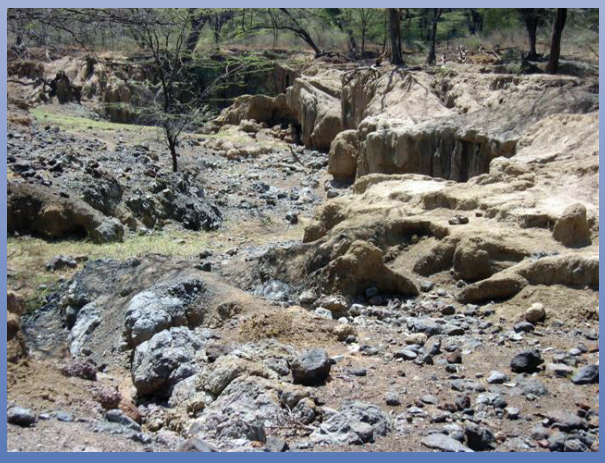
Lake Bogoria National Reserve

World Ramsar Site (No.1057)



Integrated Management Plan
2007 – 2012

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Published June 2007

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WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by:

- conserving the world's biological diversity
- ensuring that the use of renewable natural resources is sustainable
- promoting the reduction of pollution and wasteful consumption

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Contents

Approval

Management plans as vehicles for Rural Development has gained more acceptances in the recent years. This is even more crucial in the area of Natural Resource Management, a very high percentage of conflicts among and within communities is linked in one way or another to resource access and control. Water ranks the top while the rest such as Land, Fuel wood, pasture, salt licks, herbal medicines etc. follow in an order determined by the location.

This country has recently witnessed these conflicts of unprecedented magnitude leading to loss of life and property. This plan has attempted to put in place an adaptive mechanism through which best practices in resource use can be achieved from a multi-sectoral and a wide constituency approach. The Local Authority Service Delivery Plan (LASDAP) underpins the consultative process through which this plan was developed.

It is noted that this is one of pioneering initiative by Local authorities and hence shall provide a learning ground to the rest.

WWF has proven a true partner as they have overseen this painstaking process right from the word go to this moment when its implementation is just about to begin.

The Ministry of Local Government approved this Integrated Management Plan for implementation at its sitting of 25 October and 11 November 2005 as a strategic management plan for the Lake Bogoria National Reserve.

Chairman, Baringo County Council
Lake Bogoria Joint Management Committee

Chairman, Koibatek County Council
Lake Bogoria Joint Management Committee

Foreword

The Management of Lake Bogoria National Reserve produced this Integrated Management Plan with the assistance of WWF's (formerly World Wide Fund for Nature), Lake Bogoria Community Based Wetland Project. This document has been tailored to meet not only the national statutory requirements for protected area management but also the appropriate regional and international laws and conventions. It strongly builds its basis on a participatory and negotiated approach to issues, processes and decisions while taking into account the wide scope of stakeholders. Lake Bogoria is Kenya's third Ramsar Site and the 1,097th in the world underpinning the wise use concept. It took about five years of painstaking multidisciplinary and consultative process involving as many stakeholders as the time and resources could allow.

This Plan comes at a time when three very important laws relating to natural resource management in Kenya have been enacted: The National Environment Management and Coordination Act (1999), The Water Act (2002) and The Forestry Act 2005. All these statutes lay a very strong emphasis on an integrated approach to resource management with the local communities playing a significant role.

To a large extent this plan demonstrates an acceptance by the local authorities responsible for the management of Lake Bogoria National Reserve of a paradigm shift in natural resources management as provided for by the above listed legislation. The two local authorities of Baringo and Koibatek County Councils have accepted to negotiate the management of the reserve with the local communities and share revenue with them. However, they also recognise the need to work with other partners responsible for natural resource management at the national level. It is in view of this that the Kenya Wildlife Service (KWS) as the chief custodian of the country's wildlife resources shall continue to be an important partner to give the necessary supportive and advisory services and guidelines to all protected areas irrespective of land status. The local District Councils will also work with other relevant national/regional government institutions including the Water Resources Management Authority (Rift Valley Region) and the National Forest Service amongst others.

Dr. Kwame Koranteng,
Regional Representative,
WWF Eastern Africa Regional Programme Office

Acknowledgements

The Joint management of Lake Bogoria National Reserve acknowledges WWF for contributing financial and technical support towards the consultation process in the preparation of this Integrated Management Plan (IMP).

Special thanks go to the following people who were members of the Planning Team and worked tirelessly to prepare this IMP: William Kimosop, Maushe Kidundo, Musila Fabian, Musa Cheruiyot, Michael Kangogo, Kunga Ngeche, Sirma Chepkonga, Daniel Koros, Joel Meto and Sally Kibos. Special thanks also go to Mohamed Awer, Nina Bhola and the late Tom Kabii who made invaluable contribution to the plan and provided oversight of the whole planning process and is greatly appreciated.

Special appreciation also goes to Hellen Gardiner, Julie Thomas, Mark Wright, Richard Barnwell, William Pratesi, Dr. Sam Kanyamibwa, Robert Ndetei, Dr. J M Githaiga, Dr. Kwame Koranteng, George Wamukoya, Kimunya Mugo, Dr. Taye Teferi, Anderson Koyo and David Harper.

The Joint Management of Lake Bogoria appreciates the contributions of all her staff, partners, and stakeholders, local community members who were involved in one way or the other in preparation of this plan.

Executive summary

Lake Bogoria National Reserve is an important conservation area in Kenya holding regionally and nationally endangered species. The reserve has unique physiographic features and geothermal manifestations due to its geological history. The combination of landforms, biodiversity content, availability of water and forage makes this site important at community, national and global levels. It was designated as a national reserve in 1974 and in 2001 it was listed as a wetland of international importance under the Ramsar convention. Revenue from tourism, related activities and other natural resources in the reserve can play an important role in the socioeconomic development of the area.

The National reserve is at risk from environmental degradation arising from unsustainable resource exploitation and ecologically negative catchment-wide processes. The root causes of these problems are poverty, poor land use, overstocking and unsustainable farming systems. These socioeconomic circumstances of the populace and the environmental impacts are threatening Lake Bogoria National Reserve and its wider catchment. The prevailing situation has prompted WWF (EARPO) in partnership with the two reserve managing county councils and the local communities to initiate the development of this Integrated Management Plan (IMP). This IMP will be a template for sustainable conservation of Lake Bogoria National Reserve, and will involve the local community and enhance attainment of sustainable livelihoods.

This management plan takes into consideration the natural resources in LBNR, their economic potential and identifies conservation threats from catchment wide processes. The integrated approach to conservation will promote sustainable livelihoods, create new socioeconomic opportunities, harnesses existing ones and safeguard the conservation of the National reserve and its environs.

The IMP plan areas landscape, vegetation, climate, geology and biodiversity are closely inter linked. The socioeconomic activities in the area are to a large extent dependent on the natural resources especially pastures and water that sustain the pastoral economic backbone. Over exploitation of this resources are the main drivers of environmental degradation which in turn has set in motion vicious cycles leading to further degradation and high incidence of poverty in the local population. The linkage between the various ecological components, socioeconomic activities, and effects of catchment wide processes is also explained. The linkages justify the need to extend the plan area's boundaries beyond the National reserve, in order to minimize the impacts of catchment wide processes. The IMP proposes management strategies that take into account the natural ecological linkages, conservation objectives and needs in designated zones and highlights targeted research to guide reserve management and overall conservation of the plan area while ensuring sustainable livelihoods.

The planning process involved stakeholders to ensure wide participation and ownership of this management plan. The integrated management plan identifies issues that need urgent consideration, proposes mitigations strategies, and identifies appropriate stakeholders and their roles. The IMP has a time frame of five years in which to achieve the immediate objectives. A log frame for executing the IMP components, means of verification, stakeholder responsibilities and approximate costs is included. The IMP also has inbuilt mechanisms for monitoring and evaluating its implementation. This management plan is an adjustable blueprint upon which programmes can be based. It provides a framework for different stakeholders to identify areas where their intervention is needed and their linkages with other stakeholders.

List of abbreviations

WWF World Wide Fund for Nature
KWS Kenya Wildlife Service
LBNR Lake Bogoria National Reserve
LBIMP Lake Bogoria Integrated Management
CBO Community Based Organization
WCK Wildlife Clubs of Kenya
KATO Kenya Association for Tour Operators
EU European Union
EMCA Environmental Management and Coordination Act
GoK Government of Kenya
KARI Kenya Agricultural Research Institute
MENR Ministry of Environmental and Natural Resources
NEMA National Environmental Management Authority
MoL Ministry of Lands
FD Forest Department
MOE Ministry of Education
UON University Of Nairobi
MU Moi University
LA Local Authorities
MLF Ministry of Livestock and Fisheries
MA Ministry of Agriculture
NGO Non Governmental Organization
MRD Ministry of Rural Development

Introduction and background

1.1 Introduction

Lake Bogoria and its catchment are rich in natural resources that include land forms, forests, wildlife, wetlands and pastures. In the catchment there are moist upland forests around Subukia that are the major sources of surface inflows into the lake and are rich in forest products and biodiversity. The wider catchment has multiple land-use types that have undergone major changes in the last 100 years. The moist upper catchment area changed from forests to large-scale commercial farms and ranches, which were later sub-divided into small-scale holdings. The lower catchment was under nomadic livestock production, which has changed over time to a relatively sedentary mode of livestock production. Livestock numbers in this area have increased over time and are restricted to a smaller range compared to the past herding system. These land use changes and a high human population growth has exerted enormous pressure on the environment and natural resources. Consequently, these developments have disrupted ecological processes and have negatively impacted the environment. These impacts are manifested by severe soil erosion, mass wasting, high silt loads in runoff, agro-chemical pollution, land degradation, deforestation, land fragmentation and encroachment into sensitive habitats. There has been increased poverty amongst the local community members. The environmental problems have been compounded by the recent excision and degazettement of forests for human settlement.

1.1.1 Previous management plans and conservation initiatives in the area

The first formal conservation initiative around the lake was gazettement in 1970 of the Lake Bogoria National Reserve (LBNR) under the wildlife Act by the Wildlife Conservation and Management Department (WCMD). The management of the reserve was later transferred to the Baringo County Council. In the 1990's, new districts were created and the reserve was put under the joint administration of Baringo and the newly created Koibatek county councils. The parts of the upper catchment were protected under the forest Act. Various Acts and policies regulated land management and use outside the formally protected areas.

The local community around Lake Bogoria National Reserve had practised effective traditional methods of environmental conservation. Land, water and pasture were communally owned, with strict regulations that controlled dry and wet season grazing access. There have been changes over time in land tenure system from communal, trust land to individual ownership.

Poverty, environmental degradation and frequent severe food shortages did prompt the need for interventions. Stakeholders in the plan area including WWF, the local community and community-based organizations (CBO's) have initiated sustainable conservation practices and participated in the planning process for this management plan.

1.1.2 Scope of the plan

The core conservation area of the IMP is LBNR. The Reserve has undergone ecological changes emanating from management systems in place and human activities. The adverse effects originate not only from within the reserve but also the immediate environs. There are also other external processes that are linked to catchment wide ecological and socioeconomic factors.

This catchment-integrated management plan aims at addressing conservation issue in LBNR through an ecosystem-based approach. Although the focus is LBNR, the plan addresses issues influencing ecological processes in the reserve, the catchment area critical for water inflows, wildlife dispersal areas and migration corridors. Some of these processes emanate from social factors and depletion of resources in the community areas precipitating pressure on the reserve as a grazing area for livestock and a source of other natural resources to the local communities. The plan has inbuilt mechanisms for stakeholder involvement, highlights environmental and socioeconomic development issues and suggests management interventions, by identifying activities, resources and inter-agency networking. The plan recommends formation of a stakeholder implementation committee, with the necessary technical skills to oversee and coordinate the suggested activities. The plan proposes to network stakeholders and mobilise resources to Lake Bogoria catchment and provides a framework to enhance livelihoods.

1.2 General objectives of Lake Bogoria Integrated Management Plan

The success of this plan is inter-linked with the community socioeconomic status improvement, maintenance of environmental health integrity, and to ensure livelihoods support and continuity of ecological processes. To achieve this, the communities in the lower and upper catchment have to play major role in the integrated management plan (IMP).

The IMP has the following general objectives:

- Initiate community socio-economic development that ensure sustainable livelihoods, reduces pressure on the environment and natural resources, and arrests encroachment on the biodiversity in the reserve.
- Develop strategies to mitigate environmental degradation and restore degraded areas in the plan area while providing viable alternatives.
- Encourage formation of community-based management systems for natural resources such as water resource users associations, to guide the use and management of water, which is a critical and limiting resource in the area.
- Support the reserve management capacity to manage and monitor the natural resources in the reserve.

1.3 Purpose of the Lake Bogoria National Reserve

Traditionally Lake Bogoria National Reserve management has revolved around wildlife management. This IMP has redesigned and expanded the conservation to also include:

- Protection and conservation of the genetic and biological diversity of species assemblages, the integrity of the abiotic resources and interactions to ensure continued ecosystem processes;
- The local community and the reserve management participation in planning, development and management of the plan area;
- Promotion of community environmental education and dissemination of information on conservation and sustainable use of resources.

This expansion of the IMP scope is important to ensure the reserve is buffered from negative processes that emanate from its environs. This is through the recognition of the immediate environs as crucial in providing a buffer zone that absorbs impacts before they affect the reserve.

1.3.1 Planning process

Participatory and strategic planning process has been used in the development of this IMP. This process was initiated in May 2003 and involved consultations where consensus was obtained on various aspects.

The planning guidelines used in formulating this management plan included:

- The Ramsar Convention on Wetlands of international importance,
- The Kenya Wildlife Service (KWS) and the Wildlife Act,
- Local Government Act
- Environmental Management and Coordination Act (EMCA)
- Agriculture Act
- Livestock Act
- Forest Act
- The consultative meetings and interactive workshops that preceded the formulation of this plan
- Water Act 2002

Lake Bogoria National Reserve and its catchment

2.1 Introduction

The plan area encompasses LBNR, its immediate environs and the catchment of Lake Bogoria. The Lake is the deepest alkaline lake in the Kenya with numerous alkaline hot springs that contribute significant inflows into the lake. The Reserve comprises of the lake and the terrestrial portion with various vegetation types depending on soil types and terrain. Amongst these vegetation types are grasslands, thickets and woodlands. The woodlands form an important habitat for the endangered Greater Kudu (*Tragelaphus strepsciseros*) and other mammals. The Reserve is rich in biodiversity and the lake is an important stopover point for the northern avian migrants. The area has high revenue potential in terms of tourism, socio-economic and cultural activities. It is located in close proximity to both central and northern tourist circuits in Kenya.

The immediate environs of the plan area have a low human population density and currently offer limited economic opportunities, which are largely, restricted small-scale irrigation, livestock and bee keeping. The upper part of the catchment around Subukia has high agricultural potential with intense cultivation and high human population densities. The human activities in the catchment and the lake environs have adversely affected sustainable conservation and management in the plan area.

2.1.1 Location

Lake Bogoria National Reserve, lies between 36° 4′ and 36° 7′ East and 0° 20′ North and about 10km North of the equator in Baringo and Koibatek Districts of Rift Valley province Kenya (Fig. 1). It has an altitude between 970 m at the lake to 1650 meters on Siracho escarpment. The Reserve lies close to the eastern wall of the Great Rift Valley and has its headquarters at Loboi Gate.

