MARSABIT COUNTY GOVERNMENT
P.O.BOX 384 MARSABIT

MARSABIT COUNTY GOVERNMENT

ENVIRONMENTAL IMPACT ASSESSMENT

FOR

BAKULI 4 DAM PROJECT

AND

INTRODUCTION OF SEWERAGE SYSTEM

IN

MARSABIT TOWN

MARSABIT CENTRAL SUB-COUNTY
MARSABIT COUNTY





ENVIRONMENTAL IMPACT ASSESSMENT REPORT, NOVEMBER 2016

CONSULTANT
Eng. Bennard Imbambi Kasabuli
P.O. Box 7907-00200
NAIROBI, KENYA
Tel:-+254724962958/+254721624546
E-MAIL:bkasavuli13@gmail.com

Chief Executive Committee
Member in charge of Water, Environment and Natural Resources
P.O. BOX 69
MARSABIT

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LIST OF ABBREVIATIONS /ACRONYMS

ADB	African Development Bank
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
EMP	Environmental Management Plan
NEMA	National Environmental Management Authority
NWSB	Northern Water Services Board
CBD	Central Business District
PDP	Physical Development Plan
GOK	Government of Kenya
HH	Household
P.O.	Post Office
SK	Survey of Kenya
IEBC	Interim Electrical and boundaries Commission
CFU	Composite Filtration Unit
AP	Administration Police
D.C.	District Commissioner
KWS	Kenya Wildlife Service
UPVC	Unplasticed Polyvinyl Chloride
KSHS	Kenya Shillings
MFR	Marsabit Forest Reserve
FD	Forest Department

Executive Summary

Urban sanitation and waste water management project proposals from borrowing governments to ADB are rarely prepared with a full knowledge of the technical and institutional options available. It is conventional wisdom to plan for water and sanitation as though they cannot be separated. More and more people are becoming sensitive to environmental concerns associated with the outfalls of sewage and waste waters whether treated or not. There is the need for clean treated water for the sustenance of good health.

In this respect, the County Government of Marsabit intends to increase the amount of water per day by 3 to 4 times to reduce the cost of living and standard of living within Marsabit Town and also stimulate economic growth by ensuring the town plays a pivotal role of being an economic hub of Marsabit County.

The baseline information collected was used to analyze the potential impacts of the proposed Bakuli 4 Dam Project and wastewater treatment works. The potential impacts were derived from enhanced Bakuli 3 dam and sewerage treatment works in Marsabit Town. Discussions were held with various interested parties within Marsabit Town during the scoping period. Some of the envisaged negative impacts include; worsening human/wildlife conflicts,destruction of both terrestrial & aquatic wildlife habitats, loss of life due to drowning, siltation and sedimentation, increased waterborne diseases, noise and air pollution, and resettlement. The proposed environmental mitigation measures to minimize anticipated negative impacts are suggested. Alternatives have been analyzed in terms of project site, design, and rehabilitation techniques. The Environmental Management Plan (EMP) is the most important output of the EIA and it ensures that the mitigation measures are sustainable, outlines monitoring frequency, and individuals/ institutions to undertake the required actions. The EIA study report concludes that Bakuli 4 Dam Project and Introduction of Sewerage in Marsabit Town should be undertaken and makes the following recommendations;

- Implementation of Bakuli 4 Dam Project is overdue..
- The Onsite sanitation being practiced in CBD has reached its limit and Sewerage Works should be introduced soonest..
- Marsabit Town should prepare PDP to guide the development of the town as a priority.
- The proposed EMP for the identified impacts will be implemented by the proponent.
- The environmental mitigation measures will be incorporated into the Bakuli 4 Dam Project and Marsabit Sewerage Works project documents and contract agreements. The proponent should consider allocating a small percentage (10%) of the implementing budget for environmental monitoring.
- Labour should be sourced from the local community and should be gender sensitive.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

The population of Marsabit town is still growing at an alarming rate escepecially due to ongoing tarmacing of the great North Road, against the background of the severe water scarcity.

Efforts towards proportionate economic growth, private investment, public services improvement and infrastructure provision are all being constrained by the seemingly lack of a lasting solution to the prevailing problem of water scarcity for example, the Marsabit county Government is yet to have Marsabit Town housing development plan. The public health department's environment health inspection staff is fatigued by the genuine excuse of water scarcity by public service business as their reason of failure to maintain appropriate hygiene and environmental health standards, etc.

Arising from the foregoing, the County Government of Marsabit intends to increase the amount of water per day by 3 to 4 times to reduce the cost of living and standard of living within Marsabit Town and also stimulate economic growth by ensuring the town plays a pivotal role of being an economic hub of Marsabit County.

1.2 Water and Sanitation Services

1.2.1 Current Water Situation

Marsabit Town relies on Marsabit Water Supply which is limited due to source and the rising main. . No traditional sources exist and hence everybody depends on Marsabit Urban Water Supply which is the only public piped water supply system. The source of the public water system is Bakuli spring whose discharge is not constant and is on the decline due to human activity in the Catchment. During drought, the flow reduces by over 80%. During rainy season it ranges from 9 to 11 litres per second while dry season it is 3.1 to 2 litres per second.

The water coverage is estimated at about 14.76% since the average water produced is 800m^3/day of which about 30% is lost as leakages enroute against a water demand of about 3,795m^3/day. This situation is expected to worsen with time if no immediate action is taken.

To worsen the situation, the cost of producing 1m^3 of water is estimated at kshs 171.725 while the Service Provider charges an average of kshs 50/m^3.

