanding over time.					

12.3.1 Key Environmental Issues in Sand Harvesting

Table 12.10 Priority issues and interventions

Priority issues/challenges	Current interventions	Proposed interventions	Responsible institution	Remarks
Environmental Audit for the sand harvesting site	Notification of the owners of the site to carry out and EA	Enforcement of existing legislation to ensure Annual Auditing of the site and Monitoring	Relevant Local Authority and N.E.M.A.	

CHAPTER THIRTEEN

13.0 ENVIRONMENTAL HAZARDS AND DISASTERS

Most environmental disasters are climate/weather and tectonic related. Disasters can be natural or man-made which may lead to destruction of environment (land degradation), life (epidemics), and property. The causes are invader species, droughts, floods, landslides, earthquakes, accidents, lightning, fire, disease outbreaks, technological disasters and other disasters (Table 13.1). Disasters have a tendency to retard and erode gains made in building meaningful livelihoods and economic development.

13.1 Extent and Trends of Environmental Hazards and Disasters

Table 13.1 Type of hazards and occurrence/trends

Type of Disaster	Year						Remarks
	1960s	1970s	1980s	1990s	2000s	2005	
Floods				Floods were only experienced during the 1998 El-Nino Rains.			
Droughts				Cyclic droughts occur occasionally, affecting the semi arid Divisions of Sigor and Siongiroi to a large extent. Annual dry spells are also comparatively more severe in the two divisions.			

NB: Other occurrences like fire, diseases outbreak, and accidents have been reported but the scale has been minimal

Table 13.2 Type of Disasters and their impacts

Type of Disaster	Severity	Year				Remarks
Floods		1980s	1990s	2000s	2005	These occurrences have usually been comparatively low key in the District.
	No. Of people killed/affected		Nil			
	Property damaged/destroyed		Nil			
Droughts	No. Of people killed/affected		Nil	Nil	Nil	
	Property damaged/destroyed		The value of Animals that usually die is not documented			

13.2 Status of Early Warning and Preparedness

Capacities to mitigate and recover from disasters are often constrained by lack of early warning and preparedness, keeping in mind the social dimensions and livelihood options that hamper the building of resilience from external shocks. Each District should take stock of its capacities of early warning and disaster preparedness in each sector. It should also develop a mechanism for coordinating sectors resources for interventions.

Table 13.3 Sector capacities for disaster preparedness and response

Sector	Type of Disaster	Human Resource	Technical (Equipment)	Financial	Coordinating Mechanisms (Logistics)	Lead Agency
An assessment of sector specific capacities for disaster preparedness and response has not been done!						

13.3 Proposed Interventions

13.3.1 Corrective Actions

Each District has a set of unique disasters hence require appropriate interventions for those disasters. Each District should therefore review disaster mitigation actions in relation to existing policies, legal, institutional and indigenous prediction methods and disaster coping mechanisms. These include existing policies and other aspects of development planning (Table 13.4).

13.3.2 Preparation of a Risk Reduction and Contingency Plan

Such a plan should cover conservation, preparedness, monitoring, early warning, mitigation, response, recovery, and post recovery. The District should also identify institutions/agencies that will be involved in the processes outlined on day-to-day basis as well as outline the working protocol and information sharing mechanisms.

Table 13.4 Priority issues and interventions

Priority issues/challenges	Current interventions	Proposed interventions (2006–2010)	Responsible institution	Remarks
Assessment of sector specific capacities for preparedness and response	None	Carrying out of the Assessment and Documentation	Respective sectors	Each sector should carry out its own assessment and report to an oversight organ like the District Disaster Committee
Preparation of a risk reduction and contingency plan	None	Preparation of the plan and sensitization of the relevant stakeholders on the contents of the plan	District Disaster Committee	

CHAPTER 14

14.0 ENVIRONMENTAL EDUCATION AND TECHNOLOGIES

As Kenya aspires to achieve sustainable development, there is need to educate the public on the importance of participating in environmental conservation and application of appropriate technology while addressing their socio-economic development concerns.

14.1 Status of Environmental Education

Table 14.1 Status of environmental programs in schools

No. of Schools			Types of Environmental Programs	Remarks
Primary	Secondary	Tertiary		
The actual status of environmental programs in Schools has not been documented. But various schools are involved in various ways in environmental education usually through environmental clubs. Programs noted involve mainly Tree planting				

Table 14.2 Status of Environmental Programmes in the District

Environmental Programmes	Key Players	Challenges	Proposed Interventions
Afforestation	Forest Department, WWF, Action Aid, and FOMAWA, MRWUA	High cost of tree nurseries establishment and equipments	Encouragement of involvement of more stakeholders in Afforestation and especially the private sector
Soil and Water Conservation	Ministry of Agriculture, and WWF, MRWUA	Poor cultivation practices and reduced capacity for enforcement of existing legislation	Enhanced public education and capacity building of relevant stakeholders in conservation
Agro-forestry	Forest Department, ADRA-K, Action Aid, WWF, SICODO	Low adoption of Agro-forestry practices	Increased community mobilization
Water Sources Protection	Ministry of Water and Irrigation, WWF, Action Aid	Low level of coverage due to limited resources	Involvement of more stakeholders
Environmental Health Promotion	N.E.M.A., Public Health Department, Tenwek Community Development Program	Low level of coverage due to limited resources	Involvement of more stakeholders

14.2 Public Awareness and Participation

When information on the environment is made available to the public, it enhances the internalization of values that support sustainable environmental management.