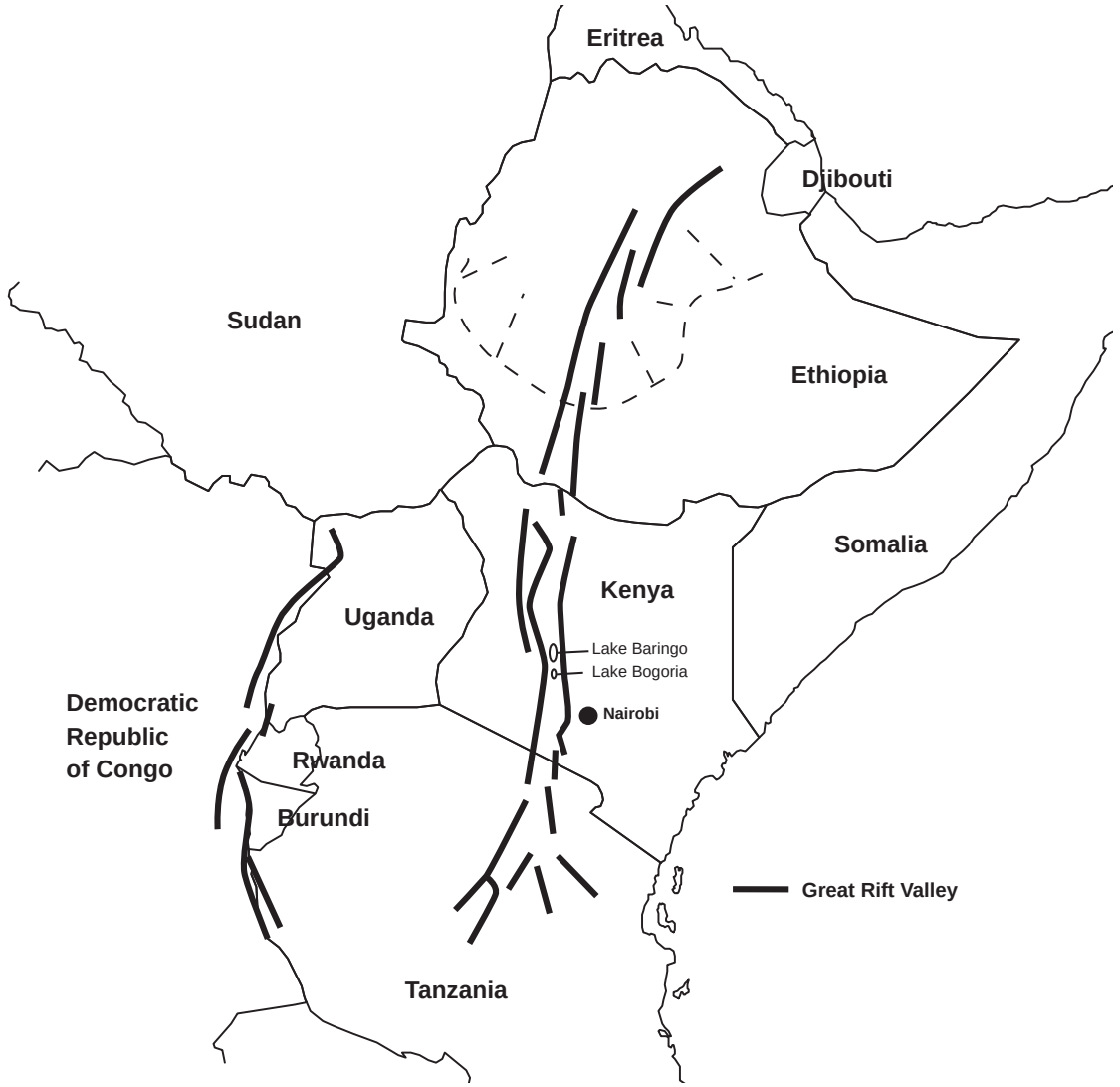

Figure 1: The location of Lake Bogoria in the East African Rift Valley

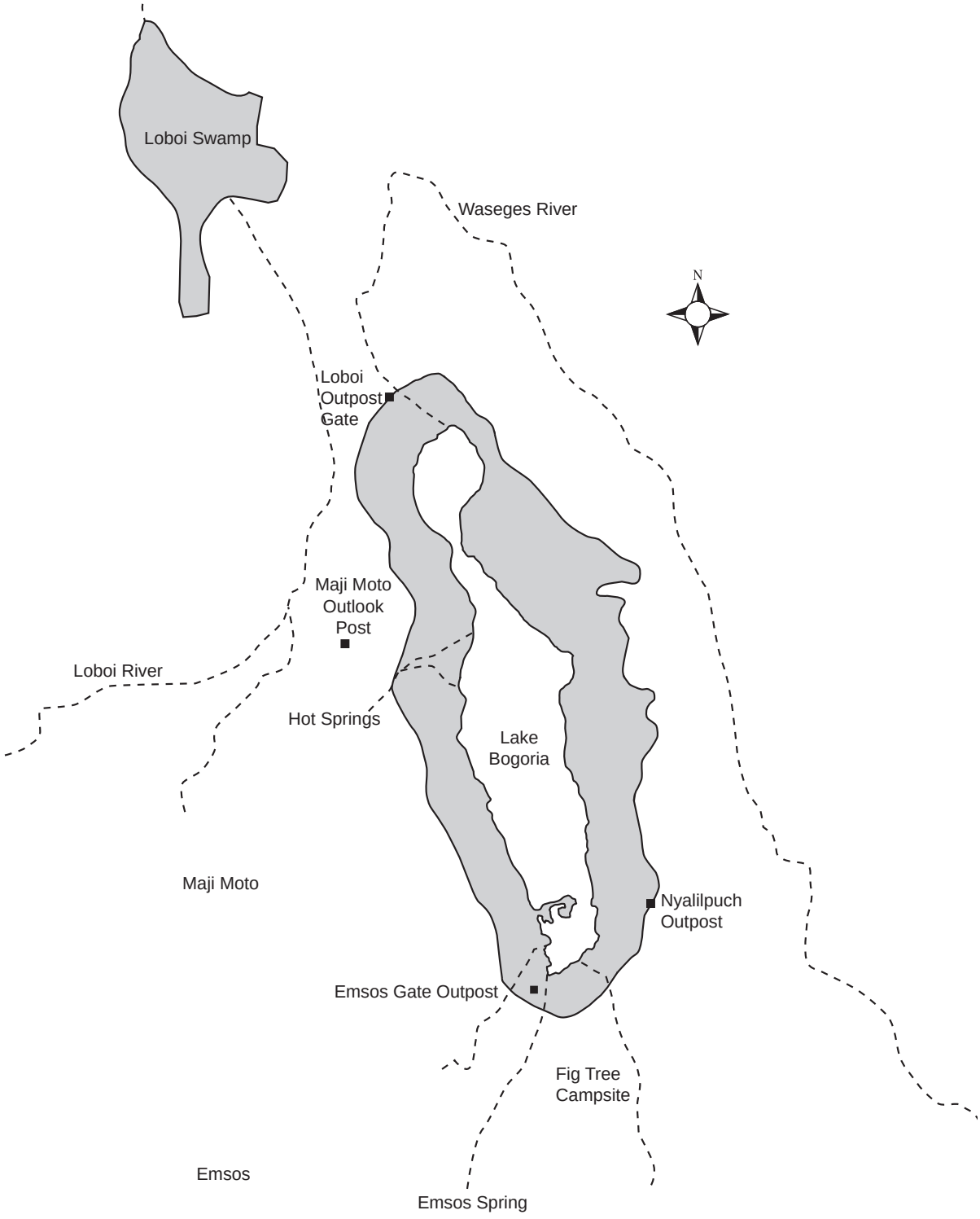

Figure 2: Lake Bogoria National Reserve, drainage system.

2.1.2 Legal status

Lake Bogoria National Reserve was gazetted as wildlife protected area, vide legal notice number 270 of 01/11/1970; and is found in boundary plan 216/26 delineating a total area of 107 km^2.

2.1.3 Road Access

There are three access roads to the reserve through three gates at Loboi, Maji Moto and Emsos. The main access is along the Nakuru-Marigat road where three Kilometres before Marigat town, is a junction to the right towards LBNR. The Loboi Gate which also serves as the reserve headquarters is 20 km from this junction. An earth road that branches off to the right near Mogotio Shopping Centre, 36 Km from Nakuru town leads to the other two gates.

2.1.4 Access by air

The Reserve can be accessed by air through airstrips in Lake Baringo and then by road through the Marigat junction. However, a non-gazetted and unclassified airstrip that can be used by light aircraft is located at the Northern part of the reserve near the Loboi gate.

2.2 Conservation status

Lake Bogoria was declared a national reserve due to its rich in biodiversity, scenery and hydrological features in 1970 and was made a Ramsar site of international importance in 2001. It used to be an important communal dry season grazing area for the local communities, and has important sacred and cultural sites.

Two local authorities, Baringo and Koibatek County Councils, currently jointly manage LBNR. WWF (EARPO) is supporting the reserve management through conservation activities aimed at enhancing sustainable natural resource conservation, socio-economic development and environmental education.

2.3 Physical environment

2.3.1 Physiography, Geology and soils

Lake Bogoria and its catchment are geological products of past tectonic events of faulting, warping, and volcanic eruptions associated with the formation of the Rift Valley. The area has geologic manifestations of ongoing volcanic processes in the form of fumaroles, hot springs and geysers within the lake, along the lakeshores and various points in the surrounding areas. The lake is located along one of the major block-defining faults in the Rift Valley, the Solai-Subukia fault block, which includes the Solai, Iguamiti and South Arabel fault scarps. Lake Bogoria is partially separated from this main fault block by the Kisanana- Chemasa-Emsos fault that merges into Lake Bogoria fault along the Emsos fault structure at Sirken Hill. These fault lines are aligned in the north - south direction with Sandai deposition pans infilling a large portion of the graben north of the lake and stretching to Lake Baringo.

The plan area is characterised by volcanic rocks and sediments overlying metamorphic substrata, which belong to the Pleistocene and Miocene geological eras. The area is highly faulted and fissured with the major rivers flowing north along the fault-lines. Close to the Lake and its surroundings are stratified deltaic silts and saline deposits. The western section of the Lake comprises of analcitic phonolites and porphyritic trachytes. The Eastern section beyond the deltaic silts comprises of sedimentary deposits, volcanic soils, screes and alluvium. Porphyritic olivine basalts are also found along the eastern faults bounding Lake Bogoria.

Lake Bogoria drainage basin has three major soil types; clay soil, clay loam and silt loam. Soil texture is not variable and most soils are categorized as loamy with exceptions of clay loams restricted to riverine areas. The riverine soils are complex with varied textures depending on the drainage conditions and are composed of eroded volcanic sediments and alluvial deposits. They consist of diverse types of granulomites, conglomerates, silts and gravels.

Clay soils are found on the upper part of the catchment, lowlands. The middle part is dominated by clay loam while a small portion at the mouth of river Waseges to Lake Bogoria was identified as silt loam.

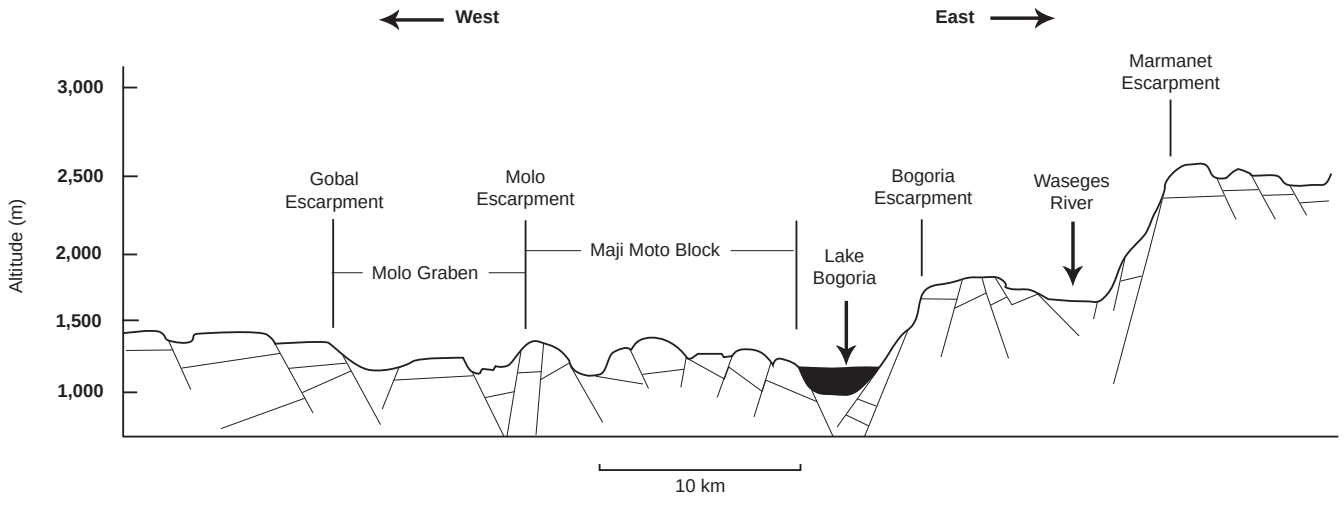

Figure 3: A cross section of the lake Baringo-Bogoria half-graben (after Renult and Tiercelin, 1994)

The soils around the lake have high a pH ranging from 6.8 to 9.0, with high sodium bicarbonate levels ranging from 0.5 to 9.92 $meql^{-1}$. The salinity and sodicity are attributed to the parent rock material. Highly alkaline soils are found along the shoreline fringes, but those close to permanent water sources have intermediate values, while soils in the ridges and scarps have the lowest pH values.

Soil nutrient availability indices are high indicating high fertility levels with mean phosphorous concentrations of 80 ppm in the riverine soils. Kaolinites constitute 70–80% of silt while illionites are inter-stratified with the rest 10–20%. Potassium, magnesium and manganese concentrations are generally low. Calcium concentrations are high and exhibit wide variation between 10.37 and 37.26 $meql^{-1}$. The spatial distributions of the soils are shown below.

2.3.2 Climate and rainfall

The climate in the plan area is arid to semi arid regimes except in the moist highlands around Subukia. The climatic conditions are strongly influenced by the ITCZ (Inter Tropical Convergence Zone) and there are two distinct wet and dry seasons. Within the reserve and adjacent areas, the climatic conditions are harsh with temperatures at the Lake ranging from 18^0C-39^0C with a daily mean of 25^0C. Mean annual precipitation varies from 500-1000mm and falls in two seasons April- May and October- November (figure5). The physiographic location of the reserve in a graben places it in the rain shadow of the surrounding fault scarps and highlands. The combination of weather variables and physiographic location give the lake basin a hot, semi arid climate.

Lake Bogoria and its surroundings are categorized under agro-ecological climatic zone E. Rainfall reliability is low (Mwangi, 1992), and daily sunshine hours average 10 making the area hot for most of the year (WWF, 2003 annual report). There is a marked hot spell from January to March when temperatures in excess of 34^0C are experienced. Cold spells occur in the months of July and August.

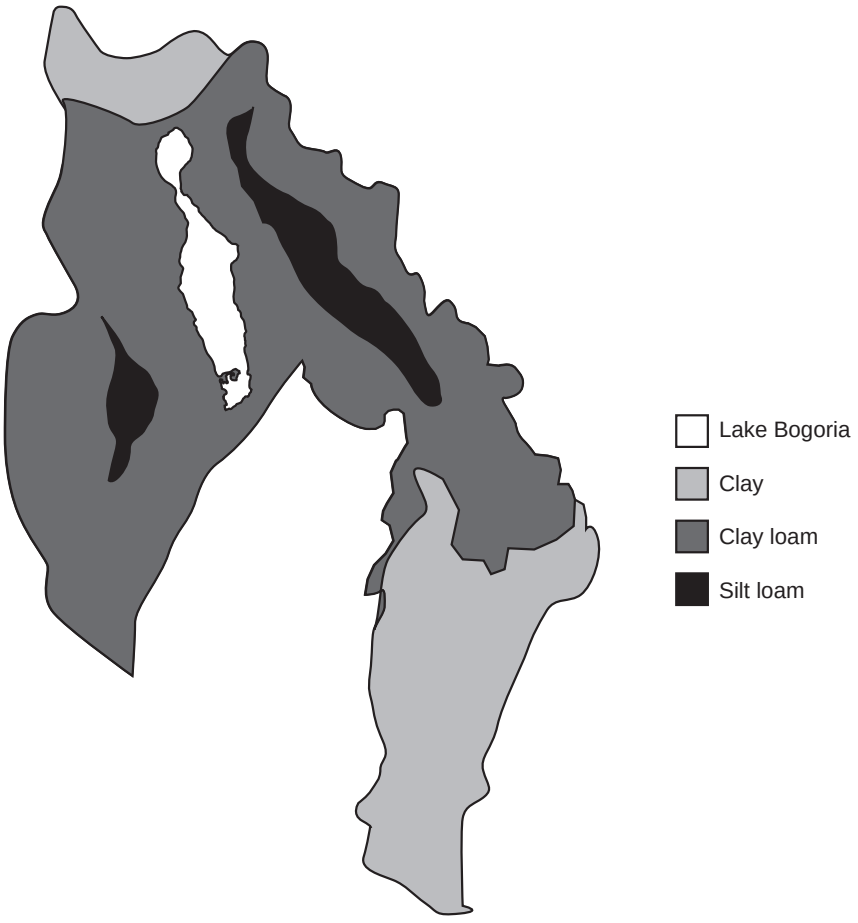

Figure 4: Distribution of soil types in the Lake Bogoria catchment and its immediate environs.

El Nino and *La Nina* events are interpreted from analyses of the 25-year record from the Lake Bogoria National Reserve weather station. The deviation of the average annual rainfall from the 25-year mean reveals 5-7 year cycles of inter-annular variability in precipitation (Figure 6).

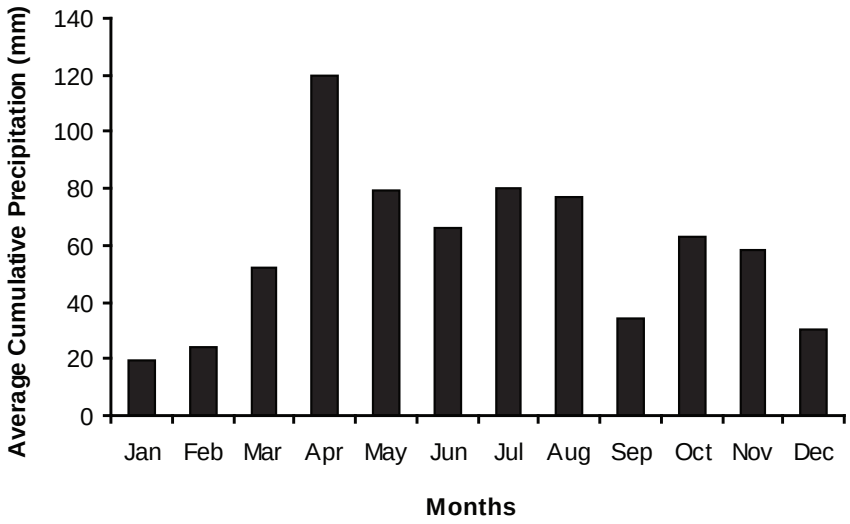

Figure 5: Average monthly rainfall for the period 1977-2001 (LaVigne and Ashley, 2002).