In order to find alternative source, efforts has been directed in harvesting flood flows. Bakuli 3 Concrete Dam of capacity about 90,000m^3 constructed in years 2008 to 2011 under GOK and Japan funding is operational and has brought some relieve to Marsabit Town. This Dam has capacity to supply 543m^3/day for four months.

Further, Badesa/Songa Dam a vision 2030 flagship project is under construction. The Dam has capacity of about 6million m^3 and yield about 7,000m^3/day is about 50% complete and is stalled due to court case.

Marsabit Water Supply is a pumping /Gravity Water Supply supplying about 14km^2 of the existing 16.2km^2 of Marsabit Town representing 86.4%.

The areas being supplied are:-

1. Mountain Location with an area of about 9km^2.
2. Nagayo location with an area of about 9km^2.
3. A small part of Dakabaricha sub location with a settled area of about 3km^2

Water is opened at Bakuli 3 where it gravitates to a pump house located about 100m into Bakuli 2 where it is pumped by high lift pumps of :-

Capacity	50.89m^3/day
Pumping Head	250m
Power	30KVA

Using diameter 6"GI pipe cleverly located on the escarpment to reduce pumping heading up to the treatment plant located about 8km and on the edge of Marsabit Forest.
At the Treatment Plant, water is treated and gravitates to the consumers.

The Water Supply is Phasing a number of challenges as follows:-

1) The Supply is grounding to a holt since it is understaffed and only one person is on duty at the treatment plant instead of the required 5 at any one given time. This has led to accumulation of leaves in the composite filtration Unit making treatment a dirtifying rather than cleaning effect.

2) Due to high head, the water supply is unsustainable.

3) Bakuli 1 is silted and requires desilting

4) No Standby Pumping Equipment and only one pump is functioning

5) There is no standby generator making the supply unreliable

6) The Water Supplied is not enough despite Bakuli 3 having eased the water shortage by 30-40%

7) Most of the water is supplied by Kiosks limiting the sanitation mode to pit latrines. For the Town to grow, it requires to embrace modern sanitation technology ie sewerage system.

8) The Supply is having Operational difficulties despite being operated by Marsabit Water Company. The Distribution of posts is being done arbitrary rather as recommended by the Ministry of Water and Irrigation Water Practice Manual,

2005. Further, the Company does not have paperwork of being a Company e.g. Stategic Plan, Registration Documents etc.

9) There is no master meter and current production is only estimated.

1.2.2 Sanitation

Marsabit Town relies on Pit latrines for its sanitation needs since 88.24% of the Household depend on Pit Latrines.

Table 1 below has the details.
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Table 1: Households by main mode of Human Waste Disposal in Marsabit Town

Households by main mode of Human Waste Disposal in Marsabit Town												
Location	**Sub location**		**Main Sewer**	**Septic Tank**	**Cess Pool**	**VIP Pit Latrine**	**Pit Latrine (Covered/ Uncovered)**	**Bucket**	**Bush**	**Other**	**Total**	
		HH	-	-	-	75	415	-	-	-	490	
	Nyayo Road	**%**	0.00	0.00	0.00	15.31	84.69	0.00	0.00	0.00	**100.00**	
		HH	-	-	2	-	1,196	-	52	8	1,258	
	Majengo	**%**	0.00	0.00	0.16	0.00	95.07	0.00	4.13	0.64	**100.00**	
		HH	-	-	2	75	1,611	-	52	8	1,748	
Nagayo		**%**	0.00	0.00	0.11	4.29	92.16	0.00	2.97	0.46	**100.00**	
		HH	-	-	-	1	192	-	78	1	272	
	Mataarba	**%**	0.00	0.00	0.00	0.37	70.59	0.00	28.68	0.37	**100.00**	
		HH	-	-	1	6	541	-	35	1	584	
	Dakabaricha	**%**	0.00	0.00	0.17	1.03	92.64	0.00	5.99	0.17	**100.00**	
		HH	-	-	1	7	733	-	113	2	856	
Dakabaricha		**%**	0.00	0.00	0.12	0.82	85.63	0.00	13.20	0.23	**100.00**	
		HH	1	30	-	7	543	-	-	-	581	
	Township	**%**	0.17	5.16	0.00	1.20	93.46	0.00	0.00	0.00	**100.00**	
		HH	-	1	2	200	888	-	1	1	1,093	
	Wabera	**%**	0.00	0.09	0.18	18.30	81.24	0.00	0.09	0.09	**100.00**	
		HH	1	31	2	207	1,431	-	1	1	1,674	
Mountain		**%**	0.06	1.85	0.12	12.37	85.48	0.00	0.06	0.06	**100.00**	
		HH	**1**	**31**	**5**	**289**	**3,775**	**0**	**166**	**11**	**4,278**	
Marsabit Town		**%**	**0.02**	**0.72**	**0.12**	**6.76**	**88.24**	**0.00**	**3.88**	**0.26**	**100.00**	
			Source:- 2009 Census Backup Data, CBS									

1.3 Proponent

1.3.1 County Government

Kenya is divided into forty seven (47) counties which are specified in the First Schedule to the Constitution. Marsabit County is County number 10 according to the First Schedule.

The constitution further provides that; there shall be a county government for each county, which shall consist of a **COUNTY ASSEMBLY** and a **COUNTY EXECUTIVE**.

Every county government is required to decentralize its functions and the provision of its services to the extent that it is efficient and practicable to do so.