Table 14.3 Status of Environmental awareness and Public participation in the District

Program mes	Key Players	Sect or	Environmen tal Benefits	Opportuni ties	Challeng es	Interventions
The public is continuously becoming more sensitized and receptive towards environmentally sound initiatives. However, more needs to be done in the area of mobilization and involvement so as to consolidate the gains already made						

14.3 Technologies

Technologies can contribute to the economic development and environment conservation when used appropriately. Such technologies as Biotechnology, Clean Production technologies, and Energy saving technologies enhance the overall environmental conservation and management. Such technologies need to be encouraged to take root in the District.

14.4 Prioritization of Key Environmental Issues

Table 14.4 Priority issues and interventions

Priority issues/challenges	Current interventions	Proposed interventions (2006 –2010)	Responsible institution	Remarks
Documentation of the actual status of environmental programs in learning institutions	None	Carrying out of a comprehensive survey to establish the status of environmental programs in learning institutions and to recommend ways of mainstreaming them in the school curriculum	N.E.M.A. through the District Environment Committee, Ministry of Education and other relevant stakeholders	
Enhance public engagement and participation	Organizing occasional Clean-ups and Environmental Days	Design a District annual calendar of events involving public mobilization and participation	District Environment Committee and other relevant stakeholders	Such events should aim to take the mobilization to the grassroots and seek to organize common interest groups for sustainability

CHAPTER FIFTEEN

15.0 ENVIRONMENTAL INFORMATION SYSTEMS

The broad challenge in harnessing environmental information and communication technology include inadequate resources and capacity for information collection, analysis, storage, and dissemination; inadequate awareness among environmental managers and the public; and lack of knowledge sharing networks at grass root level.

To lay the foundation of addressing these issues, it's important to document the types, sources and status of environmental information, address issues of access, dissemination and utilization of the information, and establishment of documentation centers in the District.

15.1 Types and sources of environmental information

Table 15.1 Information and data types in the District

Sector	Type of information	Form – GIS/Maps/ Reports/Electronic/Books	Institutions	Access Conditions	Users	System of Updating
The types of information at the District are mainly in the form of Maps, Reports and Books. However, with the continuing growth of ICT in the District, sources of information in electronic form are starting to emerge. A catalogue of the type of information available, where to access it, and access conditions does not exist in the District						

15.2 Status of Environmental Information Management System

The District has no Environmental Information Management System (EIMS). The District Environment Committee should explore options of establishing an Environmental Information documentation center to lay the foundation of EIMS. Such a system should target to enhance documentation and information sharing among stakeholders in the District.

15.3 Indigenous Knowledge (IK)

Kenya has over 42 different ethnic communities with a very rich indigenous knowledge (IK) base unique to each community. This cultural diversity offers potential information that can be exploited to contribute positively to national development and environmental sustainability. Information on IK has not been well documented and properly packaged to allow effective dissemination, hence contributing to the massive loss of IK from one generation to the next since the few remaining practitioners die with the knowledge.

Table 15.2 Types of IK, key players and challenges

Sector	Types of IK	Form – Oral, Music, Artifact	Instructions/Individual Holding	Access Conditions	Users
A catalogue of the type of Indigenous Knowledge available, its form, where to access it (institutions/individuals holding it), and access conditions does not exist in the District.					

15.4 Proposed interventions

Table 15.3 Priority issues and interventions

Priority issues/challenges	Current interventions	Proposed interventions (2006 –2010)	Responsible institution	Remarks
Preparation of a catalogue of environmental information available in the District	None	Carrying out a comprehensive survey to establish the type of information available, where to access it, access conditions, and means of updating it	N.E.M.A. through the District Environment Committee	
Preparation of a specific catalogue on Indigenous Knowledge	None	Carrying out a comprehensive survey to establish the type of Indigenous Knowledge available, its form, where to access it (institutions/individuals holding it), and access conditions	N.E.M.A. through the District Environment Committee and all other relevant stakeholders	
Establishment of an Environmental Information Documentation Center	Collecting materials available in the District mainly in form of reports	Sourcing of more relevant materials from outside the District and making it accessible to the public.	District Environment Committee	The D.E.C. should also aim to distribute relevant environmental information aimed at influencing the public and mobilizing support on various environmental issues affecting the District

CHAPTER SIXTEEN

16.0 ENVIRONMENTAL GOVERNANCE AND INSTITUTIONAL FRAMEWORKS

Environmental governance entails the formulation of comprehensive environmental policies, and the enactment of supportive legislative regimes. These should be complemented by strong and well-coordinated environmental institutions. The institutions would then draw up, and enforce environmental regulations and standards, to ensure sound environmental management. The public and civil society organizations should also be facilitated to access and use information on environmental policies and legislations. An informed society will have enhanced ability to make decisions and fully participate in sustainable development issues. For developing countries that rely mainly on natural resources, the achievement of sustainable development will depend on the empowerment and capacity of the public and civil society to complement the government's efforts in environmental management. Lastly, full environmental governance will be achieved where individual countries have the capacity to domesticate and take advantage of the technical and financial facilities provided for in various Multilateral Environmental Agreements (MEAs).

Environmental governance policies and legislations in Kenya have evolved from important global fora such as the UN conference on Human Environment held in Stockholm, Sweden in 1972, the World Commission on Environment and Development, which published "*Our Common Future*" (Brundtland Report) in 1987, and the UN Conference on Environment and Development (UNCED), held in Rio de Janeiro, Brazil in 1992. The conference adopted *Agenda 21*, a global plan of action to achieve sustainable development.