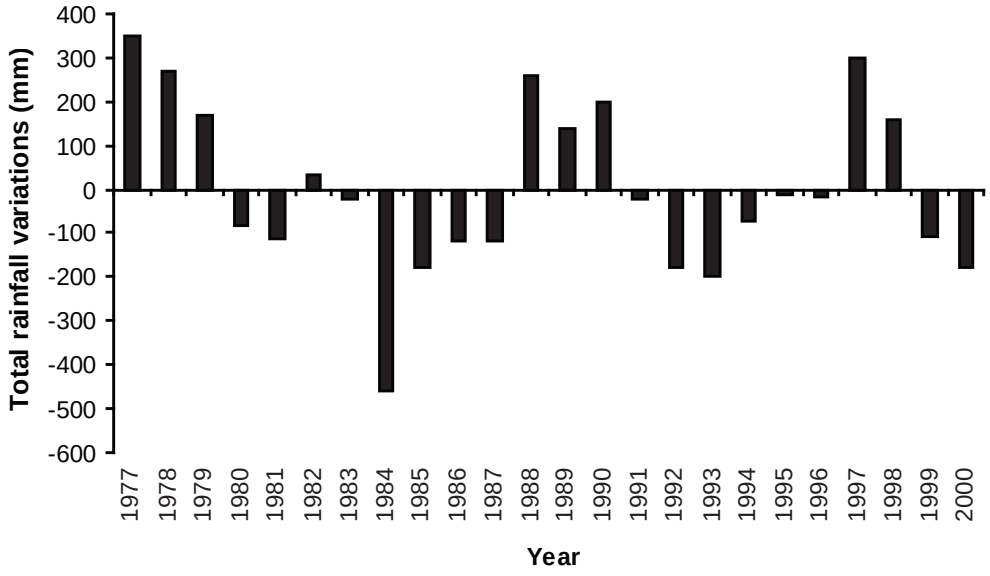

Figure 6: Departures of annual total rainfall (mm) from the 25-year mean. 1977-1979, 1988-1990 and 1997-1998 El Nino years; 1984-1986 La Nina years (LaVigne & Ashley, 2002).

2.3.3 Hydrology

Lake Bogoria area has a trellis drainage pattern and rivers flow northwards along fault lines. The lake's catchment is 930 km^2 drained by river Sandai-Waseges, which flows northwards towards Lake Baringo but deviates to the south at Sandai to drain into Lake Bogoria. The river flow is seasonal and occasionally dries up between January and March. In the long rainy season, the river brings in large volumes of silt, eroded from the degraded rangelands. River Loboi that drains into Lake Baringo diverts its course in the wet season to drain into Lake Bogoria due to clogging of its channel by sediments. This has turned out to be a normal flow pattern during the wet season, greatly increasing the amount of surface inflows and silt loads into Lake Bogoria. The plan area has several dry wadis that are characterized by flash flood flows in the wet season. In the south River Emsos and a few perennial springs discharge fresh water into the lake. The lake level fluctuates between 11 and 14 meters with precipitation but does not exhibit extreme surface area variations compared to other shallow rift valley lakes. Its trough basin morphometry preclude major surface area variations, while discharge from all the springs counterbalance evaporative losses considerably (Tiercellin et al, 1987).

A study carried out to determine the water budget for Lake Bogoria quantified inflows and outflows to the lake. The inflows include, river flows, direct rainfall into the lake and flow from springs into the lake of 31, 24.29 and 28.38 million cubic meters respectively. The outflows are mainly through direct evaporation from the lake

surface, domestic and livestock abstractions at 75, 0.7 and 1.2 million cubic meters respectively. Total inflows are 83.67 million cubic meters while total outflows are 70.65 million cubic meters resulting in a difference of 13.02 million cubic meters, which is accounted for by abstractions for irrigation upstream (Onyando and Musila, 2004).

The rivers and riverine ecosystems in this arid and semi-arid plan area are critical habitats and provide refuge for wildlife. The riverine ecosystems have distinct ecological characteristics that allow them to support wildlife, invertebrates and plant species that cannot thrive in the arid areas. The river system is a vital resource to the local community providing water and dry season grazing and irrigated agriculture.

Lake Bogoria

Lake Bogoria is characterised by steep shoreline and has a trough basin morphometry comprising of three semi-distinct but interconnected basins consisting of; the northern, central and southern basins. The southern basin, a relict volcanic crater is the deepest part (14 m), joined to the rest of the lake by a narrow isthmus. The Lake has a high alkalinity with pH ranging between 9.8-10.6, alkalinity between 480-800 $meql^{-1}$ and an electrical conductivity of 45,000-85,000 μScm^{-1}. Phosphorus levels are extremely high and occur in the form of orthophosphates. Total phosphate and nitrogen concentrations of 3.5 mgl^{-1} and 32 mgl^{-1}, respectively, have been measured in the lake.

The open water is dominated by phytoplankton species such as *Spirulina platensis, Microcystis flos-aquae, Anabaenopsis arnoldii* and bacteria extremophiles. The shoreline vegetation is characterised by plant species such as *Cyperus laevigatus, Sporoblus spicatus* and *Cynodon dactylon* among others.

Hot Springs, Geysers and springs

The hot springs have high temperatures and are highly mineralized and are sourced from shallow aquifers in contact with lava intrusions. They have an estimated discharge of 900 l sec^{-1} (28.38 Mm^3) to the lake. The springs are found in three main clusters, Loburu, Chemurkeu and Mwanasis-Kibwu-Losaramat areas (Renault *et al*., 1987). The hot spring at the Loburu and Chemurkeu have a shallow aquifer with temperatures of about 100^0C, while the southern Mwanasis-Kibwu-Losaramat hot springs have a deeper lying aquifer with temperatures of about 170^0C (Cioni *et al*., 1992). All the springs are alkaline with a pH above 8.0. There are numerous other smaller hot springs, geysers and fumaroles in the plan area.

Other wetlands and Swamps

Several swamps occur in the plan area and they differ in size, water chemistry, biota and hydrology. The Loboi swamp is the largest and constitutes a key ecosystem component in the plan area as a water reservoir for livestock, agricultural and domestic supply. Swamps along Sandai/Waseges River play an important role in nutrient removal, agro-chemical retention and sediments filtration. There are also other numerous small marshes fed by fault related springs. The wetlands especially those outside the reserve are important to the local communities for water and food production. The swamps are also rich in bird life.

2.4 Flora and fauna

2.4.1 Flora

Within the reserve, biodiversity inventories have identified approximately 210 plant species belonging to 53 plant families in the reserve and neighbouring wetlands. Amongst these, are 38 species of Graminae and 15 of Acanthaceae. These species are distributed in six broad vegetation types (Mwangi, 1992). These are; riverine forests, wooded bush land, bushed thicket, bush land, bushed grassland and swamps. These are further described into ten vegetation communities on the basis of dominance. Dominant grasses include; *Sporobolus ioclados, Dactyolectenium aegyptium, Chlonis virgata and Digitaria velutina.* Shrubs include; *Grewia tenax, G. bicolor, Acalypha fruticosa and Acacia mellifora*. The most dominant tree species is *Acacia tortilis*. Other community types include mixtures of *Balanites aegyptica, Combretum spp., Ficus spp.,* and *Terminalia spp* Evergreen and semi deciduous bush land cover large areas along stream valley and other inhospitable areas.

The distribution of the vegetation types strongly correlates to combinations of topography, soil types, elevation, drainage systems and soil moisture content (Appendix 1).

In the upper parts of the catchment, mountane forests are found around Subukia, Olrara Bel, Mchongoi and Marmanet areas. These areas are the catchment for River Sandai/Waseges. There are other riverine forests along rivers courses, seasonal water flow channels and freshwater springs.

Outside LBNR and the forest areas the vegetation comprises of grasslands, bushlands, shrublands, scrublands and woodlands. These vegetation types are associated with unconsolidated soils, rock outcrops and riverine plains in the arid parts of the plan area. These are the community areas, which are communally grazed.

2.4.2 Fauna

Wildlife

The area is rich in wildlife species characteristic by a high diversity at low densities. Animals found in the plan area include the Greater Kudu and others shown in Appendix II. There are several reptiles that include monitor lizard, lizards, tortoise, crocodiles and various species of snakes.

Bird life

Over 373 species of birds have been recorded in the plan area (Appendix 3) including over 50 migratory species, making it one of the richest birdlife areas (IBA) in Kenya. The zoogeographical location of the reserve between the Ethiopian and the Masai zoo-regions contributes to the areas high species diversity

The lake holds huge congregations of lesser flamingo that feed on the high production of blue-green algae dominated by *Spirulina platensis*. The lake shore configuration and fresh water points provide favourable environment for these assemblages and at times more than 1.5 million flamingos can be counted. Lake Bogoria sometimes supports the highest population of greater flamingos in the rift valley alkaline lakes.

2.5 Environmental and socio-economic situation in the plan area

The deteriorating environmental conditions in the plan area threaten sustainable livelihoods, environmental integrity and the continuation of natural ecological processes. Negative environmental impacts are emanating from demographic changes, inappropriate land use types and trends, poor governance and policy failure and high poverty prevalence. High livestock densities of poor stock quality have accelerated environmental degradation in this semi arid area. These factors have put the ever diminishing natural resource base under pressure from their multiple interactions that are manifested through deforestation, siltation, erosion, eutrophication, species loss, habitat degradation, loss of pasture and increase in poverty. The situation has been compounded by breakdown of indigenous environmental management and resource use systems. The recent climatic variability in the East African Region has aggravated environmental problems in this ecologically fragile semi arid area. These factors and processes have eroded the natural resource base, jeopardizing the continued sustainable conservation and utilization of the plan area.

The plan area has undergone severe environmental degradation from the interplay of several factors and processes in an ecologically fragile region. This IMP aims at reversing the environmental degradation to achieve sustainable conservation and secure livelihoods of the local people. Although they are closely interlinked, environmental issues can broadly categorized as those that predominate outside the national reserve and ultimately affect the national reserve and issues within the reserve itself. The strategies developed for mitigation and management intervention in these two areas must have synergy if the goals and objectives of this IMP are to be achieved.

2.5.1 Issues in the catchment

The reserve environs and Lake Bogoria catchment have several serious environmental issues that cascade into the Reserve through socio-economic, hydrological and proximity linkages. Outside the reserve, some of the environmental management issues revolve around:

- Human – resource conflict.
- Water quality and quantity
- Deforestation and encroachment.
- Changes in ground cover affecting underground water recharge and sustenance of river flow regimes.
- Poor farming methods.
- Land tenure system.
- Human demographic trends.
- Environmental literacy
- Human settlement patterns

The interventions adopted for these issues will be co-ordinated as an integrated approach by the various agencies such as the Local Authorities of Koibatek and Baringo County Councils, Government departments, NGO's, CBO's, communities and individuals who are already active in parts of the plan area should adopt this IMP as a framework to harmonise environmental management.

2.5.2 Issues in Lake Bogoria National Reserve

The reserve was a community grazing area before 1970s when it was made a wildlife conservation area. Livestock grazing has, however, continued within the reserve, resulting in competition for pastures, diseases transmission and other forms of human wildlife conflict. Adverse environmental impacts within the reserve can be categorized as those arising from establishment of the reserve and those from human activities within it.

Ecological issues emanating from park management practices

- Vegetation dynamics leading to species succession and invader species establishment in the absence of habitat management.
- Poor wildlife management due to lack of comprehensive data on wildlife population dynamics and trends.
- Negative impacts of livestock grazing in the reserve.
- Effects of catchment wide processes on water quality on wildlife, especially flamingo mortalities.

Human induced issues

- Impacts of infrastructure development.
- Environmental destruction by tourist activities.
- Water source and drainage alteration through cement pond construction around springs and across streams.
- High concentration of tourism in fragile habitats.
- Localized erosion foci along livestock trails.

2.5.3 Hydrological issues from catchment wide processes

These are largely driven by processes within the larger catchment and involve:

- Declining and highly variable inflows into the lake due to deforestation and abstraction of surface and ground water.
- Siltation due to extensive erosion and pollution by agro-chemicals.

2.6 Lake Bogoria catchment linkages

Lake Bogoria is linked to its catchment through ecological, hydrological and socio-economic functions as shown in Figure 7. Most of these linkages are intertwined and have cumulative impacts on the Lake and the reserve. Loss of vegetation cover by overgrazing leads to soil erosion, siltation of steams and wetlands, and land degradation. This creates a vicious cycle that leads to more environmental degradation and set in motion other processes that magnify the initial impacts.

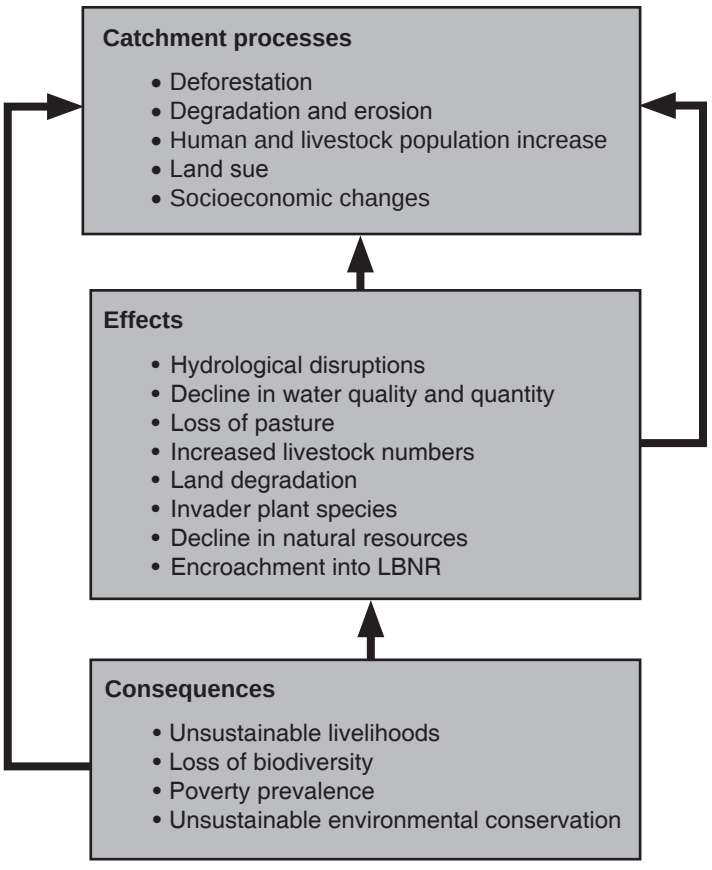

Figure 7 Linkages of ecological and socio-economic issues and processes in the plan area

Natural resources and zonation in plan area

The resilience of natural ecosystems and their resources to human impacts can be used as guidelines to zonation depending on the intensity of use. Important natural resources in the plan area include biodiversity, landscape aesthetics, geological formations and hydrological systems. The natural resources found in the plan area are an important base for socio-economic development and livelihood support. The optimum harnessing of these resources through zonation has high spin-off effects that can enhance economic opportunities and improved conservation, and sustainable livelihoods for the local community.

3.1 Criteria for resource categorization

Natural resource in the plan area can be categorised on the basis:

- Geological formation and scenic features,
- Biodiversity, cultural and ecological attributes,
- Importance of habitat for survival of threatened and endangered species,
- Susceptibility of habitats such as breeding, roosting and feeding sites to human activities impacts
- Status of populations of threatened, endangered and rare species.

The natural resource in the plan area can further grouped based on use into categories listed below.

3.1.1 Natural resources for tourism

- Lake Bogoria, wetlands, geysers and hot springs
- Flora
- Mammalian wildlife species
- Bird life
- Archaeological and contemporary historic sites
- Landscape

3.1.2. Natural resources of cultural and socio-economic importance

- Vegetation, Sand, stones and murram
- Pastures
- Fresh water sources
- Salt lick and trona (Magadi soda)
- Honey, wild fruits and vegetables

3.2 Zonation of the plan area

The plan area can be divided into several zones depending on ecological attributes, types of use, conservation status and needs.

3.2.1 Aquatic zones

These comprise of the:

- Lake Bogoria
- Swamps
- Marshes
- Geysers
- Springs
- Rivers

3.2.2. Terrestrial zones

The terrestrial zones in the plan are categorized according to vegetation types, topography, conservation status and land use system.

Protected area

This can be categorized into the following habitats;

- Grasslands
- Scrubland
- Riverine woodlands
- Woodlands

Community area

This can be categorized into;

- Farmland lands
- Grazing areas
- Urban centres and human settlements

3.3 Justification for the recommended intensity of use

The reserve has a high diversity of habitats some of which can be considered as ecologically fragile, or contain rare species of plants and animals. Human activities in these habitats can be disastrous or alter their attributes. The effects of such activities on a habitat depend on resilience to perturbations and the intensity of the disturbance. Disturbance below resilience thresholds has low impacts and such habitats normally return to their original condition after a short time, whereas less resilient ones take a long time. However, unstable systems may never return to their original condition once destroyed. It is important, therefore, to determine the stability and degree of resilience of the various habitats prior to subjecting them to the various categories of use intensity. Other habitats can be excluded from use due to special function like being breeding, roosting or feeding sites. Exclusion of use may be temporary or permanent. Special feeding areas require permanent exclusion, while seasonally waterlogged (flooded) areas may be closed during the wet season only. Other areas are functionally designed and modified to accommodate very heavy intensities of use such as reserve administrative headquarters, picnic and camps sites. Secondary natural vegetation and agricultural land can be manipulated to allow a heavy intensity of use.

Outside the reserve, topography is an important factor in determining whether or not to put certain land under cultivation. Beyond a certain degree of slope, land should not be cultivated due to the high risk of accelerated erosion. In LBNR and its environs ecological attributes, sensitivity and ongoing use have been used to delineate zones for low, medium, high and very high intensity of use. These are shown in Table 2 and 3. The designated zones are shown in Figure 8

Table 2: Zonation in Lake Bogoria National Reserve and recommended intensity of use

Zone	Habitat type	Location	Recommended intensity of use
1	a) Fragile habitats Marshes, springs, lake shores, open lake, river mouths, breeding sites, hot spring fields	Loburu, R. Sandai mouth, Emsos, Fig tree, Lake shore, Loboi swamp, HQ Marshes, Mawe Moto, Steep scarps	No
	b) Habitats for rare species (breeding terrestrial sites)	HQ marshes, shoreline, riverine habitats, Habitats known to be specific sites utilized by these species	No
2	Climax Forest Vegetation	Fig tree woodland and other riverine vegetation zones in the reserve	Low
3	Reserve administration and visitor facilities	Offices, staff quarters, all camp/picnic sites, Hot springs	High

Table 3: Zonation of habitat types and recommended use intensity outside the reserve

Zone	Habitat type	Location	Recommended intensity of use
1	Fragile habitats	Highland forests, steep slopes, hills, river sources, river valleys, wetlands	Low
2	Settlements, cultivated and rangelands lands	Small & large scale farms	High and very high

Management goal, objectives and intervention strategies

4.1 Goal, Objectives and Strategies

4.1.1 Goal

The goal of this IMP is to conserve LBNR for sustainable development in accordance with National policies, CBD (Rio convention), CMS (Bonn convention), Ramsar principals and river basin management concepts.