The County Executive is representative of the Executive arm of government within the County government.

1.3.1.1 Functions of County Executive Committees

(a) Implement county legislation;

(b) Implement, within the county, national legislation to the extent that the legislation so requires;

(c) Manage and coordinate the functions of the county administration and its departments; and

(d) Perform any other functions conferred on it by this Constitution or national legislation.

(e) A county executive committee may prepare proposed legislation for consideration by the county assembly.

(f) The county executive committee shall provide the county assembly with full and regular reports on matters relating to the county.

1.3.1.2 The County Executive

GOVERNOR	**H.E. UKUR YATANI**
DEPUTY GOVERNOR	**OMAR MOHAMED MAALIM**
COUNTY EXECUTIVE COMMITTEE (CEC)	
FINANCE & PLANNING	**IBRAHIM B. HASSAN**
EDUCATIONS & SOCIAL SERVICES	**JAHORA MOHAMED ABDI**
TRADE, INDUSTRIALIZATION, TOURISM, WILDLIFE & COOPERATIVE DEVELOPMENT	**ABDIAZIZ SHEIKH MAAD**
LANDS, HOUSING & PHYSICAL PLANNING	**ADAN HUSSEIN HASSAN**
PUBLIC SERVICE, CONFLICT RESOLUTION, COHESION & INTEGRATION	**AHMED SHEIKH AHMED**
HEALTH SERVICES	**HASSAN A. EYMOY**
LIVESTOCK & FISHERIES	**HALIMA ABDI ALI**
AGRICULTURE & IRRIGATION	**MOHAMUD OMAR ABSIYE**
WATER, SANITATION, ENERGY, ENVIRONMENT & NATURAL RESOURCES	**AHMED ALI MADEY**
ROADS & PUBLIC TRANSPORT	**ETHILA MOHAMUD ISSACK**
COUNTY SECRETARY	**CHARLES M. BEGI**

1.3.2 Marsabit County

Marsabit County set in the former Eastern Province and some 550km north of Nairobi is one of the existing 47 Counties set after propagation of the new Constitution in year 2010. It is the largest county in Kenya covering 70, 961 square kilometres.

Marsabit borders three counties; Wajir to the east, Turkana to the west and Isiolo to the south.

It also borders the country of Ethiopia to the north.

The county is said to have been named after a Burji farmer called *Marsa* who was brought to Marsabit (from Ethiopia) by colonialists to teach the locals how to grow crops.

When his name was called out by his masters, Marsa used to answer *"Abet"* (Yes in Amharic) and this led to the creation of the name Marsa-Abeit - which later became Marsabit.

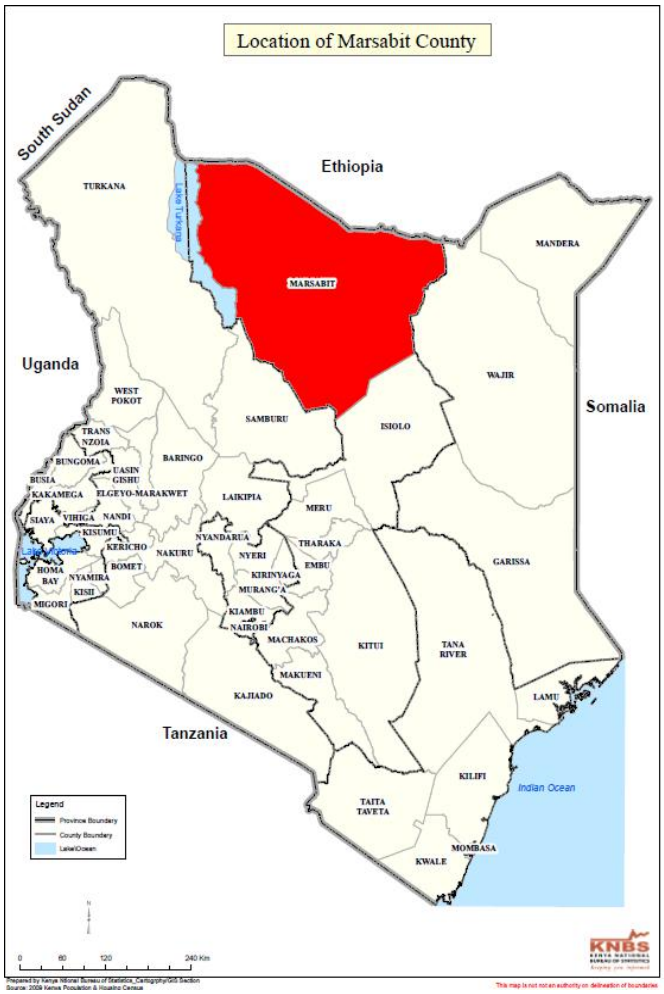

Figure 1: Location of Marsabit County in Kenya

Marsabit County constitutes four constituencies: North Horr, Laisamis, Saku and Moyale. The county's top leaders are Mr Ukur Yatani Kanacho (Governor), Mr Isaiah Nakoru (County Commissioner), Godana Hargura (Senator) and Ms Nasra Ibrahim Ibren (Women Representative).

Marsabit County in Kenya has its offices located in Marsabit District Commissioner`s Office Block on the 1st Floor.

The postal address of Marsabit County Government is P.O. Box 384-60500.MARSABIT Town

The email address of Marsabit County Assembly in Kenya is info@marsabit.go.ke.

The mobile/telephone contacts of Marsabit County are 0722654168 and 0733273506.