At the national level, the National Environment Action Plan (NEAP) was adopted in 1994, followed by the formulation of the Environment and Development Policy and the enactment of the Environmental Management and Coordination Act (EMCA) in 1999.

16.1 Status of Environmental Governance and Institutional Arrangements

EMCA (1999) created the following institutions to implement the provisions of the Act:

a) National Environment Council (NEC)

This is responsible for policy formulation, setting national goals and objectives and determining priorities for the protection of the environment, including promoting cooperation among public departments, local authorities, private sector, non-governmental organizations, and such other organizations engaged in environmental protection programs

b) National Environment Management Authority (NEMA)

This is the principal instrument of government in the supervision, coordination and the implementation of all policies relating to the environment. NEMA's office was opened for the first time in Bomet in October 2004.

c) NEMA Management Board

It is mandated to control, supervise and administer the assets of the authority; provide for capital and recurrent expenditure and for reserves of the Authority, receive any grants, gifts, donations or endowments and make legitimate disbursements therefrom;

enter into associations with other bodies or organizations, operate accounts for the funds of the Authority and invest any funds of the Authority.

d) Provincial and District Environment Committees (PECs and DEC)s

These committees are responsible for the proper management of the environment within the Province or District in respect of which they are appointed. The District Environment Committee for the District was gazetted via Kenya Gazette Notice No. 8949 – No. 77 of 11th December 2005, alongside other committees countrywide. Its appointment is valid for three (3) years with effect from 1st July 2005. The operations of this committee have been greatly curtailed by lack of adequate funding so far.

e) Standards and Enforcement Review Committee (SERC)

It advises the Authority on how to establish criteria, procedures and standards for water quality; conditions for discharge of effluents into the environment, guidelines or regulations for the preservation of fishing areas, aquatic areas, water sources, and reservoirs, and other areas where water may need special protection; and collect, maintain and interpret data from industries and local authorities on pretreatment, nature and levels of effluents. It also advises on standards of air quality and noise pollution among other standards.

f) National Environment Action Plan (NEAP) Committee

The committee facilitates the integration of environmental considerations into policies, plans, programs and projects. It prepares a national environment action plan every five years for consideration and adoption by the National Assembly. The committee was launched in June 2003. It will incorporate the DEAPs and PEAPs being prepared to produce its first NEAP report.

g) EIA Technical Advisory Committee (TAC)

It reviews/assesses and advises on EIA documents/reports/requests/comments received by the Authority.

h) Public Complaints Committee (PCC)

It investigates any allegations against any person or against the Authority in relation to the condition of the environment in Kenya; on its own motion, investigates any suspected case of environmental degradation, and to make a report of its findings together with its recommendations thereon to NEC. PCC also facilitates the public to have access to the environmental information they need. Access to information is a powerful tool in ensuring compliance and public participation.

i) National Environment Tribunal (NET)

The Tribunal shall, upon an appeal made to it in writing (against a decision or decisions taken by NEMA) by any party or a referral made to it by the Authority on any matter relating to EMCA inquire into the matter and make an award, give directions, make orders or make decisions thereon. Every award, direction, order or decision made shall be notified by the Tribunal to the parties concerned, or any relevant committees.

16.2 Regulatory and Management Tools

EMCA does not replace hitherto existing laws, which deal with specific sectors or components of the environment. It is applied alongside the existing legislation governing the different sectors of the environment. Therefore, such laws as the Water Act, the Wildlife Management Act, the Forest Act, the Fisheries Act and the Physical Planning

Act, continue to apply and the law expects that the technical directors of the respective departments will assume a major role as lead agencies of NEMA. This is already taking shape at the District level, with active participation of the respective departmental heads at the District Environment Committee level.

However, where any previous legislation has provisions that conflict with EMCA, the provisions of EMCA will override that other law to the extent of that conflict. For example, where a law did not provide for the public to be consulted on issues touching on the environment that is now mandatory under EMCA.

EMCA has also put in place various Environmental Management Tools. These are: The National Environment Action Plan (NEAP), Environmental Impact Assessment (EIA), Environmental Audit and Monitoring (EA & M), Research, Surveys and Inventories, Environmental Education, Environmental Quality Standards, and Fiscal Incentives and Penalties.

Table 16.1 Facilities that have carried out EIA/EA

No.	Facility	Status
1.	Kapkoros Tea Factory	Already carried out an Audit
2.	Up-coming Tirgaga Tea Factory	In the process of carrying out an Assessment
3.	Siongiroi Dairy Plant Ltd	Already carried out an Audit
4.	Petrol Stations	Only two, (Mobil, and Bomet Highway Petrol Station) have carried out Audits
5.	Hospitals	Only Tenwek Mission Hospital is in the process of carrying out an Audit
6.	Municipal Council	Has not carried out an Audit of its dumping site
7.	Schools	None has carried out an Audit

Source: State of Environment (2004) Report

16.2.1 Key Issues in Compliance and Enforcement

Table 16.2 Policies which impact on the environment

Title of Policy	Yr Formulated	Environmental issues addressed	Implementing Institution	Coordinating Mechanisms	Challenges in Compliance & Enforcement	Areas of Overlap with EMCA
Environment and Development Policy	1999	Various	NEMA	Recommended formation of institutions to implement the policy	Low levels of awareness and lack of adequate resources	None
Other policies still being studied						

Table 16.3 Legislation that impact on human health and environmental quality

Title of Legislation	Year of Gazettment	Environmental issues Regulated	Implementing Institution	Coordinating Mechanisms	Areas of Overlap & Conflict with EMCA
Water Act, the Wildlife Management Act, the Forest Act, the Fisheries Act and the Physical Planning Act, and Public Health Act					

Table 16.4 Regulations and by-laws for managing environmental and human health

Title of Regulation & Gazettement Notice No.	Year of Gazettement	Environmental issues Regulated	Implementing Institution	Coordinating Mechanisms	Areas of Overlap & Conflict with EMCA
Still being investigated!					