4.1.2 Objectives

To achieve the overall goal of the IMP, a set of short and long-term objectives has been identified. The attainment of the short term will facilitate and create an enabling environment for achieving the long-term objectives.

Short-term objectives

- Conserve and manage the environmental services and values of Lake Bogoria catchment for sustainable development.
- Provide a basis for diversification of tourism, benefit sharing and poverty alleviation by instituting sustainable land use practices, environmental conservation and natural resource management.
- Secure support of national and international institutions in the conservation and development of Lake Bogoria catchment.
- Promote integration, collaboration and stakeholders' participation in environmental conservation.

Long-term objectives:

- Promote community socio-economic development.
- Minimize threats and constraints that hinder sustainable conservation and development in the plan area.
- Promote environmental education and awareness for effective stakeholders' participation.
- Strengthen management oriented scientific research and monitoring in Lake Bogoria National Reserve and its catchment.
- Minimize human – resource conflicts, threats and enhance compatible land-use practices.

4.1.3 Strategies

To achieve the above objectives, the IMP proposes the implementation of the following strategies: -

- Undertake compilation and analysis of data on key biodiversity resources, habitats and the ecology of key species in the plan area.
- Strengthen park management and administration through capacity building.
- Institute and support environmentally friendly land use practices and community wildlife conservation undertakings.
- In liaison with the local community, NGO's and international bodies to enhance environmental conservation and management through strengthening multi-disciplinary participation in conservation.
- Provide reliable information and data for conservation and management purposes.
- Diversify tourism activities and attraction areas.
- In collaboration with local community, Government departments, CBOs and NGOs invest in sustainable environmentally friendly poverty alleviation programmes.
- Maintain security for wildlife and visitors in the reserve.

The achievement of the long-term management objectives for Lake Bogoria and catchment depends on a number of interacting factors linked to human activities.

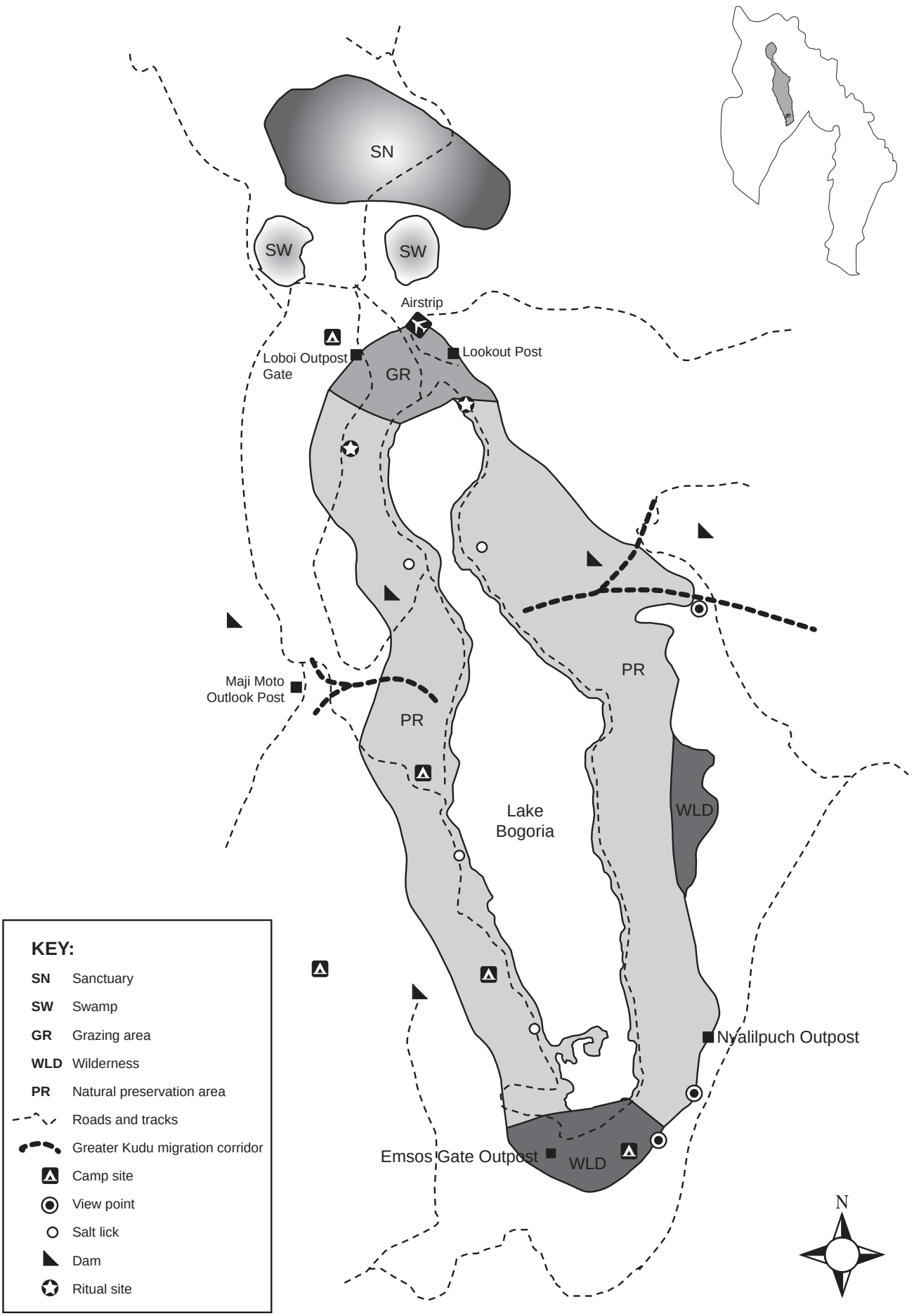

Figure 8: Recommended zones for different activities within LBNR. The exact location of Lake Bogoria within its catchment is illustrated at the top right-hand corner. (Note: Catchment land use zonation is subject to stakeholder consensus and recommendations)

Management prescriptions and programmes

5.1 Introduction

The management prescriptions and intervention programmes presented in this IMP require the participation of various stakeholders in order to attain the overall goal of sustainable conservation and management of natural resources. This will catalyse socio-economic development in the area. The management plan aims for meaningful and effective involvement of key stakeholders, especially the local community in the execution of development and management programmes in the plan area.

5.2 Land cover

The land cover has been extensively modified through various land use systems to meet human needs, precipitating severe adverse environmental impacts, with far reaching ecological and socio-economic ramifications.

5.2.1 Forests

There has been extensive deforestation in the upland forests with consequences on downstream ecosystems and water availability. The main drivers for forest cover loss are: -

- Excisions in Orabel and Marmament forests.
- Logging in bahati, Muchongoi.
- Widespread charcoal burning within the catchment especially Nyalilpuch, Olkokwe and Mugurin.
- Cultivation in riparian areas in Subukia, Igwamiti and Loboi.
- Encroachment into gazetted forests, riverine forests and other fragile microhabitats.

The impacts of forest cover loss are:

- Increased seasonality of Waseges River
- Loss of swamps and wetlands that depend on upper catchment recharge
- Siltation downstream at Sandai and Loboi
- Loss of biodiversity
- Flooding and displacement of settlements in the lowlands
- Increased stream velocity leading to gully formation and drainage of Kesubo swamps

5.1.2 Communal grazing areas

Livestock densities increased beyond the lands carrying capacity leading to over grazing and change in grazing patterns. The cumulative effect of overgrazing, localised and sustained pressure on forage in the lower catchment and the environs of the reserve. These and the changing life styles tending towards increased sedentarization has led to:

- Soil erosion with sheet and gully formation
- Loss of soil fertility
- Sparse vegetation cover with top soil exposure
- Reduced forage availability
- Increase in invader plant species
- Intensification of dust storms
- Flash flooding
- Increased poverty prevalence
- Increased pressure on fragile microhabitats
- Encroachment into swamps
- Prevalence of animal diseases
- Human – wildlife conflict

Overall the consequences of human induced changes in land cover in the plan area are:

- Intensive soil erosion at Mugurin, Kisanana leading to siltation of River Loboi.
- Loss of biodiversity outside and within the reserve
- Extensive land degradation in the entire plan area.
- Deterioration and loss of water catchment value in Muchongoi and Bahati forests.
- Loss of ecological value due to loss of water, disruption of nutrients recycling, seasonal flooding and loss of other water bodies as manifested by unusual flooding during the long rains.
- Loss of cultural and aesthetic values.

5.2.3 Land cover conservation challenges:

The following are the challenges in the conservation of land cover types in the plan area:
- Maintenance of viable land cover types, while pressure for land and overstocking continues.
- Protection and rehabilitation of degraded areas, which will soon after be considered as desirable grazing areas.
- Lack of skilled personnel and financial resources to rehabilitate degraded areas.
- Diversification of livelihood options in a socioeconomic environment characterized by high poverty levels.

5.2.4 Intervention to conserve the plan area land cover types

The following interventions will be undertaken to conserve the land cover:
- Educate community on better land husbandry, soil and water conservation.
- Train and mobilize communities through extension programs to manage land cover.
- Rehabilitate and protect degraded areas.
- Improve livestock quality and create links to livestock markets to manage stocking rates.
- Explore and promote alternative sources of livelihood (game farming).
- Demarcate and acquire title deeds for the forestland.
- Enhance capacity within Government department to deal with land cover loss.
- Support implementation of polices, laws and indigenous management systems.

5.3 Livestock and agriculture

Demographic changes has led to changes in lifestyle influencing land use patterns, where agricultural activities and pastoralism are practised in fragile habitats. This has been aggravated by the shift to individual landholding, reduced communal grazing and changes in settlement patterns.

5.3.1 Issues on livestock, agriculture and settlement

- Loss of pasture,
- Prolonged grazing in the reserve.
- Loss of dry season pasture in swamps and wetlands
- Localized extinction of pasture species through seedbank depletion
- Localized degradation through gully formation and exposure of bedrock,
- Siltation of water channels and swamps,
- Pronounced stream seasonality,
- Pollution of water bodies by agrochemicals, domestic waste,
- Farming on steep slopes leading to soil erosion.
- Drainage of wetlands.
- Water abstraction

The interplay of these factors has set in motion a vicious cycle leading to escalating poverty levels and unsustainable livelihoods. Challenges in addressing issues revolving around agriculture and livestock are:
- A cultural system that glorifies high livestock numbers rather than quality.
- Institutionalizing appropriate land husbandry practices in a populace where land tilling is a recently acquired practice.
- Instilling a sense of individual ownership of land where ownership was previously communal.

5.3.2 Mitigating measures

The following measures will be undertaken to mitigate the impacts of livestock, agriculture and human settlement.

Agriculture:
- Undertake education and awareness, sensitisation and appropriate action on riverbank, steep slope farming.
- Advocate integrated pest management and wise use of agro-chemicals.
- Introduce drip irrigation and regulate community irrigation schemes.
- Conduct a cost-benefit Analysis of crops grown in the area.
- Initiate best agricultural practices and on farm forestry.

Overgrazing:
- Educate community on appropriate stocking rates.
- Initiate incentives for appropriate stocking rates.
- Undertake reseeding programme.

- Regulate dry season grazing and control grazing in steep slopes.
- Improve livestock breeds and establish community based grazing committees.
- Discourage grazing in the reserve.

The following incentives are necessary to attain the above objectives:
- Assist in the marketing of farm produce.
- Assist in on-farm and post harvest management and pest control.
- Diversify income-generating projects such as bee keeping, *Aloe-vera* cultivation and small stock rearing.

5.4 Water resources

The plan area is largely water deficit and the situation has been aggravated by human activities that have disrupted the hydrological regimes, and affected water quality and quantity. Cultivation along riverbanks and clearing of forests in the upper parts of the catchment has affected water percolation, springs and river flow regimes. There is a severe water shortage especially in the dry months between December and March.

5.4.1 Issues and challenges

Water availability in the plan area is constrained by:
- Dwindling water resources.
- Deforestation in Marmanet, Olara Bel, Muchongoi and West Mau Forests.
- Declining water quality.
- Conflicts on water rights and use.

5.4.2. Mitigation strategies

The following strategies will be employed to manage water resources in the plan area:
- Implement the water Act, through formation of a water apportionment board and water users association to resolve conflicts.
- Undertake riverine vegetation rehabilitation and river bank protection.
- Encourage alternative water harvesting technologies
- Adopt water efficient irrigation technologies

5.4.3 Challenge

Regulating water resources utilization in an area where a large proportion of the population does not have access to safe drinking water.

5.5 Land tenure and land use dynamics

Land tenure and land use systems in the plan area have undergone extensive changes in historical and recent times. The land has changed from nomadic pastoralism, to communal sedentary grazing and currently individual holding.

This has led to:
- Catchment destruction resulting in drying up of rivers and encroachment of riparian areas.
- Deforestation.
- Subdivision of land leading to unsustainable livelihood.

5.5.1. Challenges

In addressing issue on land ownership the following challenges need to be met:
- Cultural change to cope with emerging issues relating to land.
- Goodwill in implementation of relevant legislation that safeguard the environment such as river bank, wetland and spring protection.

5.5.2 Strategies

The following strategies will be employed to manage impacts emanating from land ownership and management problems:
- Streamline various Acts and policies relating to land use and ownership.
- Intensify education and awareness campaigns among the various stakeholders on appropriate land uses and practices

5.6 Human–wildlife conflict

In the plan area, the human –wildlife conflict has increased due to grazing in the reserve, settlement in wildlife dispersal areas and destruction of crops and property by wildlife. The conflicts have intensified with time due to poor management of natural resources outside protected area and it is strongly correlated with increased poverty. This is in the form of:

- Livestock predation
- Subsistence poaching
- Crop destruction

5.6.1 Intervention

- Minimise human-wildlife interactions and attend to PAC
- Minimise human activities in the official gazetted and protected areas
- Diversify and increase benefits to community accrued from tourism and conservation
- Establish land use practices compatible with wildlife or biodiversity conservation

5.6.2 Strategies

The following strategies will be applied to address human wildlife conflict.

- Community Education and awareness on conflict coping methods, and sensitisation on range management techniques,
- Develop Compensation for death, injury or loss of property due to wildlife in form of incentives like communities living adjacent to the protected area be provided with access to water resources within the reserve and other conservation benefits,
- Undertaking environmental education and awareness programme that targets farmers, school children and teachers, adult learners and the rural urban community

In addition to the environmental education and awareness programme targeting the local community, the reserve management will undertake the following activities:

- Develop and implement environmental education programme directly linked to issues in the reserve.
- In collaboration with WWF, complete development of the resource and information centres within the reserve.
- Publish a guidebook on the National Reserve.

Lake Bogoria National Reserve infrastructure inventory and management

This section deals specifically with LBNR issues and the need to focus the reserve management to realise its conservation and management objectives. Infrastructure inventory in the reserve has been done and prescription of management measure necessary for its management documented.

6.1 Infrastructure and facilities inventory

6.1.1 Administration and staff accommodation

The Reserve Head Office is located at Loboi and consists of an office block, staff houses with 2 senior staff units and 8 junior staff units. At Maji Moto outpost, there are 2 staff housing units, where as at Emsos there are 4 semi permanent single housing units. In addition to these is a single general-purpose house at Nyalilpuch viewpoint. Office space and staff housing in place is inadequate.

A new gate was constructed as part of the reserve boundary realignment, which is currently disused. All the reserve entry gates are radio connected.

6.1.2 Lake Bogoria Dryland Environmental Education Centre.

This Education Centre equipped and supplied with education materials and a kitchen unit, is located next to Loboi Gate. It is used in promoting sustainable use of natural resources through awareness creation among the local community, schools and visitors to the Reserve. It offers the following services:

- Lectures on Lake Bogoria ecosystem to visitors, schools and other groups.
- Video and slide shows.
- Environmental lessons and Training on environmental themes such as conservation of wildlife, wetlands, soil and water conservation, Lake Bogoria ecosystem, agroforestry, among others.

6.1.3 Curio shops

There are several curio shops along the main road leading to the reserve, offering locally made handcrafts, papyrus mats and other artefacts. These include Chelaba Women Group curio shop located opposite Lake Bogoria Hotel,

6.1.4 Cultural Centers

There are two cultural centers, depicting Tugen and Endorois community cultures. The Tugen cultural center displays traditional homesteads built in Tugen architectural design, old stools used by elders, and a viewpoint and is about 15 Km from the Reserve along Marigat–Loboi road. The viewpoint offers a panoramic view of the area including the Kiborgoch Swamp. Traditional dances and dishes are viable at the centre on request. The Endorois Community Cultural Centre is located near the Reserve head office and similarly has traditional artifacts and resident traditional dancers' troupes.

6.2 Accommodation

Two categories of accommodation are available, in the reserve and outside the reserve.

6.2.1 Accommodation in the reserve

There are three campsites inside the Reserve:

- Acacia campsite - about 6 Km beyond the Hot Springs;
- Riverside campsite and
- Fig tree campsite and
- The Lake Bogoria Dryland Environmental Education Centre campsite

6.2.2 Accommodation outside the reserve

Hotels

Lake Bogoria Hotel: This is a 3 star hotel with private cottages and seminar facilities. The hotel has a natural health spa and a normal cold-water swimming pool.

Papyrus Inn and Zakayo's Hotel: These are low budget outfits located near the Reserve headquarters and offer accommodation and meals.

Campsites

There are three camps outside the Reserve;

- Loboi River camp and picnic site next to Loboi River Bridge,
- NETBON camping site near Maji Moto gate and,
- Emsos community camp.

6.3 National Reserve management

Processes and impacts arising from within the reserve, its immediate environs and the wider catchment have negatively affected the reserve, minimizing its significance as a wetland of international importance and a stopover for migratory birds. The impacts within the reserve are due to the reserve the management regimes, livestock grazing and tourism activities.