The website of Marsabit County is at http://www.marsabit.go.ke/.

1.4 The purpose of the Environmental Impact Assessment.

According to section 58 of the Environmental Management and Coordination Act of 1999 (EMCA) all projects must be subjected to an Environmental Impact Assessment (EIA).The EIA for the Bakuli 4 Dam Project and Introduction of Sewerage System has identified potential environmental impacts, proposed mitigation measures and Environmental Management Plan (EMP).

1.5 Objectives of the EIA study

- To collect baseline information on the proposed Bakuli 4 Dam Project and Introduction of Sewerage System in Marsabit Town
- To identify and assess significant environmental impacts likely to be generated by the proposed water and Sanitation works.
- To propose the necessary mitigation measures to minimize the negative environmental impacts.
- To develop an Environmental Management Plan (EMP).

1.6 Scope of the Project

To carry out an EIA for the existing water and sanitation facilities, and to assess expansion of Water facilities and introduction of Sewerage System in accordance with the population growth in Marsabit town.

CHAPTER TWO

2.0 EXISTING WATER AND SANITATION SERVICES

2.1 Location of the Project area

Marsabit Town is located in Central Division, Marsabit Central Sub-County, Marsabit County.
It consists of 3 Locations and 6 sub locations as detailed below:-

- ✓ Nagayo location consisting of 2 sub-locations of Nyayo Road and Majengo
- ✓ Dakabaricha Location consisting of 2 sub-locations of Mataarba and Dakabaricha and
- ✓ Mountain Location consisting of 2 sub locations of Township and Wabera.

Marsabit Town is located about 500km North of Nairobi and is the main market centre in the Northern Region of Kenya.

It can be located on SK Sheet No. NA-37-6 scale 1:250,000 at coordinates 38^0 East of Greenish and $2^0$20' North.

It is situated within Mount Marsabit Forest Reserve in the Northern Region of Marsabit County.
.(Refer Map 1)

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Marsabit Town

Map 1: Location of Marsabit Town in Kenya

It consists of 3 locations and 6 sub locations.

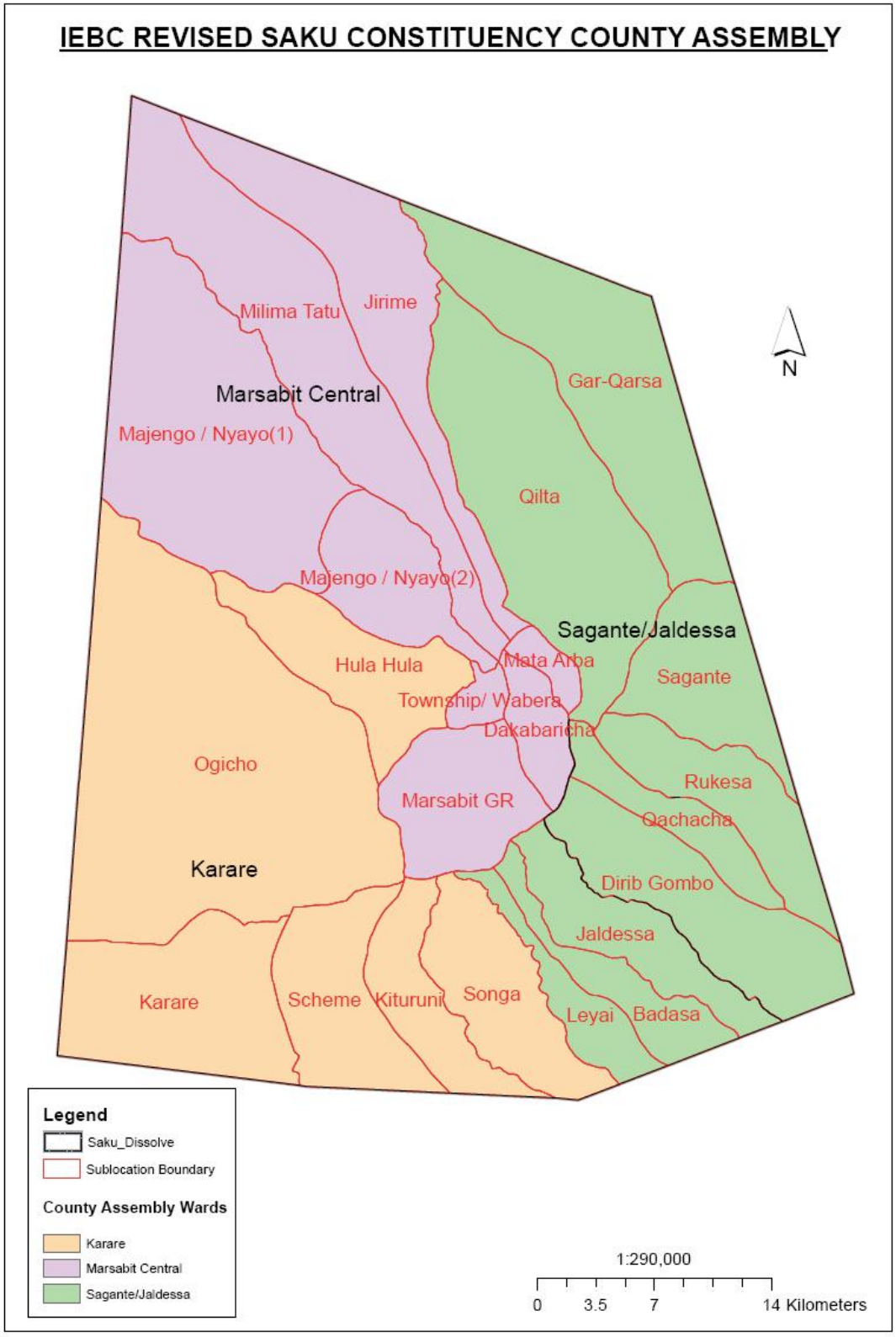
Table 2 has the characteristics of the Administrative Units.