16.3 Multilateral Environmental Agreements (MEAs)**Table 16.5 Sources of funds for programs in the District**

Programmes/ Projects/ Activities	Date Started	Duration (Yrs)	Total Amount (Kshs.)	Source of Funding	Actors	Remarks
There are no Programs/Projects/Activities currently being implemented in the District as a result of funding from any Multilateral Environmental Agreement						

16.3.1 Proposed Interventions**Table 16.6 Priority issues and interventions**

Priority issues/challenges	Current interventions	Proposed interventions (2006 –2010)	Responsible institution	Remarks
Capacity building of the District Environment Committee	Training of the D.E.C. on the provisions of EMCA and its (D.E.C's) mandate	Establish structures and reporting mechanisms at the Divisional Level	NEMA and all other stakeholders	This will take the D.E.C. closer to the public and stimulate participation

CHAPTER SEVENTEEN

17.0 IMPLEMENTATION STRATEGY

As envisaged by EMCA, the implementation of this District Environment Action Plan is Multi-disciplinary and Crosscutting. It is therefore heavily depended on the effective Capacity building of the District Environment Committee to enable it coordinate the implementation, monitoring and evaluation. Further, the list of environmental issues drawn so far is not exhaustive by any means. It will require constant revision to take care of emerging issues.

Table 17.1 Implementation Strategy

No	Priority Issue	Responsible Institution/s
1.	Capacity building of the District Environment Committee to enable it play its role of proper management of the environment at the District level adequately	N.E.M.A., and other relevant stakeholders
2.	Installation of a Water and Sewerage Handling Infrastructure	Municipal Council and other relevant stakeholders
3.	Establishment of Proper and Adequate Infrastructure for Solid Waste Management	Municipal/County Council and other relevant stakeholders
4.	Public mobilization and enforcement of standards and guidelines to enhance public engagement and participation	District Environment Committee and other relevant stakeholders
5.	Encourage investment in the development of alternative sources of water e.g. Roof Catchment and Boreholes	Relevant stakeholders
6.	Restoration of degraded water catchment areas and intensification of reforestation efforts across the District	Forest Department, District Environment Committee, and other relevant stakeholders
7.	Intensify Soil and Water Conservation	Ministry of Agriculture and other relevant stakeholders
8.	Address issues of poverty alleviation through improved food security, provision of amenities and improved security	All relevant stakeholders
9.	Promotion of Energy Saving Technologies and diversification of sources of energy	All relevant stakeholders
10.	Address gender constraints in fuel wood access, ownership and conservation	All relevant stakeholders
11.	Support the ongoing formulation and implementation of the National Charcoal Policy	Relevant stakeholders
12.	Address issues of safe and sustainable use and handling of Agro-chemicals	Ministry of Agriculture and other relevant stakeholders
13.	Empowering communities to take up the management of Natural resources like Forests and Water through formation of Forest Users Associations and Water Users Associations	Forest Department, Water Resources Management Authority and other relevant stakeholders
14.	Improvement of livestock productivity so as to limit overstocking	Ministry of Livestock and Fisheries development and other relevant

		stakeholders
15.	Establishment and documentation of the exact status and extent of Indigenous Knowledge and Technologies	Relevant stakeholders
16.	Establishment of adequate structures for Biodiversity Management and protection against potential Biopiracy	N.E.M.A. through the District Environment Committee, and other relevant stakeholders
17.	Encourage private sector participation in Environmental Conservation and Management	N.E.M.A. through the District Environment Committee, and other relevant stakeholders
18.	Assessment of Sector specific capacities for disaster preparedness and response mechanisms	Relevant stakeholders
19.	Preparation of a risk Reduction and Contingency Plan	Relevant stakeholders
20.	Assessment and documentation of the actual status of environmental programs in the learning institutions	N.E.M.A. through the District Environment Committee, Ministry of Education and other relevant stakeholders
21.	Preparation of a catalogue of environmental information available in the District	N.E.M.A. through the District Environment Committee, and other relevant stakeholders
22.	Establishment of an Environmental Documentation Center	District Environment Committee, and other relevant stakeholders

17.1 Stakeholders Involvement

The stakeholders were involved to amend and adopt the DEAP document for Bomet District. A total of seventeen stakeholders from the government departments, CBO's, NGO's and private sector attended the meeting. Their request is if those activities can be carried at in Bomet, then our environment could be saved from degradation. The biggest setback is the enormous resources required.

17.2 Resources requirements

The resource requirement has been outlined in the implementation matrix and no one stakeholder can implement those activities alone, but requires partnership and collaboration. The enormous resources can be raised from the government of Kenya budget, donors, private sector and other well wishers. Interest parties are requested to write proposal to willing sponsors for any of those activities Government departments can also use the documents to make their annual budgets.