6.3.1 Invasive plant species

Lack of management interventions in the reserve has lead to proliferation of invasive species. Invasive species management requires habitat management like mechanical removal. Invasive species are a serious threat in the reserve, especially around the main gate, Waseges river inlet, South of Loburu hot springs and Mawe Moto.

The impacts of invader plant species are:

- Reduction of forage for animals
- Changes in habitat structure, quality and utilization by animals
- Reduction in overall biodiversity
- Poor animal condition due to toxins and diseases
- Influence on animal species composition, distribution, home range sizes, recruitment and survival

6.3.2. Sustainable conservation and management requirements

The national reserve has a wide diversity of wild herbivores in direct competition with livestock grazed in the reserve. This has resulted into confinement of wild herbivores to certain areas. The localization of these herbivores has resulted in overgrazing, invader species increase and high incidences of livestock-game disease transmission. For sustainable management of the wild herbivores the management will:

- Identify key habitats for:
    - Grazers
    - Browsers
    - Mixed feeders
- Identify the reserve species equilibrium
- Manage habitats for specific wildlife species while retaining key biodiversity features of the reserve.
- Establish ecosystem management monitoring programmes.

6.3.3 Management actions

- Rehabilitate the grasslands at Sandai River mouth area, area south of Loburu springs and Mawe Moto area.
- Stop livestock grazing in the reserve.
- Remove and control spread of invader species through mechanical removal or burning between reserve headquarters and Northern shoreline.
- Determine reserve productivity

6.3.4 Tourism

The long-term tourism objective in the plan area is to diversify tourism to increase the revenue base and enhance tourism products while minimizing environmental impacts of tourism through diversification of activities.

Tourism management issues

Visitors to LBNR concentrate around the hot springs and fig tree areas. This creates disproportionate pressure around these fragile sites. The range of visitor activities is low due to lack diversification and poor marketing of other possible activities within the reserve. Linking the reserve to Lake Baringo and other potential areas around Marigat and the catchment can relieve the pressure.

The quality of service and product offered by the reserve and the hotels are adequate; but there is a need to promote other tourism attractions in the plan area. The current visitor accommodation facilities are adequate, however the campsites should be relocated and rehabilitated.

Tourism zoning

Within the reserve, some of the most important tourist attractions are located in sensitive habitats susceptible to degradation by uncontrolled tourist activities. Sensitive areas include the hot springs, river mouths and sections of the lake shoreline. The reserve will zoned to reduce pressure on sensitive habitats as earlier described.

Diversification of tourist activities

To encourage extended stay and repeat visits, the following actions will be undertaken:

- Undertake an inventory of other potential sites for tourism and market them.
- Develop and market the cultural sites within the catchment.
- Improve curio shops and their product range.
- Introduce hiking and safari walks in the reserve.
- Relocate and rehabilitate the campsite at the education centre.

6.3.5 Research and monitoring

The ecology of the plan areas is easily impacted by extraneous factors especially those of anthropogenic origin. Understanding the ecological linkages in the plan area is vital in making informed and judicious management decisions. Management oriented research programmes should be initiated to provide greater understanding of resource interactions and to help managers respond appropriately to changes that may occur. Collaborative research within the catchment will be encouraged to facilitate interactions among managers, researchers and the community. The following programmes will be undertaken.

Ecological/environmental monitoring

This will include environmental attributes, ecological and socioeconomic trends to generate data for an early warning system; and provide information to guide managers. Socioeconomic indicators to be monitored include:

- Catchment land use,
- Projected development activities,
- Livestock stocking rates,
- Expansion of areas under agriculture and
- Land cover trends.

The ecological monitoring programmes will include:

- Physical parameters

Meteorology: Meteorological variables currently being monitored are rainfall, temperature, relative humidity, evaporation and wind speed. More community managed rainfall stations should be established in the catchment.

Lake level and river flow: The lake and river staff gauges will be regularly read to collect data.

- Water quality monitoring

A collaborative effort will be put in place to maintain the ongoing water quality monitoring and develop a water quality database.

- Ecological monitoring

- Animal census

Quarterly animal counts will be undertaken on a regular basis to generate information on population dynamics and trends for management purposes. This will provide information on habitat utilization patterns, distribution and aid in security patrols and management of human-wildlife conflict.

- Waterfowl counts.

The current biannual waterfowl counts will continue and in addition emphasis will be wet/dry transition periods.

- Habitat monitoring

Vegetation monitoring transects and enclosures are to be established and monitored. A vegetation-monitoring programme will be developed in year one and carried during dry and wet periods.

- Flamingo Mortalities

Episodes of lesser flamingo mortalities have become frequent in the Rift Valley alkaline lakes and have been attributed to several factors. The lesser flamingo health status will be monitored and used as a bio-indicator of the ecosystem health. This monitoring will also include phytoplankton densities, water quality and quantity, physical, chemical and biological parameters.

A monitoring programme will be developed to cover the Rift Valley lakes in Kenya and Lake Natron. The factors, to be monitored are:

- Water quality and quantity
- Phytoplankton dynamics
- Algal toxins: microcystin-LR and anatoxin-A
- Heavy metals and pesticides concentrations in water, sediments, algae and waterfowl.
- Flamingo movements
- Flamingo health and infectious diseases

6.4 Reserve infrastructure maintenance and management

6.4.1 Buildings

- The reserve buildings will be maintained and rehabilitated to suit human habitation standards.
- Education Centre
- Accommodation facilities dormitories, ablution blocks, kitchen and dinning hall will be constructed to cater for groups from far.

6.4.2 Roads

The existing permanent road network will be regularly maintained during the plan period. The County Councils of Baringo and Koibatek will ensure this road is prioritised and included in the development plans for the Districts.

6.4.3 Airstrip

The current non-registered airstrip will be gazetted and maintained.

6.4.4 Campsites and Picnic sites

These will be maintained through out the plan period.

6.4.5 Water supply

To augment water supply to staff houses, the clinic and the neighbouring schools, the collapsed pipeline to Lake Bogoria Hotel will be rehabilitated and water Kiosks provided for the local community. Likewise the fresh water source at each campsite will be rehabilitated.

6.4.6 Vehicles

The reserve has no reliable transport, especially for field operations and general transport. The current reserve fleet will be maintained and additional vehicles purchased to address the current transport shortage.

6.4.7 Communication

The park has adequate telephone, e-mail and radio communication facilities.

Implementation strategy, institutional framework and stakeholder involvement

7.1 Introduction

This chapter identifies key stakeholders and describes the framework for their involvement in the Integrated Management Plan (IMP) implementation and provides for linkages, legal framework and responsibilities of the stakeholders. This will be in conformity to Environmental Coordination and Management Act 2000. This Act provides a strategy for stakeholder collaboration in environmental management through establishment of environment focused management committee. Collaborative participation provides for ownership, commitment, resource mobilization and collaboration with development partners and other conservation agencies.

7.2 Implementation strategy

The implementation strategy of this has the following elements: -

- Involvement and collaboration of stakeholders in the implementation of the IMP and development of proposals to implement the IMP.
- Active consultation and collaboration amongst stakeholders
- Adaptive management approach in the IMP implementation
- Management programmes based on sound scientific findings.

The IMP implementation strategy is based on the ecosystem/catchment approach, collaboration and policy making.

7.2.1 Ecosystem /catchment approach

The current LBNR management system is ad hoc, sectoral and fails to consider the reserve as an integrated system with several interdependent components. The IMP implementation will be guided by the ecosystem based approach to environmental management, which calls for the plan area to be managed as one ecological unit. There is need to recognize the inter-linkages between the reserve and its environs as environmental issues are interlinked and often crosscutting; and adopt a collaborative approach to ensure harmonization and integration of conservation and development efforts to realize the objectives of this IMP.

7.2.2 Collaboration

Implementing this IMP will involve establishing collaboration and linkages amongst the various stakeholders to ensure consensus in implementation and formulation of appropriate mitigation measures. This is necessary as the various issues and challenges the plan area are intricate, crosscutting and multifaceted affecting various stakeholders and ecosystem components in different ways. Integrated approach to natural resource management is only successful if there is:

- Inter-agency linkages to management,
- Coordinated interdisciplinary teams to address challenges,
- Inter-sectoral teams to address implementation strategies, and
- Stakeholder participation and support to ensure success.

7.2.3 Policy making

Stakeholders' participation in the implementation of environmental decisions will help achieve community empowerment and enhance public trust. To accomplish this core objective, this IMP encourages all stakeholders to accept each other as partners in decision-making and policy making process. Subscription to this perspective in shaping and reaching decisions will greatly be guided by institutionalising the consensus-building process.

7.3 Factors guiding development of institutional framework for the IMP

Developing institutional framework to implement this IMP will be guided by the following principles:

- The conservation and sustainable use of natural resources in the plan area is influenced by social, cultural, economic and political factors that must be considered exhaustively.
- Taking cognizance of existing linkages, policies and institutional frameworks that are influencing the conservation and management of the plan area.
- The need to strike an optimal balance between environmental conservation and human livelihoods.
- The need for multi-disciplinary and inter-sectoral teams to address conservation and socioeconomic development issues in the plan area.

7.4 Possible roles and responsibilities of the major stakeholders in the successful implementation of this IMP

7.4.1 Baringo and Koibatek county councils

The two county councils have authority to manage the reserve as provided for in the Wildlife Act. They are responsible for conservation of biodiversity and natural resources especially within the National Reserve and have to:

- Ensure ecological integrity of the reserve through proper planning and management
- Coordinate and play a key role in supporting the IMP implementation
- Support initiatives of the other stakeholders in the plan area
- Develop a way of incorporating research findings into management of the reserve
- Establish strong network and take initiative in establishing collaboration with other stakeholders and government departments especially to write joint proposals for the successful implementation of this IMP
- Promote responsible tourism as an income-generating project in the plan area.
- Promote scientific driven decisions.
- Have control over developments in the urban centres within the catchment.
- Develop and put in place disaster response mechanisms

7.4.2 Forest Department

The forest department is responsible for conservation and development of forest resources as stipulated in the forest Act. In respect to this IMP, the forest department will be responsible for:

- Guiding rehabilitation and conservation of catchment forest areas
- Initiating and promoting on farm forestry
- Controlling forest excision, fires and encroachment
- Interpretation of the forest master plan and its implement.
- Enforcing and policing conservation of the gazetted forests as stipulated in the forest Act.
- Securing title deeds of forest lands and ownership documents
- Undertaking forest related education, awareness and extension services
- Developing integrated forest management plans.
- Providing a lead in forest research, monitoring and conservation.
- Develop and put in place disaster response mechanisms.

7.4.3. Ministry of Water and Irrigation

This will be responsible for conservation of water resources as stipulated in the Act, and will ensure the WRMA is active to:

- Ensure protection of riverbanks.
- Undertake education and awareness on water conservation.
- Monitor and enforce water quality standards.
- Apportion water resources through permits and licenses.
- Gazette water catchment areas within the basin.
- Establish and gazette Water User Associations.
- Interpret the water master plan to all stakeholders within the catchment.
- Maintain hydrological data and act as custodians of information and database related to water conservation.

7.3.4 District Environmental Committee

This committee is responsible for proper management of environment in the district as stipulated in EMCA. The responsibilities of this committee will be to:

- Ensure and support the IMP implementation.
- Ensure gazettement of the plan implementation committee and provide its link to NEMA.
- Mobilize resources to implement the IMP
- Provide linkages between government sectors and other stakeholders
- Act as an executive organ to ensure all development projects are environmental friendly

7.4.5 District Development Committee

- Ensure environmental standards are adhered to in development project.
- Address poverty reduction issues.
- Coordinate development programmes in the region.

7.4.6 Local provincial administration

- Enforce environmental regulations on the ground.
- Provide an enabling environment for IMP implementation.

7.4.7 National Museum of Kenya

- Develop, maintain cultural heritage and monuments within the catchment area
- Coordinate research and monitoring of flora and fauna especially that of water bird, invertebrates and plants.

7.4.8 Non-governmental organizations.

- Support in the implementation of conservation and development activities
- Collaborate with the committees in operationalising the plan
- Encourage formation of Community Based Organizations
- Mobilize resources to support implementation of the plan

7.4.9 Community-based organizations

- Provide networks and linkages between the implementation committee and the grassroots
- Mobilize community support and participation
- Mobilize Resources and undertake education and awareness
- Participatory development and implementation of Action plans

7.4.10 Agriculture Department

- Coordinate agro- based activities to control soil erosion, pollution and siltation.
- Provide relevant officers to be co-opted within the committee
- Integrate research findings into applied agriculture
- Promote good farming practices

7.4.11 Institutions of higher learning

- Collaborate with other stakeholders to develop proposals for funding
- Undertake research activities in collaboration with stakeholders.
- Identify plant species that are potentially harmful to the environment
- Assist in monitoring of trends in the catchment.
- Provide technical support to the committee.
- Undertake Training as resource persons and enhance capacity building for specific stakeholders.

7.4.12 Kenya Wildlife Service

Kenya Wildlife Service will provide technical advice in accordance to the wildlife Act, through the Lake Bogoria Joint Management Committee of this management plan.

7.5 The Plan implementation structure

To implement this plan it is proposed that an implementation committee be constituted. This committee will be called IMP Implementation Committee and will be the executive body mandated with the implementation of the Management Plan as shown in Figure 9.

7.5.1 IMP Steering committee

Committee will be composed of the following stakeholders:

- Senior Warden Lake Bogoria National Reserve
- Technical expert from KWS – District Warden
- WWF EARPO representative
- Clerk Baringo County Council
- Clerk Koibatek County Council
- Treasurer Baringo County Council
- Treasurer Koibatek County Council
- Provincial officer - NEMA
- Two experts from institutions of higher learning with knowledge of the plan area (*when need arise*)

7.5.2 Terms of Reference of the Steering committee

As a starting point, the following is proposed as TOR that can be refined by the Committee.

- Develop a framework defining its operations
- Interpret the management plan for purposes of implementation
- Co-ordinate the implementation of the management plan.
- Co-ordination of research
- Mobilize resources for the plan implementation
- Evaluate the progress of activities within the plan areas.
- In collaboration with other stakeholders, develop a code of conduct, regulation guidelines or by-laws of the forum.
- Identify constraints in the processes of plan implementation.
- Produce annual work plans based on the management plan.
- Recommend review of the management plan.

7.6 Operationalization of the Committee

- Stakeholders will be mobilized and hold meeting to constitute the plan implementation committee.
- The committee will be facilitated to develop its terms of reference and implementation programme
- The committee will develop a funding proposal for implementation of the plan.

7.7 Risks and assumptions

- Stakeholders remain committed and willing to participate in the plan implementation
- Adequate resources (financial, human and equipment) will be mobilized to support plan implementation
- The two County Councils willingness to facilitate the initial operationalization of the plan in conjunction with other stakeholders
- WWF EARPO will support the management plan implementation
- Political goodwill and stability prevails
- Inter-institutional coordination and harmony exists

Monitoring and evaluation, activities and budget

8.1 Monitoring and evaluation

Monitoring and evaluation will be continuous throughout the plan period. To guide evaluation, a log-framework will be institutionalized. The monitoring component will include:

- Evaluating the extent of acceptance of the management plan among the stakeholders and implementers.
- Evaluating the implementation of activities by evaluating progress reports, work programmes and work plans, stakeholder involvement and participation.
- Monitor and evaluate the impact of management prescriptions.
- Monitor budget allocations, expenditure and accounting procedures.
- Monitor and evaluate the environmental status of the Lake and its catchment through use of ecological, social and economic indicators.
- Monitor and evaluate the responsiveness to the education and awareness initiatives.
- Monitor and evaluate the extent of security activities in the reserve.

The responsibility of monitoring and evaluation lies with the plan implementation committee and the two County Councils monitoring and evaluation unit.

8.2 Scheduled activities and outputs

This plan identifies activities for the first five years and after this period activities will be drawn for subsequent periods depending on level of implementation of activities in the first five years.