Marsabit Town is neither an Urban Council nor Municipal Council. It has no Peri-Urban like other Urban Centres in Kenya.

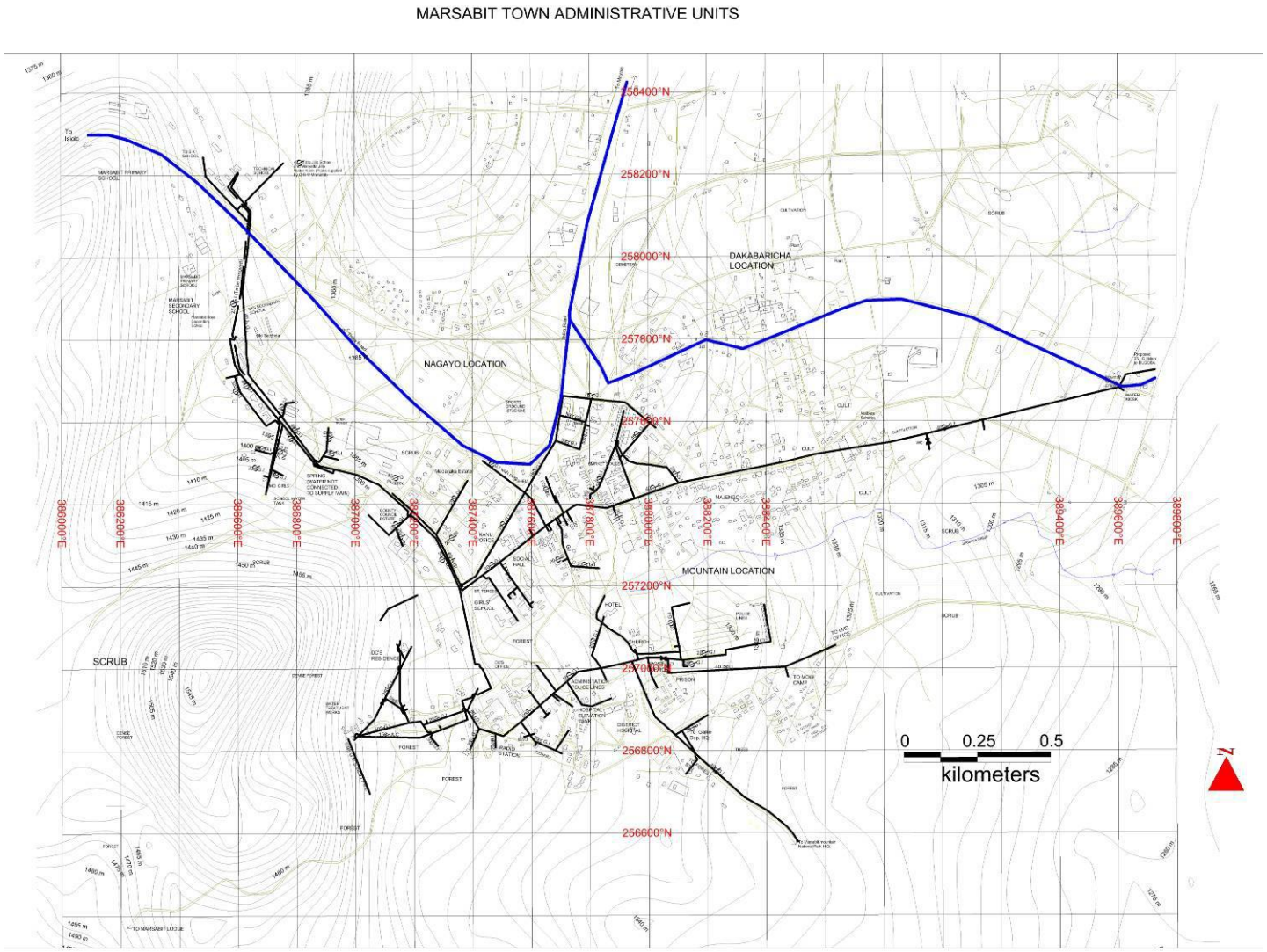
It is located in Saku Constituency, which covers the entire Central Division.. Map 2 has the Layout of Administrative Units of Saku Constituency while Map 3 has the administrative units of Marsabit Town.