17.3 Monitoring and Evaluation

M& E is a very important component of any activity and therefore it has been given emphasis. The action plan identifies implementers and responsible stakeholders, but not shut out. Annual reports need to be developed to show achievements or failures of activities identified. The existing monitoring and evaluation team in the district can be adopted to carry out this noble duty.

TABLE 17.2 IMPLEMENTATION MATRIX

Priority issues	Objectives	Output	Activities	Time frame	Stakeholders	Responsible institution	Est. cost 06/07 Kshs	07/08 Kshs	08/09 Kshs	09/10 Kshs	11/12 Kshs	Remarks
Capacity building of DEC	To empower DEC	Improved environmental management in the district	-Train DEC members -Hold ¼ meetings -Train committees to sub-location level	2005 - 2010	DEC Members and community	NEMA	1.3 M	1.4 M	1.4 M	1.45 M	1.55 M	DEC has been gazetted
Installation of sewerage system & expand water supply system in Bomet town	-To ensure proper handling of effluent -Ensure supply of safe water	-Improved waste disposal -Increase access to safe drinking water	-Survey & design -Tendering -Sourcing of funds -Implementations & construction -Provision of public toilet in town -Promote use of septic tanks in towns -Expansion of water supply in Bomet	2007 - 2010	BMC BCE WRMA NBI Other stakeholders	Local authorities Water & sewerage companies	4.2 M	37 M	100 M	110 M	-	Design & E.I.A in progress
Est. of proper &	To enhance	Improved solid waste	-Promote the following:	2005 -	-local authorities	NEMA	10 M	10 M	10 M	10 M	10 M	- Implementa

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adequate infrastructure for solid waste management	proper solid waste management	management	-Recycling - Decomposing -Land filling - Incineration -Installation of litter bins	2010	-other stakeholders							-tion of waste management regulation in process
Restoration of degraded water catchment area & intensification of reforestation efforts across the district	To restore water catchment & forest cover	-Improved forest cover in the district -Restore water catchments in district	- Tree planting - Designate catchment areas & forest area -Create awareness - Surveillance -Promote river bank protection -Promote farm tree forestry	2005 - 2010	KFS MOA WRMA NEMA	-WRMA -forest (K.F.S) -NGOs -CBOs	15 M	15 M	20 M	25 M	30 M	Forest cover stands at 1 %

TABLE 17.2 IMPLEMENTATION MATRIX contd.

Priority issues	Objectives	Output	Activities	Time frame	Stakeholders	Responsible institution	Est. cost 06/07 Kshs	07/08 Kshs	08/09 Kshs	09/10 Kshs	10/11 Kshs	Remarks
Soil & water conservation	Reduce soil erosion &	Enhance soil & water conservation	-Promote organic farming -Water	2005 - 2010	CBOs NGOs GOK	-MOA -NEMA -WRMA	300,000	400,000	500,000	600,000	1 M	Soil conservation requires

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	conserve water		harvesting - Construction of soil conservation structures -Awareness creation -Construction of cattle drinking points -Construction of water harvesting structures on cost sharing basis		departments Other stakeholders	-KFS						integrated approach
Poverty & food insecurity	To alleviate poverty and improve food security in the district	Reduce poverty levels Improve food production	-Capacity building & awareness e.g. field days, demonstration & tours -Promote drought tolerant crops -Improve marketing channels -Improve storage	2007 - 2010	CBOs NGOs GOK departments Other stakeholders	-MOA - KFS	20 M	15 M	10 M	8 M	5 M	Poverty levels in Bomet district is 54 %

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			structures -Promote emerging crops - Establish agro industries									
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TABLE 17.2 IMPLEMENTATION MATRIX contd.

Priority issues	Objectives	Output	Activities	Time frame	Stake - holders	Responsible institution	Est. cost 06/07 Kshs	07/08 Kshs	08/09 Kshs	09/10 Kshs	10/11 Kshs	Remarks
Private sectors participation in environmental conservation & management	To involve private sector in environmental conservation & management	Enhance private sector participation in conservation and management	-Promote energy saving technologies e.g. energy saving jikos, Biogas & Solar - Carry out EIAs - Use of cleaner production technologies -Participation in formulation of charcoal policy -Promote sustainable charcoal harvesting	2005 - 2010	Private sector NGOs NEMA	-Private sector -NEMA	3 M	4 M	4 M	4 M	5 M	- Private sector is involved in energy saving technologies
Handling Of Agro – Chemicals Hazardous waste	To increase awareness of use, handling & disposal of	- Safe use of Agro & Hazardous chemicals -Proper disposal	-Training / Capacity building in handling and disposal -Monitoring	2005 - 2010	CBOs NGOs GOK departments Farmers Other	MOA NEMA AAK Industries / Manufacturers	1 M	1.5 M	2 M	2 M	2.5 M	- Currently there is improper disposal of chemicals

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	chemicals				stakeholders							
Low livestock productivity	To increase livestock productivity	Increase income from livestock and livestock products	-Promote pasture and fodder production -Promote optimum stocking rates -Improve livestock breeds - Awareness - Value addition in livestock products - Promote silviculture, Aquaculture & bee keeping	2007 - 2010	CBOs NGOs Farmers GOK departments Other stakeholders	-MOA - KFS -MOLFD NGOs - Research institution	5 M	10 M	10 M	15 M	20 M	Livestock is the main livelihood activity in Bomet District