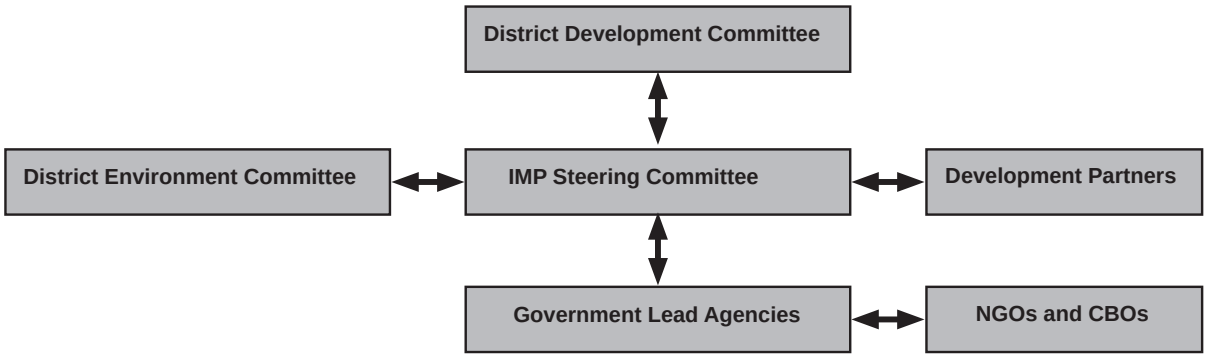

Figure 9: The Proposed Management Plan Implementation Structure. (The structure is not hierarchical. The implementing committee can form other ad hoc committees as need arise)

8.2.1 Scheduled activities

Objective	Activity	Means of Verification	Output	Time Frame in Years					Responsibility
				1	2	3	4	5	
I. Education and awareness in upper catchment	Expand School education programme & curricula	Type & No. of Programmes in place, programme report	Programme in operation						WWF , WCK, MOE, LA
A. Formal education and awareness • School programmes	Develop more education materials	Type of materials developed Pamphlets, Magazines, Videos, Puzzle	Facilitate teaching education materials						WWF, WCK, LA, MOE
	Undertake School education programme in upper catchment	Progress reports, no. of Schools visited	8 Schools a year visited, schools aware						WWF, WCK, KWS
	Upgrade, maintain resource/education information centre to include upper catchment needs	Conditions of facilities in centre	Education centre in good condition, Easy demonstration						WWF, WCK, LA
• School outreach programme	Develop outreach programme	Type of programme, programme report	Programme in place by year one						WWF, WCK, MOE, KWS
	Implement outreach programme	Progress report on no. of Schools visited	8 Schools a year						WWF, WCK, MOE
• School campaigns	Organize specific environmental rallies (environment day, wetland day, world water day)	Rally reports	3 rallies a year per education zones						WWF, WCK, LA, MOE
B. Informal education in upper catchment Mobilization	❑ Identify targets groups & Develop out reach materials	Type of materials developed & groups identified	Pamphlets, news letters						WWF, WCK, LA, CBOs,
	Organize public Barazas	No. of Barazas organized/reports	6 Barazas in a year						WWF, WCK, LA CBOs,
Community Environmental conservation	Form local environmental conservation committees, committee meetings	No. of committees formed, meeting reports	1 committee in target zones, quarterly meeting reports						WWF, LA, NEMA, FD
II. Community participation in environmental conservation in upper catchment	Develop environmental education programme on soil & water conservation, aforestation, resource use,	Type of environmental education programme & activities in place, programme progress reports	Programme in place by year two, quarterly progress reports						MRD, WWF, LA, ME&NR, MA, MLF
	Develop environmental education materials	Type of materials developed	Materials in place by year Three						MRD, WWF, LA, ME&NR MA, MLF
	Undertake environmental education programme	No. of Villages reached	6 villages in year						WCK, LA, ME&NR, MA, MLF
	Establish demonstration plots	No. of plots established	1 per village						WWF, LA, MA, MLF, FD
	Organize workshops for Community leaders	No. of workshop organized in a year,	1 in a year, workshop reports						WWF, LA

III. Expand human wildlife conflict & community, development & enterprise projects to upper catchment	Establish types & conflict intensity	Conflict report	Report in place by year 1						LA, Community
	Formulate conflict mitigation measures	Mitigation status	Report in place by year 1						LA Community, KWS, FD, WRMA, Prov. Admin
	Identify community social projects	Projects proposals in place by year 2	No. of proposals						LA, Community
	Undertake community social projects	Type of project in place	1 per conflict zone						LA Community
	Identify community enterprise projects	Projects proposals	No. of proposals						LA Community, Donors
	Implement community enterprise projects	No. of projects implemented	1 project per year & zone						LA, Donors, Community
IV. Reserve Management Habitat management (vegetation)	Identify key habitats and establish carrying capacity	Data	Habitat utilisation report						KWS, UON, MU, EU, WWF, Donors
	Develop habitat management programme (fire, Mechanical) to meet reserve goals	Management programme report	1 Programme report						KWS, UON, MU, EU, WWF, Donors
	Implement habitat management programme	Programme progress reports	Improved habitat						KWS, UON, MU, EU, WWF, Donors
	• Control bush encroachment	Bush control progress report	Acreage controlled						KWS, UON, MU,, EU, WWF, Donors
	• Open grass lands	Progress report	Acreage controlled						KWS, UON, MU, EU, WWF, Donors
	• Remove invasive species	Area controlled progress report	Acreage removed						KWS, UON, MU, EU, WWF, Donors
	Develop wildlife species management strategy	Strategy report	Proposal in place by year one						KWS, UON, MU WWF,
Species Management	Kudu, Klip Springer and other endangered species management	Population of target species	Population growth of Kudu, Klip Springer and other target species, quarterly reports						KWS, UON, MU, WWF, Donors
V. Reserve Maintenance & management programme	Complete Staff establishment	Cadre of Staff in place	No. of staff recruited						LBNR, LA, KWS, WWF
	Institute continuous adaptive Training needs assessment	Assessment report	Needs identified						LBNR, LA, KWS, WWF
	Undertake relevant training	No. of personnel trained	Improved efficiency						LBNR, LA, KWS, WWF
	Enhance continued capacity to monitor water quality river level and climate variables and initiate in upper catchment	Data	Improved environmental monitoring						LBNR, LA, KWS, WWF
	Waste management within reserve and environs	Progress reports on west management	Waste management programmes in place						LBNR

A. Infrastructure (i) Water supply	Identify water sources & undertake water distribution survey	Distribution map for water sources & points	Sources & distribution points outlay						LBNR, LA, KWS, WWF
	Supply water to camp sites, staff houses, school & clinic	Water supply at designated points	Water availability where desired						LBNR, LA, KWS, WWF
(ii) Roads	Close and upgrade as necessary	Closure and upgrading	Improved road network						LBNR, LA, KWS, WWF
	Routine road maintenance	Maintained roads	Accessible roads.						LBNR, LA, KWS, WWF
(iii) Buildings & housing	Maintenance of existing buildings and provide staff accommodation Provide adequate office space	Condition of buildings, all Rangers housed in LBNR staff quarters by year 3 Office block ready by year 4	Improvement of buildings, improved housing for Rangers, improved office accommodation						LBNR, LA, KWS, WWF
(iv) Education centre hostels	Construction 50 bed hostel and associated facilities	Structures in place	An enhanced and effective education programme						LBNR, LA, KWS, WWF
1. Security	Ranger patrols	Quarterly patrol reports/OB/ Reported insecurity incidences	Reserve secure/incidences of insecurity						LBNR, LA, KWS, WWF
	Intelligence information gathering	Sitreps reports	Tourist insecurity minimised						LBNR, LA, KWS, WWF
	Procurement of security equipment	Equipment in place	Convenient data gathering						LBNR, LA, KWS, WWF
2. Tourism (a) Promotion	❑ Produce tourist information materials ▪ Brochures ▪ Pamphlets ▪ Maps Website	Type and number of materials produced & their availability	Increase in visitation & appreciation						LBNR, LA, KTB, KATO, WWF, KWS
	Develop other tourism facilities	Quality Facilities in place	1 of each facility ready by year 3						LBNR, LA, KTB, KATO, WWF, KWS
(b) Diversify Tourism	Establish Tourist facilities	Facilities in place	Ready by year 2						LBNR, LA, KTB, KATO, WWF, KWS
	Feasibility study & designs for a safari walk around	Progress report	Safari walk report						LBNR, LA, KTB, KATO, WWF, KWS
	Feasibility study for night game drives	Progress report	Night game drive report						LBNR, LA, KTB, KATO, WWF, KWS
	Develop tourist circuit in the catchment	Circuit report1 Report	1 report						LBNR, LA, KTB, KATO, WWF, KWS
	Establish cultural centre	Established cultural centre	1 cultural centre						LBNR, LA, KTB, KATO, WWF, KWS
	Control access to the hot springs	Number of incidents	Reduced incidents						LBNR, LA, KTB, KATO, WWF, KWS

(c) Tourist Facilities	Construct guard rail at view points	Guard rail in place	Visitor safety						LBNR, LA, KTB, KATO, WWF, KWS
	Open campsite at the Nyalilpuch escarpment	Campsite established	Increased camping facilities						LBNR, LA, KTB, KATO, WWF, KWS
	Develop nature trail	Trails opened	New trails in place						LBNR, LA, KTB, KATO, WWF, KWS
	Develop tourist information centre	Work reports	Information centre in place						LBNR, LA, KTB, KATO, WWF, KWS
3. Community Development and Catchment Management	Initiate community based development programmes in the upper catchment and enhance ongoing lower catchment community based development programmes	Progress reports on community development, reports on community income and poverty levels	Improved community income levels						Community CBOs, NGOs, GOK, Development partners
	Rehabilitation of degraded sites in both upper and lower catchment areas	Number of sites rehabilitated and their state	Improved environment and sustainable livelihoods						Community CBOs, NGOs, GOK, Higher learning and research institutions
	Aforestation (on farm tree planting)	No. of seedlings planted	Increase in tree cover						FD, Community,
	Campaign against polythene and plastics	Reduced littering	Clean environment						Community, LBNR
	Constitute Land use planning team to co-ordinate land use	Team in place	Minimized land use conflicts						Stakeholders & GOK
	River bank rehabilitation	Rehabilitation progress report	reduced siltation						MENR, Community
	Soil erosion control	Soil control measures in place	Reduced siltation & erosion						MENR, land owners, WWF, CBOs
	Control Water abstraction from rivers & ground water	Water regulation report	Sustained river flow						MENR, Community, Stakeholders
	Promote Energy conservation (Jikos)	No. of homesteads using energy saving Jikos	Reduced use of fuel wood						Community CBOs, NGOs, GOK
	Surface runoff harvesting along roads	No. of people involved , dams & Tanks in place	Reduced erosion, siltation & abstraction of water						Community CBOs, NGOs, GOK
	Initiate long term monitoring programme on land use, rainfall and river flow	Data	Detection of trends						KWS, UON, MU

4. Reserve Zonation	Develop a zonation map	Map in place	Map						LBNR
	Close access roads to Eastern & western shore line except at the designated observation points	Road closed	Minimized visitor impact/ habitat recovery						LBNR
	Close access to Sandai river mouth	Access closed	Secured habitat & improved						LBNR
	Close unnecessary roads in the Reserve	Roads closed	Secured habitat & improved						LBNR
	Construct a raised rail to control visitor close proximity to Loburu geysers	Facility in place	Secured habitat & improved						LBNR
• Catchment Zonation	Identify fragile areas (Steep slopes, lowlands fragile soils, rainfall zones)	Areas identified	Fragile areas report						All stakeholders, landowners
	Protect fragile habitats	Areas protected	Secured habitat						All stakeholders, landowners
	Identify land use types	Map in place	Catchment land use zones						Research Institutions, LBNR
	Quantify environmental impacts of various land use types	Data	Impacts quantified by land use						Research Institutions, LBNR
	Socio economic survey	Data	Socio-economic categories identified						Research Institutions
5. Research To strengthen management through generation of scientific information by	**I. Ecological monitoring** Vegetation monitoring	Reports on vegetation trends Vegetation trends reports	Programme in place 1 report @ year						LBNR, WWF
	Collect meteorological data	Monthly reports	Trends in meteorology established						LBNR, WWF
I. Undertaking ecological monitoring	Collection of River and lake levels	Quarterly progress reports	Trends in river flow and lake levels established						LBNR, WWF
	Animal counts	Quarterly reports	Trends in wildlife dynamics established						LBNR, WWF
	Waterfowl counts	Quarterly reports	Trends in waterfowl populations established						LBNR, WWF
II. Habitat Monitoring	**II. Habitat Monitoring** Vegetation monitoring	Biannual reports	Trends in vegetation structure determined						LBNR, WWF
	Water quality monitoring	Quarterly reports	Trends in water quality established						LBNR, WWF
	Collect environmental data in the catchment	Annual reports in environment status	Trends in environmental conditions established						WWF, Community, GOK
	Initiate a monitoring programme of water quality across the alkaline lakes in the Rift valley used by the lesser flamingo	Data and reports	Trend in water Quality that affects lesser flamingo						KWS,MU EU,UoN

III. Special species studies	**III Species studies to determine population status and viability**	Status reports on species, viability	Management decisions derived from the reports						LBNR, KWS, Institutions of higher learning
	Kudu								
	Klip Springer								
	Grazers								
	Leopard								
	Specialised browsers								
6. Development	Construction of buildings (Staff houses, Office, Gift shop, workshop, Ablution block, Information centre)	Works progress reports	Buildings in place						KWS
	Purchase of vehicles, plant and equipment	Procurement report	Facilities in place						KWS
7. Operationalization of the Implementation committee	Second stakeholder meeting to elect the implementation committee and endorse the IMP	Stakeholder meeting	Elected implementation committee in place						All Stakeholders
	Support establishment of network for stakeholders and proposal writing	Proposal	Flow of information and draft proposals						KWS, MU,UoN,EU and donors
	Support initial implementation committee meeting an linkages to other agencies	Committee meeting	Functional committee						KWS, MU,UoN,EU and donors

8.2.1 Budget

Objective	Activity	Budget year in USD '000					
		1	2	3	4	5	TOTAL
I. Education and Awareness in upper catchment	Expand School education programme & curricula	6.25					6.25
A. Formal education and awareness	Develop School education programme & curricula	6.25					6.25
• School programmes	Develop more education materials	50					50
	Undertake School education programme		1.25	1.25	1.25	1.25	5.0
	Upgrade , maintain resource /education information centre	6.25					6.25
• School outreach programme	Develop outreach programme	6.25					6.25
	Implement outreach programme		Budget as in 1 iii				
• School campaigns	Organize specific environmental rallies (environment day, wetland day, world water day)	1.25	1.25	1.25	1.25	1.25	6.25
B. Informal education in upper catchment	Identify targets groups & Develop out reach materials	5					5
Mobilization	Organize public Barazas	1.25	1.25	1.25	1.25	1.25	6.25
Community Environmental Conservation	Form local environmental conservation committees, committee meetings	0.625	0.625	0.625	0.625	0.625	3.125
II. Community Participation In Environmental Conservation	Develop environmental education programme on soil & water conservation, a forestation, resource use,	0.625					0.625
	Develop environmental education materials	3.75	2.5				6.25
	Undertake programme	.625	.625	.625	.625	.625	3.125
	Establish demonstration plots		1.857	1.25	.625	.625	4.357
	Organize workshops for Community leaders	1.875	1.875	1.875	1.875	1.875	9.375
III. Human Wildlife Conflict & Community , Development & Enterprise Projects	Establish types & conflict intensity	0.625					0.625
	Formulate conflict mitigation measures	3.75					3.75
	Identify community social projects	0.625					25.0
	Undertake community social projects				12.5	12.5	2000
	Identify community enterprise projects	0.625					0.625
	Implement community enterprise projects			12.5	12.5	12.5	37.5
IV. Reserve management	Develop habitat management programme (fire, Mechanical) to meet Park goals	1.25					1.25
Habitat management (vegetation)	Implement habitat management programme						
	• Control bush encroachment	1.875	1.25	1.25	1.25	0.625	6.25
	• Open grass lands		2.5		2.5		5.0
	• Remove invasive	1.25	1.25	1.25	1.25	1.25	6.25
					1.25	1.25	2.50
	Develop wildlife species management strategy	1.25					1.25
Species Management	Species population studies & management			50	3.75	2.5	54.25
V. Reserve Maintenance & Management Programme	Complete Staff establishment	0.625					0.625
	Training needs assessment	1.25					1.25
	Undertake training			50	50	50	150

A. Infrastructure	Identify water sources & undertake water distribution survey	1.25					1.25
(i) Water supply	Supply water to specific points for staff			6.25	5.0	1.25	12.5
(ii) Roads	Close and upgrade as necessary		3.75				3.75
	Routine road maintenance	6.25	5.0	3.75	2.5	2.5	20.0
(iii) Buildings & housing	Maintenance of existing buildings and provide staff accommodation	6.25	6.25	5.0	3.75	2.5	23.75
1. Security	Ranger patrols	1.25	1.25	1.25	1.25	1.25	6.25
	Intelligence information gathering	2.5	1.875	1.875	1.875	1.875	10.0
	Procurement of security equipment	6.25	6.25				13.5
2. Tourism	Produce tourist information materials	3.75	3.75				7.5
(a) Promotion	Develop other tourism facilities						
	- Rehabilitate campsites & picnic sites	6.25	6.25	3.75			16.25
(b) Diversify Tourism	Gazette Loboi, Baringo as conservation areas			12.5	0.625		13.125
	Establish Tourist facilities (artefacts, curio-shop, cultural villages)		0.625	0.625	0.625	0.625	2.5
	Feasibility study & designs for a safari walk				6.25	2.5	8.75
	Develop tourist circuit in the catchment	3.75	3.75				7.5
	Construct guard rails	12.5					12.5
	Open campsite at selected sites	1.25					1.25
3. Community Development and Catchment Management	Campaign against polythene and plastics	6.25	6.25	3.125	3.125	3.125	21.875
	A forestation (on farm tree planting)	18.75	6.25	6.25	6.25	6.25	43.75
	Constitute Land use planning team to co-ordinate land use		6.25	2.5			6.45
	River bank rehabilitation	12.5	6.25	6.25	6.25	6.25	37.5
	Soil erosion control	12.5	12.5	12.5	12.5	12.5	62.5
	Control Water abstraction from rivers & ground water	6.25	6.25	6.25	6.25	6.25	31.25
	Promote Energy conservation (Jikos, solar)	12.5	12.5	12.5	12.5	12.5	62.5
	Surface runoff harvesting along roads	25	25	12.5	6.25	6.25	75
	Close access roads to flamingo landing points, Sandai River mouth & restrict entry past hot springs except at the designated observation points	25	12.5	2.5			38
4. Reserve zonation	Construction of guard rails at view points	62.5					62.5
(a) Park	dentify fragile habitats & protect	12.5					12.5
	Identify land use types & recommend appropriate use in each site	87.5					87.5
	Socio-economic survey	18.75		18.75			37.5
(b) Catchment **zonation**	Ecological monitoring						
	Vegetation monitoring	62.5	62.5	62.5	62.5	62.5	312.5

5. Research I. To Strengthen management through generation of scientific information II. Undertaking Ecological Monitoring	Collect meteorological data & establish community rainfall stations in the upper catchment	25	1.25	1.25	1.25	1.25	31.3
	Collection of River and lake levels	50	2.5	2.5	2.5	2.5	60
	Animal counts	6.25	6.25	6.25	6.25	6.25	31.25
	Waterfowl counts	12.5	12.5	12.5	12.5	12.5	62.5
	II. Habitat Monitoring						
	Vegetation monitoring	Budget included in 1 above, vegetation monitoring					
II. Habitat Monitoring	Water quality monitoring	187.5	4.5	4.5	4.5	4.5	205.5
	III Species studies to determine population status and viability						58.75
	Kudu, Klip Springer & Grazers & assess management interventions	56.25		2.5			250
III. Special species studies	Construction of buildings- Education Hostel & Ablution block	250					
	Office block		125				125
6. Reserve Development	Staff houses	375					375
	Mechanical workshop		125				125
	Houses		75	70	60	50	225
	Roads	15	15	15	15	15	75
7. Maintenance	Procurement of vehicles, plant and equipment		1,375				1,375