Table 2: Administrative Units and there Characteristics of Marsabit Town

Characteristics of Marsabit Town									
Location	**Sub location**		**2009 census**						
		Male	**Female**	**Male/Female**	**Total Population**	**Households**	**Size of Family**	**Area in Km^2**	**Population Density in km^2**
	Nyayo Road	1,123	1,205	0.9	2,328	490	5	0.4	5,820
	Majengo	2,762	2,883	1.0	5,645	1,258	4	339.2	17
Nagayo		**3,885**	**4,088**	1.0	**7,973**	**1,748**	5	**339.6**	23
	Mataarba	605	582	1.0	1,187	272	4	6.4	185
	Dakabaricha	1,497	1,556	1.0	3,053	584	5	7.6	402
Dakabaricha		**2,102**	**2,138**	1.0	**4,240**	**856**	5	**14.0**	303
	Township	1,399	1,048	1.3	2,447	581	4	1.3	1,882
	Wabera	2,099	2,105	1.0	4,204	1,093	4	0.9	4,671
Mountain		**3,498**	**3,153**	1.1	**6,651**	**1,674**	4	**2.2**	3,023
Marsabit Town		**9,485**	**9,379**	1.0	**18,864**	**4,278**	4	**356**	53
Approximate Area of Marsabit Town								**16.2**	



Map 2: Administration of Saku Constituency



Map 3: Administrative Units of Marsabit Town

2.2 Water Supply

2.2.1 Historical Background

Marsabit Urban Water Supply was established in the early 1950s by then British Colonial administration to serve a small population of less than 2,000 people.

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This population grew initially after independence to about 4,000 people by 1970. In 1970, more rapid population growth occurred due to the establishment of five small scale resettlement schemes at Manyatta Jillo Gabra Schemes, Hulahula, Karare and Songa. Those who were resettled were pastoralist families from other lowland areas of the district, who had been impoverished by the loss of livelihood to droughts and rustling. These initial resettlement activities were a precedent that led to a continuous shift from the colonial administration's Mt. Marsabit environment conservation policy that controlled the population on the mountain. These re-settlement efforts encouraged continued re-location of drought and conflict displaced pastoralist to Marsabit in search of alternative means of livelihood from cultivation and employment in both the formal and informal sectors.. It later, as a district headquarters, attracted many public sector institutions and private sector investments, which resulted in continued human inflow and more rapid population growth.

2.2.2 Overview

Marsabit Town relies on Marsabit Water Supply which is limited due to source and the rising main. . No traditional sources exist and hence everybody depends on Marsabit Urban Water Supply which is the only public piped water supply system. The source of the public water system is Bakuli spring whose discharge is not constant and is on the decline due to human activity in the Catchment. During drought, the flow reduces by over 80%. During rainy season it ranges from 9 to 11 litres per second while dry season it is 3.1 to 2 litres per second.

The water coverage is estimated at about 14.76% since the average water produced is 800m^3/day of which about 30% is lost as leakages enroute against a water demand of about 3,795m^3/day. This situation is expected to worsen with time if no immediate action is taken.

To worsen the situation, the cost of producing 1m^3 of water is estimated at kshs 171.725 while the Service Provider charges an average of kshs 50/m^3.

In order to find alternative source, efforts has been directed in harvesting flood flows. Bakuli 3 Concrete Dam of capacity about 90,000m^3 constructed in years 2008 to 2011 under GOK and Japan funding is operational and has brought some relieve to Marsabit Town. This Dam has capacity to supply 543m^3/day for four months.

Further, Badesa/Songa Dam a vision 2030 flagship project is under construction. The Dam has capacity of about 6million m^3 and yield about 7,000m^3/day is about 50% complete and is stalled due to court case..

2.2.3 Existing Facilities

Marsabit Water Supply is a pumping /Gravity Water Supply supplying about 14km^2 of the existing 16.2km^2 of Marsabit Town representing 86.4%.

The areas being supplied are:-

1. Mountain Location with an area of about 9km^2.
2. Nagayo location with an area of about 9km^2.
3. A small part of Dakabaricha sub location with a settled area of about 3km^2

Water is opened at Bakuli 3 where it gravitates to a pumphouse located about 300m into Bakuli 3 where it is pumped by high lift pumps of :-

Capacity	50.89m^3/day
Pumping Head	250m
Power	30KVA

Using diameter 6"GI pipe cleverly located on the escarpment to reduce pumping heading upto the treatment plant located about 8km and on the edge of Marsabit Forest.
At the Treatment Plant, water is treated and gravitates to the consumers.

The existing facilities are as follows:-

a. Bakuli Spring
b. Three Concrete Dams acting as Water Harvesting sites consisting of:-
   - Bakuli 1 of total capacity 870m^3
   - Bakuli 3 of total capacity about 60,000m3 and estimated safe yield of 583m^3/day and
   - Bakuli 2 at the extreme end with total capacity of 570m^3.
c. Abandoned Bakuli 1 Pump house
d. Two grade 9 staff houses
e. Pit Latrine
f. Suction main varying from 4"-3"-21/2" and also 4"
g. High lift pumping station
h. 8km of 6"diameter GI Rising Main cleverly sited along the escarpment despite there being limitation in Technology
i. Treatment Plant consisting of:-
   - ✓ Inlet Well
   - ✓ Flocculation Chambers
   - ✓ One number Composite Filtration Unit of capacity 20-25m^3/hr
   - ✓ Clear Water Tank of capacity 225m^3 as masonry ground tank
   - ✓ Ground Backwash Tank of capacity 25m^3 masonry located about 5-7m above the top of CFU
   - ✓ Backwash System
   - ✓ Condemned 4Nos Staff Houses
j. Storage of total capacity 525m^3

- ❖ Treatment Plant
  -Steel Elevated tank of capacity 50m^3 on a 10m platform
  -One Ground steel tank of capacity 50m^3
  -One Masonry Tank of capacity 25m^3

- ❖ Three Storage Sites consisting of:-
  -Manyatta Ote Tank of capacity 100m^3
  -2Nos. Manyata Chile Tank of capacity 100m3 and total capacity 200m^3
  --Marsabit Boys High School of capacity 100m^3.

k. Power Supply with transformers fitted to satisfy the current power demand.
l. 2Nos. 8-10m^3/hr CFU which are no longer in use
m. Distribution System varying from 6"GI to 1" and
n. 3 Water Kiosks

2.2.3.1 Bakuli Springs

Marsabit Urban Water Supply Scheme sources its water from:-

1. Bakuli -1 and Bakuli -2 springs, which have measured wet season, flow rates of 9 and 11 liters per second respectively. These flow rates however decrease with the progression of dry weather to measured late dry season discharge rates 3.1 and 2 litres per second respectively.