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Priority issues	Objectives	Output	Activities	Time frame	Stakeholders	Responsible institution	Est. cost 06/07 Kshs	07/08 Kshs	08/09 Kshs	09/10 Kshs	10/11 Kshs	Remarks
Poor biodiversity management	To promote sustainable use of biodiversity	- Sustainable utilization of biodiversity	-Promotes sustainable use of Biodiversity -Awareness - Training -Survey & documentation of biodiversity -Wetland protection -Hilltop conservation -Pollution control -Policing against bio piracy & patent issues	2005 - 2010	Private sectors CBOs NGOs GOK	KFS NEMA Research institution NGOs	2 M	3 M	5 M	5 M	4 M	
Inadequate disaster preparedness & response mechanism	To establish proper disaster management structures	Enhance disaster preparedness safety	-Awareness & Training - Est. disaster management committee -Est. a kitty for disaster response -Purchase disaster management	2007 - 2010	Local authorities NGOs GOK departments CBOs Other stakeholders	- Local authorities -Provincial administration -Private sector	50 M	60 M	40 M	30 M	20 M	District is highly risky area i.e. Drought , quarrying activities & floods

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			equipment									
Poor biodiversity management	To promote sustainable use of biodiversity	- Sustainable utilization of biodiversity	-Promotes sustainable use of Biodiversity -Awareness - Training -Survey & documentation of biodiversity -Wetland protection -Hilltop conservation -Pollution control -Policing against bio piracy & patent issues	2005 - 2010	Private sectors CBOs NGOs GOK	KFS NEMA Research institution NGOs	2 M	3 M	5 M	5 M	4 M	

District Environment Action Plan (2005-2010), Bomet

Priority issues	Objectives	Output	Activities	Time frame	Stakeholders	Responsible institution	Est. cost 06/07 Kshs	07/08 Kshs	08/09 Kshs	09/10 Kshs	10/11 Kshs	Remarks
Inadequate disaster preparedness & response mechanism	To establish proper disaster management structures	Enhance disaster preparedness safety	-Awareness & Training - Est. disaster management committee -Est. a kitty for disaster response -Purchase disaster management equipment	2007 - 2010	Local authorities NGOs GOK departments CBOs Other stakeholders	- Local authorities -Provincial administration -Private sector	50 M	60 M	40 M	30 M	20 M	District is highly risky area i.e. Drought, quarrying activities & floods
Lack of proper environmental Data base for the district	To establish an environmental data base for the district	- An environmental Data base in the district	-Establish an environmental documentation Centre -Assessment & documentation of the actual environmental status -Catalogue of environmental information	2005 - 2010	DEC Other stakeholders	-NEMA -National museums of Kenya -Research institutions -Ministry of gender, culture, sports & social services	-	20 M	5 M	3 M	2 M	An environmental documentation centre is not in the district

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			and ITK available in the district - Monitoring									
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TABLE 17.3 MONITORING AND EVALUATION MATRIX

No.	Activity	OVP's (objectives verifiable indicators)	MoV's (means of verification)	Reporting schedules	Implementation	Responsible institution M & E	Remarks
1.	Training and capacity building of DEC	-One training annually -Semi annual workshop for capacity building	-Reports -Attendance list	- Annually	NEMA & Other stake holder	NEMA	-Funding should be given priority
2.	-Holding quarterly DEC meetings	-One quarterly meeting in the district to address environmental issues	-Minutes - Reports -Attendance	-Quarterly	NEMA	NEMA	-Technical sub – committee need to be in place and funded
3.	Establishment & training of sub – committee for environment up to sub – location	-An environmental committee up to sub-locational level district wide -A training for each committee established	-Reports -Minutes -Training reports	Quarterly	-NEMA -Provincial administration -Other stake holders	NEMA & provincial administration	-these ensures public participation
4.	Establishment of sewerage system in Bomet municipality	-E.I.A & design reports -Tender awarded - A sewerage system in place	-Reports -Field visits	Quarterly & Annually	-Bomet municipal council -Sewerage & water company	-Bomet municipal council -Nile basin initiative	- E.I.A and design work in progress
5.	Expansion of water supply in Bomet Municipality	-An expanded water treatment plant. -Expansion of water lines -Increased water supply to town residents by over 50%	-Reports -Field visits - Interviews	Annually	-Lake Victoria South water board -Water & Sewerage company -Nile Basin initiative	-Water board -Nile Basin initiative	-The project has been founded with about Kshs 17 M

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6.	Promote provision of public toilets and use of septic tanks in urban centers	-One public toilet:-all majority towns in the district – total of about 6 towns -50 septic tanks constructed annually	-Reports -Field visits	- Annually	-Local authorities -Developers	-Public Health -NEMA -NGO'S	-District major towns lack public toilets
7	Promote proper waste management practices e.g. – Recycling, Decomposing and incineration	-5 Recyclers in the district -2 Decomposers in the district -1 land fill - 1 Operational incinerator in the district	-Reports -Field visits - Licenses issued	- Annually	-Local authorities -NEMA - Investors	-NEMA -Local authorities - Public health	-No proper waste management in the district

MONITORING AND EVALUATION MATRIX contd.