Appendices

Appendix 1: Trees and shrubs of Lake Bogoria National Reserve and its environs

Scientific Name	Common Name	Local Name	Scientific Name	Common Name	Local Name
Boscia angustifolia		Linto	*Opuntia opuntia*	Prickly cactus	Matunchiate
Acacia milliner	Hook thorn	Ngorore	*Warbugia ugandesis*		Soke
Grecian villas		Mokuywe	*Grevia bicolor*		Sitewe
Casaba farinose		Imbirikwo	*Rrhus natalensis*	Red currant	Siriande
Varies glomeration		Chepkoriande	*Acacia tortilis*	Umbrella thorn	Sesia
Acacia militia	Egyptian thorn	Chepiywe	*Aloe secundiflora*	Aloe	Tangaretwe
Acacia deficient		Barsule	*Maema angolense*		Cheboskewe
Cumbersome aculeate		Kamsalawa	*Kigelia africana*	Sausage	Rotinwo
Grecian tuna		Toronwe	*Calotropis procera*	Elephant apple	Lopusakii
Cappers trascularis		Korobuywe	*Cordial ovalis*	cordia	Tembererwe
Cumbersome hereroense		Miskitwe	*Acalypha indica*		Walbeyon/ jepnondos
Salvadora persica	Toothbrush tree	Sokotoiwo	*Aclyrantha aspera*		Chesirim
Balanite aegyptiaca	Desert date	Ngoswe	*Albublin spp.*		Kipnyali/kiptulwa
Acacia brevispiza	Wait-a-bit thorn	Gornista	*Boscia salicifolia*		Kurionde
Casaba edulis		Eidumeitolyon	*Cucumis spp*		Solopchesiny
Alchornea fruticosa		Lokurwe	*Euphorbia tirucalli*	Finger euphorbia	Kormotwo
Cissus rotundifolia		Rorowe	*Maerua triphylla*		Roson
Berchemioa discolor	Wild almond	Muchukwe	*Ludwigia spp.*		Chepchorusion
Commiphora samharansis		Kelepmoi	*Lycium europaeum*		Kipyambatia /kipnaget
Euphorbia scartina		Ele	*Gardenia ternifolia*		Kipbulwo
Commiphora edulis		Masian	*Albizia amara*		Kotutwo
Croton dischogamus		Kelelwe	*Commifora africana*		Tolginy
Sterculia stenocapa		Mukoywo	*Acacia gerrardii*		Sibeldi
Adenum venenata		Sotoplekech	*Olea europaea*	Brown olive	Temtit
Adenum obesum somalensis		Simbalwe	*Pappea capensis*		Kibiriokwo
Lannea triphylla		Tabuye	*Solanum nignum*		Sojonte
Albizia anthelmintica		Barmukunte	*Syzygium gguineense/ cordata*		Lomoiwo
Terminalia brownee		Koloswo	*Lanea fulua*		Lelit
Aspragus africana		Tobororwe	*Dodonaea angustifolia/ viscosa*	hopbush	Tibilibkwo
Cumbersome molle	Cumbersome	Chepchopoiwo	*Ocorea kenyesis*		Kipnaget
Acacia senegalis	Gum Arabic thorn	Chemange	*Tarchonanthus comphoratus*		Lelekwet
Dichrostachy cinerea		Tinet	*Carrisa edulis*	Legetetwet	
Ziziphus macronata	Buffalo thorn	Noiwet	*Pisticia aethopica*		tulda
Euphorbia candlebrum		Kunes	*Ficus thonningii*	Strangler fig	Simotwe
Ormocarpum kenieuse		Chemoyukobil	*Phyllantus zepialis*		Ariab lakwa
Acacia ceyal	White thorn	Lengne	*Crateva adansonii*		Kolewon
Haplocoelum foliotosum		Kokonte	*Lantana camara*		Ketip
Diospyros scabra		Tuwetye	*Meyna tetraphyila*		Tilingwo
Cissus quadringularis		Sungurtutwe	*Terminalia spinosa*		Tukuwemet
Zanthoxylum chalybeum	Knob wood	Kokchante	*Acacia drepanolobium*	Whistling thorn	Ngowe
Maema subcordata		Chepuluswo	*Premna resinosa*		Britapta/kekech
Maema decumbens		Monogwo	*Arundinalia alpina*	Mountain bamboo	Tegande
Acacia hockii		Tilatilie	*Vanguemia madagascarensis*		Komolwe
Tarmarindus indica	Tarmarind	Orwe	*Ficus sycomorus*	Sycomore fig	Lokoywe

Appendix 2. Lake Bogoria National Reserve checklist of mammals

Common name	Scientific name	Remark
Greater kudu	*Tragelaphus strepsiceros*	Threatened
Cape buffalo	*Syncerus caffer*	Rarely seen
Impala	*Aepyceros melampus rendilis*	Common
Grants gazelle	*Gazella granti*	Common
Dikdik	*Rhynchotragus kirki*	Common
Klipspringer	*Oreotragus oreotragus*	Rare
Blue duiker	*Cephalophus caeruleus*	Rare
Yellow – backed duiker	*Cephalophus silvicultor*	Rare
Anubis baboon	*Papio anubis*	Common
Leopard	*Panthera pardus*	Very rare
Serval cat	*Felis (Leptailurus) serval*	Very rare
Wildcat	*Felis (Sylvestris) libyca*	Very rare
Common waterbuck	*Kobus ellipsiprymnus*	Rare
Wart hog	*Phacochoerus aethiopicus*	Common
Bush pig	*Potamochoerus porcus*	Common
Common jackal	*Canis aureus*	Common
Spotted hyena	*Crocuta crocuta*	Rare
Stripped hyena	*Hyaena hyaena*	Rare
Bat-eared fox	*Otocyon megalotis*	Rare
Burchell's zebra	*Equus (Hippotigris) burchelli*	Common
Patas monkey	*Erythrocebus patas*	Rare
Vervet monkey	*Cercopithecus pygerythrus*	Common
Cheetah	*Acinonyx jubatus*	Rare
Aardvark	*Orycteropus afer*	Rare

Appendix 3. Lake Bogoria National Reserve checklist of birds

Common Name	Scientific Name	Common Name	Scientific Name
Common Ostrich	*Struthio camelus*	Jackson's Francolin	*Francolinus jacksoni*
Little Grebe	*Tachibuptus ruficollis*	Crested Francolin	*Francolinus saphaena*
Black necked Grebe	*Podiceps nigricollis*	Black Crake	*Amaurornis flavirostris*
Great-white pelican	*Pelecanus onocrotalus*	Grey Crown Crane	*Balearica regulorum*
Cattle Egret	*bubulcus ibis*	Black-winged Stilt	*Himantopujsn himantopus*
Striaed/Green-backed Heron	*butorides striatu*	Pied Avocet	*Recurviurosta avosetta*
Little Egret	*Egretta garzeta*	Spur winged Lapwing	*Vanellus spinosus*
Gredy Heron	*Ardea cinerea*	Crowned Lapwing	*Vanellus coronatus*
Black-headed Heron	*Ardea malanocephala*	Black-headed lapwing	*Vanellus tectus*
Hamerkop	*scopus umbretta*	Kittlitz's plover	*Charadrius pecuarius*
Yellow-billed stork	*Mycteria ibis*	Three-banded plover	*Charadrius tricollaris*
Wooly-necked Stork	*Ciconia episcopus*	Common ringed plover	*Charadrius hiaticula*
Marabou stork	*Leptoptilos crumeniferus*	Lesser sandpiper	*Chandarius mongolus*
Sacred ibis	*Threskiornis aethiopicus*	Little Bee-eater	*Merops pasillius*
Hadada ibis	*Bostrychia hagedash*	Cinammon-chested Bee-eater	*Meros oreobates*
Glossy ibis	*Bostrychia falcinellus*	European Bee-eater	*Merops apiaster*
Greater flamingo	*Phoenicopterus rubber*	Madagascar Bee-eater	*Merops superiliosus*
Lesser flamingo	*Phoenicopterus minor*	Lilac breasted Roller	*Coraciass caudate*
Egyptian Goose	*Alopochen aegyptiacus*	Green Wood Hoopoe	*Phoeniculus purpureus*
Spur- winged goose	*Plectopterus gambensis*	African Hoopoe	*Upupa Africana*
Knob–billed duck	*Sarkidiornis melanotos*	Red- billed Hornbill	*Tockus erythrorhynchus*
White –faced Whistling Duck	*Dendrocygna viduata*	Von der Deckens Hornbill	*Tockus deckeni*
Cape Teal	*Anas capensis*	Jackson's Hornbill	*Tockus jacksoni*
Yellow-billed Kite	*Milvus parasiticus*	African Grey Hornbill	*Tockus nasutus*
African fish eagle	*Haliaeetus vocifer*	Red-fronted Tinkerbird	*Pogoniulus pusillus*
African Harrier-Hawk	*Polyboroides typus*	Red-fronted Barbet	*Tricholaema diademata*
Augar buzzard	*Buteo augur*	Black throated Barbet	*Tricholaema melanocephala*
Common buzzard	*Buteo buteo*	White -headed Barbet	*Lybius leucocephalus*
Montangu's Harrier	*Circus ranivorus*	d'Arnaud's Barbet	*Trachyphonus darnaudii*
Dark Chantineg Goshhawk	*Melierax metabates*	Red and Yellow Barbet	*Trachyphonus erythrophalus*
Gabar Goshhawk	*Micronisus gabar*	Lesser Honeyguide	*Indicator minor*
Tawny Eagle	*Aquila rapax*	Nubian Woodpecker	*Campethera nubica*
Steppe Eagle	*Aquila nipalensis orientalis*	Cardinal Woodpecker	*Dendropicos fuscescns*
Verreaux Eagle	*Aquila verreauxii*	Bearded Woodpecker	*Dendropicos namaquus*
Martial Eagle	*Polemaetus bellicosdus*	Grey Woodpecker	*Dendropicos goertae*
Pygmy Falcon	*Polihierax semitorquatus*	Fischer's Sparrow Lark	*Eremopterix leucopareia*
Peregrine Falcon	*Falco peregrinus*	Rock Martin	*Hirundo filigula*
Helmeted Guinea fowl	*Numida meleagris*	Plain Martin	*Riparia paludicola*
Red-rumped Swallow	*Hirundo fuligula*	Sand Martin	*Riparia riparia*
Lesser striped swallow	*Hirundo abyssinica*	African scops-owl	*Otus senegalensis*
Barn swallow	*Hirundo rustica*	Verreaux's eagle-owl	*Bubo lacteus*
Wire-tailed swallow	*Hirundo smithii*	Pearl-spotted owlet	*Glaucidium perlatum*
African pied wagtail	*Motacilla lutea*	Little swift	*Apus affinis*
Common bulbul	*Pycnonotus barbatus*	White-rumped swift	*Apus caffer*
African thrush	*Turdus pelios*	Mottled swift	*Apus aequatorialis*
Isabelline wheatear	*Oenanthe pleschanka*	Nyanza swift	*Apus niansae*
Sported morning Thrush	*Cichladusa guttata*	Eurasian swift	*Apus apus*
Grey-baked camaroptera	*Camaptera brachyuran*	Speckled mousebird	*Colias striatus*
Southern black flycatcher	*Melaenornis pammelaina*	Blue-naped mouse bird	*Urocolias macrourus*
African grey flycatcher	*Bradornis microrhynchus*	Red-faced mouse bird	*Urocolias indicus*
Silverbird	*Empidornis semipartitus*	Grey-headed kingfisher	*Halcyon leucocephala*
Rufous chatterer	*Turdoides rubiginosus*	Woodland kingfisher	*Halcyon senegalensis*
Northern pied babbler	*Turdoides hypoleucus*	Malachite kingfisher	*Alcedo cristata*
White-bellied tit	*Parus albiventris*	African pigmy kingfisher	*Ispidina picta*
Northern grey tit	*Parus thruppi*	Beautiful sunbird	*Cinnyris pulchella*
Red-throated tit	*Parus fringillinus*	Eastern violet-backed sunbird	*Anthreptes orientalis*
Ruff	*Philomanchus pugnax*	Common fiscal	*Lanius collaris*
Common sandpiper	*Actitis hypoleucos*	Long-tailed fiscal	*Lanius cabanisi*
Wood sandpiper	*Tringa glareola*	Grey-backed fiscal	*Lanius excubitoroides*
Green sandpiper	*Tringer ochropus*	Slate-coloured boubou	*Laniarius funebris*

Common greenshank	*Tringa nebularis*	Brubru	*Nilaus afer*
Marsh sandpiper	*Tringa stagnatilis*	Black-backed puffback	*Dryoscopus cubia*
Spotted redshank	*Tringa erythropus*	Nothern White-crowned shrike	*Eurocephalus rueppelli*
Little stint	*Calidris minuta*	Fork-tailed drongo	*Dicrurus adsimilis*
Curlew sandpiper	*Calidris ferriginea*	Pied crow	*Corvus albus*
Common snipe	*Gallinago gallinago*	African black-headed oriole	*Oriolus larvatus*
Lichtenstein's sand grouse	*Pterocles lichtensteinii*	African golden oriole	*Oriolus auratus*
Africa green-pigeon	*Treron calva*	Red-billed oxpecker	*Buphagus erythrorhynchus*
Speckled pigeon	*Columba guinea*	Ashy starling	*Cosmopsarus unicolor*
Emerald-spotted wood-dove	*Turtur chalcospilos*	Ruppell's long-tailed starling	*Lamprotornis purpuropterus*
Namaqua dove	*Oena capensis*	Magpie starling	*Speculipastor bicolar*
Ring-necked dove	*Streptopelia capicola*	Supurb starling	*Lamprotornis superbus*
Red-eyed dove	*Streptopelia semitorquata*	Wattled starling	*Creatophora cinerea*
African mourning dove	*Streptopelia decipiens*	House sparrow	*Passer domestica*
Laughing dove	*Streptopelia senegalensis*	Chestnut sparrow	*Passer eminibey*
White-belied go-away-bird	*Corythaixoides leucogaster*	Grey-headed sparrow	*Passer griseus*
White-browed coucal	*Centropus superciliosus*	White-browed sparrow-weaver	*Plocepasser mahali*
White-billed buffalo-weaver	*Bubalornis albirostris*	White-headed buffalo-weaver	*Dinemellia dinemelli*
Northern masked weaver	*Ploceus taeniopterus*	Pin-tailed whydah	*Vidua macroura*
Speke's weaver	*Ploceus spekei*	Straw-tailed whydah	*Vidua fischeri*
Jackson's Golden-backed weaver	*Ploceus jacksoni*	Steel-blue whydah	*Vidua hypocherina*
Red-headed weaver	*Anaplectes rubriceps*	Village indigobird	*Vidua chalybeate*
Red-cheeked cordon-bleu	*Uraeginthus bengalus*	African citril	*Serinus citrinelloides*
Blue-capped cordon-bleu	*Uraeginthus cyanocephalus*	Streaky seedeater	*Serinus striolatus*
Red-billed firefinch	*Lagonosticta senegala*		

Appendix 4: Institutional Linkages

Institution	Functions	Potential role	Capacity	Area of operation
LA	Urban & Reserve Development	Urban Planning, development & Pollution control	Empowered to enact local Government policy, has political influence	County
KWS	Wildlife Management & Conservation	Biodiversity & Nature conservation, Tourist development	Strong net work, limited resources in comparison to mandate	National Parks, Forest Reserves and Communities, biodiversity areas
Forest Department	Forestry Conservation & development	Implementation of forest management & extension, catchment conservation	Strong network, weak in resources	Gazetted forests and extension country wide
Water Department	Conservation & apportionment of water resources	Protection of water supply & the catchment, river bank protection	Strong network, weak in resources	Nation-wide and local
District Environment Committee	Coordination of environmental protection and conservation activities	Mobilization of environmental actors and monitoring of environmental conditions	Strong network through elected leaders, limited resources & technical know-how	District level upto Communities
District Development Committee	Planning & coordination of development activities	Mobilization of Communities, feedback & evaluation of project activities at District level and landuse planning	Weak, lack of skilled manpower & resources compared to mandate	District level
Kenya Agricultural Research Institute	Agricultural Research & information dissemination	Research & advise on agricultural aspects	Strong in research, technical know-how.	Nation-wide with international contacts
National Museum of Kenya	Research, Education & conservation of heritage	Research & information provision on biodiversity & cultural aspects	Strong in research	National
WWF and other NGO's or CBO's	Community based development & conservation initiatives	Mobilization, Conservation, Education & awareness and Research	Strong network & resources	Nakuru catchment
WCK	Education	Mobilization & education	Strong network	Nation wide
KREMU	Natural resources survey and research	Research	Strong in research, technical know-how.	Nation-wide with international contacts
Agriculture Department	Agricultural development	Soil erosion and siltation control, eutrophication control, agro-chemical pollution control, river basin protection and catchment protection	Strong networking limited by resources compared to mandate, technical know how.	
Higher Learning Institutions	Research and education	Research and education, information dissemination	Strong in research, technical know-how.	Nation-wide with international contacts

Appendix 5: Institutional framework and collaboration

Management Unit/area	Issues	Options	Implementation Strategy	Management Authority/implementers
catchment	Afforestation	Establish tree nurseries	Forest Department to give technical expertise in afforestation process. Other agencies to give logistical support. Community to play an active role in forest establishment.	Forest department, Local community and other conservation agencies
		Forest rehabilitation	Tree planting on communal basis	Forest Dept., Community
		On farm tree planting	Community to plant, with technical advice from the forest department. Other agencies like WWF to assist	Forest department, Community, WWF and Agriculture
	Deforestation	Strict adherence to existing law	Forest guards and KWS rangers to apprehend lawbreakers.	Forest Department, KWS, Local authority, and Law courts.
		Education and awareness on the harmful effects of deforestation	Training of educationists and extension officers while mobilising communities through a bottom up approach.	WWF, WCK and KWS education programmes
	Soil erosion, Siltation and eutrophication	Terracing	Agriculture to identify areas for terraces & provide Technical advice	Agriculture, Community, WWF
		Terrace protection	Community to undertake embankment	Agriculture, Community
		Agroforestry/wind breaks	Agriculture to advice community on sustainable methods of agroforestry	Agriculture, Forest, Community, WWF
		Land use planning	Physical planner to ensure land use and planning confirm to IEM	Physical Planner, Administration
		Contour ploughing	Agriculture to ensure all farm on sloppy grounds are terraced	Agriculture, Local Community
	Migration and Land prospecting	Strengthen the existing laws on land encroachment and prospecting.	Authorities in charge of land adjudication be sensitised on environmental issues.	Ministries of Lands – Environment, KWS, WWF, WCK
		Discourage squatters and relocation of people especially tribal clash victims.	Awareness and education programmes especially for migrant landowners not familiar with certain environmental issues.	WWF, WCK, KWS, MENR, MLS
	Overpopulation	Plan for rapidly expanding population. Encourage family planning strategies especially where population are youthful. Construction of housing schemes that put environmental. considerations into place	Ministries of Environment, Health, Planning etc to work in concert and articulate issues of mutual concern. Stress family planning as a way of reducing over reliance on natural resources	Ministries of Health, Planning, Env to work in concert and with logical support from KWS, WWF, WCK schools and churches.