   The springs can be located at N02^{0}16'45" and E037^{0}57'26" at elevation 1348m in Marsabit Game Reserve.

In view of the above, harvesting of Bakuli Spring was pursued to offer storage of at least 2minutes through construction of Bakuli 2 and 1.

Due to climate change and human activity, Bakuli Spring flow has been on the decline and in some cases completely drying forcing harvesting of flood water through construction of Bakuli 3.

2.2.3.2 Dams

2.2.3.2.1 Bakuli 1 Dam

Bakuli 1 was the first storage and was constructed in 1950's (Plate 1) with a sole aim of:-

- Storing Water in extreme droughts when flows of Bakuli Spring are low
- Providing Storage of at least 2 minutes to stabilize the pumping equipments.

Bakuli 1 is the first dam in the series of three and can be located at:-

Region	37N
Longitude	0383962E UTM
Latitude	0252100N UTM
Altitude	1331m

The Dam is Tapping with top being of width about 0.3m, bottom 0.60m and height about 1.5m. It is currently acting as a silt rap of Bakuli 3 and hence silted. There is a pump house which is equipped but was abandoned because of limitation of the Rising Main.

Plate 1: Bakuli 1 of Capacity 870m^3 and

Plate 2: Silted Bakuli 2 of Capacity 570m^3

2.2.3.2.2 Bakuli 2

Bakuli 2 is located downstream of Bakuli 1 and 3 and was constructed in 1995.(Plate 2) Bakuli 2 is located about 0.5km downstream of Bakuli 1. The Dam has similar dimensions to Bakuli 1 and has a capacity of 570m^3.

It can be located at:-
Region 37N
Longitude 0384108E UTM
Latitude 0251747N UTM
Altitude 1307m

There is a pump which used to pump from Bakuli 2 and combine with Bakuli1 using diameter 4"GI pipeline before combining to 6"GI.

Water is opened from Bakuli 1 to 3 and to 2 before it is pumped to Marsabit Treatment Plant.

2.2.3.2.3 Bakuli 3

Bakuli 3 harvests its storage from Flood flows. It is a Reinforced Concrete dam of capacity about 90,000m^3 (Length - 400m, width sloping from 0.60m at top to 1.2m at bottom and depth - 11.50m). The dam is made of reinforced concrete and is located between Bakuli 1 and 2 , about 400m from Bakuli 1 at elevation 1321m, longitude 037^0 57.448'East and latitude 020 16.667'North. It was constructed from year 2008 to 2011 under Government of Kenya and Japan funding at a cost of Kshs70million. The dam water is stinking because of fallen and washed leaves.

The dam has top width of 0.6m, height of 10m and bottom of 1.2m with apron thickness of 1m Refer Plate 3 and 4.


Plate 3:Rear Elevation


Plate 4:Water in Bakuli 3 Dam

The dam has brought relieve to Marsabit Town since it satisfies the current water demand by about 30-40%.

The Dam has the following characteristics:-

Length	270m
Average width	30m
Silt Accumulation	1-2m per year

2.2.3.3 Intake

1. The existing intakes are protected springs which collect into two reservoirs created by overflowing weirs. Bakuli 1 has a capacity of 870m^3 while Bakuli 2 has a capacity of 570m^3.
2. Water flows from Bakuli 1 to 3 to 2 from where it is pumped from the old pump house.
3. The intake consists of a a 10" GI pipe which is opened systematically.(Plate 5)

Plate 5:Bakuli 3 Dam Intake being opened

2.2.3.4 Abandoned Bakuli 1 Pump house

This pump house used to pump water from Bakuli 1 which was being fed by Bakuli Spring. The Pump house is equipped but due to limitation of Rising Main and very minimal Recharge of Bakuli Spring, it has been abandoned.

It can be located at:-

Region 37N
Longitude 0383966E UTM
Latitude 0252087N UTM
Altitude 1324m

Plate 6: Abandoned Bakuli 1 pump house

2.2.3.5 Grade 9 Staff Houses

There are two grade 9 houses which houses two pump attendants on weekly rotational basis.

The houses can be located at the tip of Bakuli Springs at:-

Region 37N
Longitude 0383956E UTM
Latitude 0252155N UTM
Altitude 1338m

Plate 7: Staff houses in the back

2.2.3.6 High Lift Pumping Station

This is the only pumping station operating. It pumps water from Bakuli 2 to Marsabit Town Water Treatment Plant.

The pump house can be located just about 300m downstream of Bakuli 3 at:-

Region 37N
Longitude 0384122E UTM
Latitude 0251734N UTM
Altitude 1291m

The pump house has size of about 5.6m by 3.1m.

The pump house has only one pump working and the rest is defective.

The characteristics of the pump are:-
Power 30/36KW
Pumping Head 170m (164m)
The pump house currently seems full..
There is no standby pump nor generator.