No.	Activity	OVP's (objectives verifiable indicators)	MoV's (means of verification)	Reporting schedules	Implementation	Responsible institution M & E	Remarks
8	Tree planting e.g. - Hill tops - River bank protection - Catchments - Institution Promotion of farm forestry	-3 hill tops rehabilitated - catchments areas conserved - 10 institutions have tree planted - 30 Kms of river banks protected -100 ha planted with trees	-Reports -Field visits -Photographs -Interviews	- Annually	-Kenya Forest Service (KFS) -NEMA -WRMA -NGO's -Other stake holders	-KFS -NEMA -MOA	-Rehabilitation is on - going
9	Promote soil and water conservation activities - Water harvesting - laying soil conservation structures - Designate catchments and forest areas - Construction of cattle watering points.	- 20 water harvesting structures in place - 50 Kms of soil conservation structures -20 areas designated - 10 water points constructed in the district	-Reports -Field visits - Interviews	-Semi Annually & Annually	-MOA -WRMA -KFS -MOLD&F - OP	-MOA -NEMA -WRMA -KFS	- Ministry of Agriculture currently doing much of the extension work

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10	<p>Promote cleaner production technologies</p> <ul style="list-style-type: none"> - Organize farming - Energy saving technologies -Cleaner energy sources 	<ul style="list-style-type: none"> - Cleaner technologies increase in the district by 20 % - Use of energy saving technologies raise from a current 1 % to 10% - Water pollution reduce by 50% 	<ul style="list-style-type: none"> - Reports - Field visits - Lab tests results 	-Annually	<ul style="list-style-type: none"> - Min of Agriculture - NGO'S - Ministry of Energy - Other stakeholders 	<ul style="list-style-type: none"> -M.O.A -WRMA 	
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MONITORING AND EVALUATION MATRIX contd.

No.	Activity	OVP's (objectives verifiable indicators)	MoV's (means of verification)	Reporting schedules	Implementation	Responsible institution M & E	Remarks
11	Promote sustainable agricultural & livestock production in the district -Drought tolerant crops and emerging crops -Storage structures & marketing channels -Establishment of Agro industries for value addition - Pasture and fodder production -Optimum stocking rate -Silk production, fish production and bee keeping	-Growing of drought tolerant crops and emerging crops increase by 30% -Farmers with proper storage structures increase by 20% -6 Agro industries established all over the district - 10 Ha of pasture and fodder established in the district - 20 % of the farmers upgrade their animals -Farmer in Bee keeping and fish farming increase by 20% and 10% respectively -Have 2 farmers do silk production	- Reports - Field visits - Interviews	-Annually	-MOA -MOLD& F - Investors -CBO's - NGO's	-MOA - MOLD& F	-Main stake holders are Ministry of Agriculture and Ministry of Livestock Development & Fisheries

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12	<p>Promote sustainable use of Biodiversity</p> <ul style="list-style-type: none"> - Sustainable charcoal harvesting - Document existing biodiversity - Policing against bio – piracy and patent issues - Wetland protection 	<p>-Sustainable charcoal burning move up to 20%</p> <p>-Have one report about biodiversity in the district</p> <p>-Reduce cases of bio- piracy by 50 %</p> <p>-wetland encroachment reduce by 50 %</p>	<ul style="list-style-type: none"> - Reports -Field visits -Kiln in place 	-Annually	<ul style="list-style-type: none"> -KFS - NGO's -CBO's -WRMA -Museums of Kenya -KWS -NEMA 	<ul style="list-style-type: none"> -WWF -NEMA -KFS 	-No documented report on biodiversity for the district
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MONITORING AND EVALUATION MATRIX contd.

No.	Activity	OVI's (objectives verifiable indicators)	MoV's (means of verification)	Reporting schedules	Implementation	Responsible institution M & E	Remarks
13	Promote disaster preparedness and management strategies. <ul style="list-style-type: none"> - Establishment of disaster management committee - Establish disaster management kitty - Installation of disaster management equipment 	-1 active disaster management committee in place - A disaster kitty in place in the district -1 basic disaster management equipment in place e.g. fire fighting equipment	- Reports - Field visits - Minutes	-Annually	-Provincial Administration -NGO's -Local Authorities -Other stake holders	- OP	- No active committee in place
14	Establishment of Environmental documentation centre - Catalogue information & ITK's	- Have 1 documentation centre in the district - have a catalogue showing ITK's in the community for use in conservation	- Reports - Visit to documentation centre - Interviews - field visits	-Annually	-Museums of Kenya -NGO's -NEMA Research stations -Ministry of Gender, Sports , Culture & Social Service	-NEMA -NGO's - Other stake holders	- Environmental documentation centre does not exist in the district

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15	Surveillance & monitoring	- 1 quarterly field visits for surveillance and monitoring activities	- reports - field visits	-Quarterly	-KFS - NEMA - NGO's - OP -Other stakeholders	- OP - DDO	- A committee in place in the district for monitoring
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Annexes