Management Unit/area	Issues	Options	Implementation Strategy	Management Authority /implementers
Catchment	Agriculture	Integrated farm use	Agriculture to conform to IEM	Agriculture, Community
	Agro-chemicals	Control leaching	Agriculture to confirm to Agro-chemical control	Agriculture, Community
		Avoid use of non biodegradable agro-chemicals	Promote use and application of biodegradable fertilizers. Agriculture to train farmers on use of biodegradable	Agriculture, Community
	River bank protection	Use 30 m strip for grass plots and forestry	Agriculture and landowners to ensure this strip is used wisely. E.g. Like growing grass	Agriculture, Community
Urban Centres	Infrastructure development	Control surface run-off	Public works and community to ensure roads have adequate and relevant drainage systems in place	Public works, Community, All
	Fuel Wood	Agroforestry	Community to plat trees and use energy saving jikos in each home stead; Train community on energy conservation	Community, Forest, All
		Use of energy conserving stoves		
	Land use/ Planning	Encourage Integrated land use practices	Physical planner, Administration, Lands and settlement to ensure all plans comply to IEM	ALL
	Pollution (Solid and Liquid waste)	Increase monitoring of solid and liquid waste pollution e.g. oil spillage by tracks and household effluents into rivers.	Local authorities to enhance efforts in collaborating together and with others especially in areas where they have no jurisdiction.	Local Councils NEMA
	Drainage	Assess water takeoffs and usage in important catchment areas such as Subukia	Water department to provide technical assistance, other institutions to provide logistical support.	Water department, Local councils, WWF
		Undertake EIA's on borehole construction and water distribution strategies	Educate and create awareness on the wise use principle.	WWF, KWS, WCK, Ministry of Water.

Management Unit/area	Issues	Options	Implementation Strategy	Management Authority/implementers
National Reserve	Wildlife dynamics, Wildlife Management	Manage stocking rates and populations of wildlife species	Establish Park Ecological monitoring programme & determine Park biomass by: • Biomass estimation • Census • Remote sensing	KWS, County Councils, Institutions of higher learning
			Establish Park species carrying capacities	KW County Councils, Institutions of higher learning
			Manage species stocks by: • Culling • Exchange • Trade	KWS County Councils, Institutions of higher learning
	Habitat management	Establish habitat management programmes	Develop & implement Active habitat management programme like: • Fire regime & programme • Habitat mechanical control • Zonation	KWS County Councils, Institutions of higher learning
	Pollution	Manage pollution levels, collaborate and network with other institutions	Develop water quality monitoring programme	KWS, County Councils, Institutions of higher learning
			Encourage KARI to play a role IPM	KARI, KWS, County Councils
	Visitor management	Manage Tourist activities and diversify	Establish Reserve Tourist carrying capacity	LBNRS, Institutions of higher learning
			Develop other tourism facilities	Hoteliers, Local Authorities
			Diversify Tourism activities in the plan area through development of new tourism attractions	Local Authorities, Hoteliers, Tour operators
	Invader species	Pursue ecologically friendly land use practices that prevent overstocking and animal confinement likely to lead to instability. Prevent soil erosion, compaction and degradation that allows overgrowth of invasive species	Encourage culling of overstocked species and manual removal of invasive plant species.	KWS, WWF, KARI, MoL&FD

Appendix 6: Laws supporting Integrated Management Planning (IMP)

Laws, regulations, policies and conventions are necessary for the harmonization of multi-sectoral interests and practices in conservation and management of the plan area. These laws give mandate to stakeholders, local community, local authorities, government departments and development partners in implementing the plan. Observance of these laws will enhance participatory approach in decision–making, ecosystem approach in management and provide legitimacy to stakeholder involvement. It is important to note that these laws are not exclusive and other rules and regulations can be developed in the form of codes of conduct and by laws that will improve conservation and management in Lake Bogoria catchment.

Environmental management and coordination Act (EMCA)

The law is based on the principle that everybody is entitled to a healthy and clean environment. Section 42, pertinent to the implementation of this plan deals with water catchment conservation whereas section 29 subsection 3 deals with the establishment of local Environmental Committees.

Social services laws on registration of CBO's

This Act will provide for the registration of CBO's and empower them to contribute to the implementation of the management plan. It will also provide for the laws and regulations that govern their operations.

Non-Governmental Organisations' (NGO) registration Act

This Act will provide for the registration of NGOs, the laws and regulations that govern them. A coordinated NGO front provides great opportunities for resource mobilization and optimum utilization of these resources for the benefit of stakeholders.

The Wildlife (Conservation and Management) Act

This is the principal Act regulating wildlife conservation and management in Kenya, and provides guidelines for wildlife resource management in the plan area. The Act establishes National Reserves and stipulates permissible activities inside the reserve.

The Water Act

The water Act seeks to provide better conservation, control, apportionment and use of the water resources in Kenya, and -for purposes incidental thereto and connected therewith. The Act vests ownership and control of water in the Government subject to any rights of user. Under this provision, therefore, Water Department has the responsibility to regulate access, use, and control pollution of water resources.

The Agriculture Act

The Agriculture Act Cap 318 of the Laws of Kenya seeks to promote and maintain a stable agriculture, to provide for the conservation of the soil and its fertility and to stimulate the development of agricultural land in accordance with the accepted practices of good land management and good husbandry.

The Forest Act

The Forests Act, Cap 385 of the Laws of Kenya provides for the establishment, control and regulation of forests and forest areas in Kenya. The Act, therefore, applies not only to state plantations and land controlled and managed by the Forestry Department for research purposes or for establishment of commercial timber plantations, but also areas which have been set aside for the conservation of fauna and flora, for the management of water catchment area, for the prevention of soil erosion or for the protection and management of indigenous forests on alienated Government land.

The Land Planning Act

The Land Planning Act Cap 303 of 1968 of the Laws of Kenya makes provision for planning the use and development of land. Sec 6 (1) of the subsidiary legislation provides that "*a local authority may, after consultation with, and with the agreement of the Minister, prepare and submit to the Minister for his approval a town plan or area plan, as the case may be, for that part of the area under its jurisdiction to which these regulations apply.*"

Physical Planning Act

This Act provides for the preparation and implementation of physical development plans and establishes the responsibility for the physical planning at various levels of Government in order to remove uncertainty regarding the responsibility for regional planning. The Act also promotes public participation in the preparation of plans and requires that in preparation of plans proper consideration be given to the potential for economic development, socio-economic development needs of the population, the existing planning and future transport needs, the

physical factors which may influence orderly development in general and urbanization in particular, and the possible influence of future development upon natural environment.

Environmental Impact Assessment (EIA)

This act requires any new development to be an environmental impact assessment to minimise negative environmental impacts.

Land Control Act CAP 406

This law provides for the control of transactions in agricultural land, especially the machinery of the Land Control Boards

The Local Government Act CAP 265

This law empowers a local authority to apply through the Minister for land to meet its different development purposes. Such requests and purposes are deemed to be public purposes within the meaning of the Land Acquisition Act (Cap 295). Such a local authority may, within such land, establish and maintain a conservation area. It may also take measures necessary for the prevention or control of bush fires or quarrying for minerals, sand gravel, clay, or stones.

The Kenya Tourist Development Corporation Act

This regulates tourism is the Kenya as contained in the Tourist Development Corporation Act Cap 382 of the Laws of Kenya which establishes KTDC as a parastatal body. The functions of the KTDC include, *inter alia,* provision of travel, expedition of tours, whether hunting, fishing, photography or other wise. The corporation may also plan the development, preservation, or study of the wild and natural life, flora and other vegetation.

Tourist Industry Licensing Act

The sister statute to the KTDC Act is the Tourist Industry Licensing Act Cap 381 of the Laws of Kenya deals primarily with the licensing of tourism activities.

Appendix 7: Participation in development of Integrated Management Plan

Detailed list of participants at first brainstorming meeting to develop a strategy for the development of a management plan for Lake Bogoria National Reserve held on 19 April 2002 at WWF -EARPO Boardroom.

Name	Organization
Dr. Kelly West	IUCN EARO
Edmond Barrow	IUCN.EARO
Dr. Patrick Milimo	WWF-EARPO
Hussein Cheburet	Clerk Koibatek County Council
William Kimosop	Senior Warden LBNR
Maushe Kidundo	WWF-LBCBWP
Michael Kangogo	WWF-LBCBWP
Musa Cheruiyot	WWF-LBCBWP
Oliver Nasirwa	WWF-LBCBWP
Anderson Koyo	KWS ((absent with apologies)
Dr. Nathan Gichuki	NMK (absent with apologies)

Detailed list of participants during the 1st planning workshop held at Lake Bogoria Hotel conference room on 5-6 May 2003.

William Kibet	Chief, Koibos Location	P. O. Box 121	Mogotio, Kenya
William Lorukoti	Councilor Sinende Location	P. O.	Kisanana, Kenya
Justus Tanui	Ag. DSDO	051-752075	
Cheburet Kiptui	Secretary, LEPC Koituimet	P .O. Box 121	Mogotio, Kenya
Wilson Chesang	Councilor Koibatek	P. O. Box 121	Mogotio, Kenya
Bernard Chepkui	Chairman Majimoto LEPC	P. O. Box 121	Mogotio, Kenya
Michael Kimeli	Chairman Friends of Nature Bogoria	P. O. Box 64	Marigat, Kenya
Kiprotich Kobetbet	Councilor. Kamar Ward	P. O. Box 121	Mogotio, Kenya
Geoffrey Chepkuto	Chairman LEPC Loboi	P. O. 94	Marigat, Kenya
Simeon Komen	Ag. Chief Sinende Location	P. O.	Kisanana, Kenya
Joseph Kurui	Chairman LEPC Olkokwe	P. O.	Kisanana, Kenya
James Kiptek	Senior Chief Loboi Location	P. O. Box 94	Marigat, Kenya
James Kibowen	Chief Kapnosgei Location	P. O.	Kisanana, Kenya
Samuel K. Kabeto	Chief Olkokwe Location	P. O.	Kisanana, Kenya
Kibos S. J	District Environment Officer, Baringo	053-21870	
R. J Seronei (Mrs)	District Forest Officer, Baringo	053-22055	Kabarnet, Kenya
J. Chepsat Chairman	LEPC Sandai	P. O. Box 94	Marigat, Kenya
Michael Chepkuto	Chief Sandai Location	P. O. Box 180	Marigat, Kenya
R. Kemboi	Assistant Manager, Lake Bogoria Hotel		
P.O.Nachuru	Warden, LBNR	P. O. Box 64	Marigat, Kenya
Joseph Kibet	Councilor Loboi Ward	P. O. Box 94	Marigat, Kenya
M. C. Sang	DSCO Koibatek	P. O. Box 71	Eldama Ravine
S. K. Kitony	District Water Office	P. O. Box 218	Eldama Ravine
J. Kairu	DALEOs Office	P. O. Box 4	Kabarnet
Kimeu Musau	District Water Office	P. O. Box 31	Kabarnet
Peter Keitany	Clerk to Council Baringo County Council	P. O. Box 53	Kabarnet, Kenya
J. Karato	Project Advisory Committee Member	P. O. Box 94	Marigat, Kenya
Kunga N	Project Officer, Natural Resource Planner	P. O. Box 43	Marigat, Kenya
Sheilah Cheburet	FA Loboi	P. O. Box 43	Marigat, Kenya
John Bereke	FA Sandai	P. O. Box 43	Marigat, Kenya
Evans Kipkemboi	FA Koibos	P. O. Box 43	Marigat, Kenya
Job Kiprop	FA Sinende	P. O. Box 43	Mariga, Kenya
Musa Cheruiyot	Project Officer-EE & CD	P. O. Box 43	Marigat, Kenya
Maushe Kidundo	Project Manager LBCBWP	P. O. Box 43	Marigat, Kenya
Koima Ben Tiong'ik	Chairman, LEPC Sinende	P. O.	Kisanana, Kenya
Fabian Musila	Project Ecologist –WWF	P. O. Box 43	Marigat, Kenya
Hussein Cheburet	Rep. to Clerk Koibatek County Council	P. O. Box 18	Eldama Ravine, Kenya
Irene J. Chebii	Councilor, Loboi Ward	P. O. Box 64	Marigat, Kenya
Councilor Moses Kimeli	Vice-Chairman Koibatek County Council	P. O. Box 18	Eldama Ravine
William Tengecha	World Vision		Marigat, Kenya
William Kimosop	Senior Warden, LBNR	P. O. Box 64	Marigat, Kenya
P. K. Kisoyan	Lake Baringo GEF Project	P. O. Box 111	Marigat, Kenya
Julius Zephania	Lands Officer-Loboi	P. O. Box 7	Kabarnet, Kenya
David Chelugo	Chairman-Baringo County Council	P. O. Box 53	Kabarnet, Kenya
Samuel Kasitet	LEPC Chairman Kapkuikui	P. O. Box 87	Marigat, Kenya
Asukile R.Kajuni	Facilitator	P.O. Box 105994	Dar es Salamm, Tanzania

Programme for 3rd Planning Workshops for Presentation of proposals to all stakeholders 19th – 23rd January 2003

January 2004	Venue	Stakeholders
19	Dryland EE centre, Loboi	Loboi, Sandai, Kapkuikui, Majimoto, + Marigat Officers
20	County Council Chambers, Kabarnet	GoK officer, NGOs, County council of Baringo chief officers + All councillors of Joint Management Committee
21	Kapnoskei Centre	Sinende, Kapnoskei, Olkokwe, + Kisanana officers
22	District Education Hall, Eldama Ravine	GoK officer, NGOs, County council of Koibatek chief officers + All councillors of Joint Management Committee
23	Nakuru, Nyahururu, Nyandarua	Site visits and discussions with GoK officers

List of participants during 3rd Planning Workshop for Presentation of proposals by all Stakeholders held at Lake Bogoria Dryland Environmental Education Centre on 19 January 2003

Maushe Kidundo	Project Executant	WWF
Musa Kimaru	Land Adjudication Officer, Loboi	Ministry of Lands and Settlement
James Kiptek	Chief	Loboi
Samwel Chelal	Vice Chairman	Kiborgoch Swamp Committee
Paulo Chepkirwok	LEPC	Kapkuikui Location
Irene Chebii	Nominated Councillor	County Council of Baringo
Jackson Borchikei	LEPC	Loboi Location
Joseph Cheruiyot	LEPC	Kapkuikui Location
Salina Wendot	Treasurer	Sandai Women Group
Wilson Chebotibin	LEPC	Kapkuikui Location
Richard Kamuren	Member	Bogoria Moran Dancers
Jackson Kibon	LEPC	Loboi Location
Symon Chesang	Technical Assistant	Veterinary Department, Ministry of Agriculture
Joseph Cherutich	Assistant Chief	Kapkuikui Location
William Kapyekoi	Chairman	Bogoria Moran Dancers
Richard Yegon	Chairman	Kiborgoch Swamp Committee
Wilson Karato	LEPC	Loboi Location
Elijah Kipteroi	Assistant Chief	Loboi Location
Kiprotich Kobetbet	Councillor	Koibos Ward
Stephen Koech	LEPC	Koibos Location
John Bereke	Field Assistant	WWF
Jonathan Tereito	Zonal Chairman	World Vision, Marigat
Paul Kipkoros	LEPC	Koibos Location
Michael Chepkuto	Chief	Sandai Location
Samwel Keitany	Chief	Kapkuikui Location
Kasitet Samwel	Chairman LEPC	Kapkuikui Location
Rael Kiptek	Chairlady Sandai	Women Group
Geofrey Chepkuto	Chairman LEPC	Loboi Location
Joseph Kipkurere	Secretary LEPC	Sandai Location
Jackson Chepsat	Chairman LEPC	Sandai Location
Evans Kipkemboi	Field Assistant	WWF
John Changole	LEPC	Sandai Location
Samson Kiptai	LEPC	Sandai Location
Joseph Wendot	Assistant Chief	Sandai Location
Mary Mbelel	Lobusakie	Women Group
Festus Kiptisha	Field Assistant	WWF
Kunga Ngece	Project Officer	NRM
Samwel Kiptai	LEPC	Sandai Location
Daniel Chepkui	Chairman	LEPC Koibos Location

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