Annex I. Summary of District Profile

Table 1. Summary of the District Profile

1.1 Geographical Location, Size and Administrative Units		
Geographical Location: Latitudes 0° 29'' and 1° 03'' South of the equator and Longitudes 35° 05'' and 0° 35'' East.		
Total Area:		1,450KM ²
Administrative Units:	Divisions:	6
	Locations:	38
	Sub-locations:	133
	Constituencies	3 (Bomet, Chepalungu and Sotik)
	Local Authorities:	2 (Bomet County and Municipal Councils)
1.2 Climate and Physical Features		
Altitude		900 – 1,850
Soils*		Clay Soils - Cover 43.6% of the District
Annual Rainfall		1,100mm – 1,500mm
Rainfall by Seasons		Long rains: March – May Short rains: August – October
Temperature range		10 ⁰ C – 27 ⁰ C
Average temperature		18 ⁰ C
Gazetted Forest		5,000ha
1.3 Population Size and Distribution		
Population size		440,000
1.3.1 Population Structure		
Total No. of males		213,000
Total No. of females		227,000
Female/male ratio		105:100
Total No. of youthful population (15 – 25 yrs)		115,000
Total population of primary school going age (6 – 13 yrs)		117,000
Total population of secondary school going age (14 – 17 yrs)		55,000
Total labor force (15 – 64 yrs)		190,000
Dependency ratio		1:1.2
Population growth rate		2.6%
Total fertility rate		6.7
Infant Mortality rate		54/1000
Under 5yrs mortality rate		82/1000
Migration		N/A
Urban Population		24%
Rural Population		76%
Highest density: Bomet central Division		388
Lowest density: Ndanai Division		251
Average density		288

Life expectancy	60yrs
Urban population	100,000
Number of Municipal Towns	1
Factors Influencing Distribution:	
1.4 Social, Cultural, and Economic Characteristics	
Total No. Of households	70,769
Average household size	5
No. Of female headed households	12,774
No. Of children headed households	N/A
No. Of disabled	7,650
Children needing special protection	4,109
Absolute poverty	Rural: 62%; Urban: 25%
Contribution to national poverty	2.94%
1.5 Sectoral Contribution To Household Income	
Agriculture	40%
Rural self – employment	0.3%

Table 1. Contd...

Table 1. Contd...

Wage employment	0.6%		
Urban self – employment	5.1%		
Others	N/A		
No. Of unemployed	54%		
1.6 Agriculture			
Average farm size (small scale)	2ha		
Average farm size (large scale)	15ha		
Main food crops produced in the district	Maize, Beans, Irish Potatoes		
Main cash crops produced in the district	Tea, Pyrethrum, Coffee		
Acreage under cash crops	570ha		
Acreage under food crops	46,000ha		
Main storage facilities	Granaries		
Population working in the Agricultural Sector	190,000		
1.7 Livestock And Fisheries			
No. of Ranches	Nil		
Main livestock breeds	Dairy Cattle, Beef Cattle, Sheep, Goats, Poultry, Donkeys, and Rabbits.		
Land carrying capacity	LH1 – 1.5LU/Acre, LH2 – 1LU/Acre, LH3 to UM3 – 1LU/2Acres, UM4 – 1LU/3Acres, UM5 – 1LU/5Acres		
Main species of fish catch	Berbs, Clarias, O. Variables, O. Niloticus		
Fish farming (2003)	No. of farmers	82	
	No. of ponds	111	
	Production (kgs)	443	
2.3.8. Forestry			
Size of Gazetted Forest	5,000ha		
Size of Non – Gazetted Forest	Nil		
Main forest products	Wood fuel, Timber, Fencing posts, Traditional herbs		
Per cent of people engaged in forest related activities (saw mills, furniture works etc)	0.2%		
2.3.9. Cooperatives			
Society/Economic Sector	No.	Membersh ip	Turnover
Dairy	23	9,800	12,865,000
Pyrethrum	10	1,900	1,480,000
Coffee	6	1,500	12,000
Multipurpose	3	850	
Unions	1	16 Societies	233,000
Women	3	1,300	750,000
Land purchase	2	4,000	120,000
Consumers	3	450	N/A
Jua Kali	1	80	N/A
Housing	3	175	N/A

SACCOs	4	6,000	7,000,000
2.3.10. Water and Sanitation			
No. of houses with access to piped water			2,200
No. of households with access to portable water			1,500
No. of permanent rivers			3
No. of wells			1,040
No. of protected springs			30
No. of boreholes			1
No. of Dams			59
No. of ponds			200
No. of households with roofed catchments			750
Average distance to the nearest portable water point			4KM
No. Of VIP Latrines			200

Source: District Development Plan, 2002 – 2008

Annex II. Rainfall Data (2000 – 2004)**Table 2. Rainfall Data (2004)**

Month	Rainfall/Station	
	Bomet Water Office	Nyangores Forest Station
January	131.5	144.0
February	120.0	23.4
March	182.0	210.8
April	318.0	271.2
May	167.0	86.0
June	13.5	80.0
July	89.5	61.0
August	91.0	113.8
September	97.5	109.6
October	19.0	85.8
November	101.5	105.5
December	117.5	91.0
Total (2004)	1,475.0	1,382.1
Total (2003)	1,245.5	
Total (2002)	1,521.1	
Total (2001)	1,385.3	
Total (2000)	1,187.0	

Source: District Water Office (2004)

Annex III: References:

1. District water office reports (2004)
2. District Development (2002 - 2008), Bomet District
3. Baseline survey, Mara river Basin – Nairobi Rotary club (2004)
4. Population and housing census report (1999) Report
5. Population and housing census, analytical report on housing, condition and household amenities – Vol X
6. Ministry of water and irrigation report (2003)
7. District development plan (1997 - 2000), Bomet District
8. District education office report (2004)
9. District agriculture office report (2004)
10. District livestock production report (2004)
11. District fisheries report (2004)
12. State of environment report (2004), Bomet district
13. District forest office report (2004)
14. District veterinary office report (2004)
15. Kapkoros Tea Factory Siongiroi Dairy Plant – Environmental Audit Report (2004)
16. NEMA strategic Plan (2005 - 2010)