According to the pump attendants, they normally pump from 8.30AM to 4.30Pm in the morning and 6-7 in the evening implying they pump water for 22 hours and produces about 1,119.58m^3/day of which about 783.706m^3/day reaches the treatment plant and 336m^3/day representing 30% is lost through leakages enroute on the rising main.

2.2.3.7 Rising Main

The Rising Main runs from high lift pump house along the Bakuli 3 Dam walkway and enters the escarpment.

The Rising Main passes through Marsabit Reserve.

The current Rising Main is of length 8km and diameter 6"GI and follows previous older routes followed by older rising mains of diameter 3"GI which was later upgraded to 4".

The older pipeline has been vandalized and stolen. The new main has 14 Single Airvalves and 5 washouts. There are about 5 Leakages making the pipe to loose about 30% of the water pumped.

The pipe follows a cleverly selected contour.

2.2.3.8 Treatment Plant

The Treatment Plant is located at:-

Region 37N
Longitude 0386903E UTM
Latitude 0256715N UTM
Altitude 1448m

The Treatment Plant consists of:-

- ✓ Inlet Well
- ✓ Flocculation Chambers
- ✓ One number Composite Filtration Unit of capacity 20-25m^3/hr
- ✓ Clear Water Tank of capacity 225m^3 as masonry ground tank
- ✓ Ground Backwash Tank of capacity 25m^3 masonry located about 5-7m above the top of CFU
- ✓ Backwash System
- ✓ Condemned 4Nos Staff Houses and
- ✓ Abandoned 1Nos. CFU of capacity 8-10m^3/hr

Plate 8: Existing Treatment Plant

2.2.3.8.1 Inlet Well

The Water from Bakuli is pumped to a well where it flows through a parshal flume into a composite filtration unit.

Plate 9: Parshal Flume

2.2.3.8.2 Composite Filtration Unit of capacity 20-25m3/hr

Raw water is pumped into a 20-25m^3 /hr composite filtration unit where it undergoes full treatment. After treatment, it flows into a 225m^3 masonry tank which serves both as clear water and storage tank. The treatment is located at the edge of game reserve at:-

Elevation - 1404m
Longitude - 20 19.381'
Latitude - 370 59.043'

The colonial 10m^3CFU is abandoned but the 20-25CFU built during drought recovery in 1990's is the one being used

Plate 10:20-26m^3/hr cfu with clear water tank hidden

The CFU is filled with rotten leaves while the sand is won out putting to doubts whether it is treating or dirtifying water.

2.2.3.8.3 Backwash System

There is a backwash system in a disused state. The last time it was used was several months ago. It Consists of:-

A masonry backwash tank of capacity 25m^3 located at:-

Region	37N
Longitude	0386884E UTM
Latitude	0256735N UTM
Altitude	1445m

A pump house containing 2 pumps is in a disused state and a rising main of diameter about 4inch and length about 300m.

2.2.3.8.4 Staff Houses

There are 4 Nos. staff houses which have been condemned since they were not built on solid base. The walls have cracked but none the less, they are being used.
There are 3 more buildings put up at the Treatment Plant by BADASA Dam Project which are in a sorry state and deriorating by the day.

2.2.3.9 Storage Facilities

The total storage facilities amount to 595m^3 which can be broken down as follows:-

- ✓ 225 m^3 main storage tanks is located at the treatment and acts as clear water tank. It serves the following seven zones:-
    1. Lower Shauri Yako Zone
    2. Upper Shauri Yako Zone
    3. Nyayo Road
    4. Town
    5. AP
    6. Majengo
    7. Manyatta Ote and
    8. Technical
- ✓ 100m^3 elevated steel tank supported on 10m platform serves Moi Girls Secondary and Zone 3

- ✓ 100m^3 steel elevated tank serving the following four kiosks:-
    1. Shauro yako kiosk
    2. Town kiosk
    3. Majengo and
    4. Muslim Agency
- ✓ Each kiosk is connected by 1" pipe

- ✓ Ground 100m^3 Steel tanks has been rehabilitated and it is awaiting being connected to the system.

There are Three Transmissions tanks totaling 400m^3 at:-

-Manyatta Ote Tank of capacity 100m^3

-2Nos. Manyata Chile Tank of capacity 100m3 and total capacity 200m^3 and

--Marsabit Boys High School of capacity 100m^3.

100m^3-Manyata Ote (Ajatisa) Tank

This tank is served by 4"GI Gravity Main and can be located at:-

Region	37N
Longitude	0387432E UTM
Latitude	0258274N UTM
Altitude	1399m

The tank supplies:-

- Majengo Kiosk
- Ajaatisa Kiosk
- Bomb Blast zone (Tari Adi Zone) and
- Upper Ajatisa zone.

The tank does not fully command its service area since some people have built above the tank. It does not have ball valve and from the field investigation, there is a lot of overflows which the community have bought plastic tanks to store this fee valuable rather than live it overflow to waste.

To remedy the situation, a ball valve is necessary.

100m^3-Marsabit Boys High School Tank

This tank is served by 4"GI Gravity Main and can be located at:-

Region	37N
Longitude	0386644E UTM
Latitude	0257442N UTM
Altitude	1421m

The tank supplies:-

-Technical Zone
-Marsabit Boys and Moi Girls Secondary Schools from the Gravity Main
-Manyatta Otte and Lower Majengo and
-Best Place to pump to Governor's Residence

The tank inlet is 3inch while the outlet is 8inch

Manyatta Chile Tank of capacity 2Nos. 100m^3

There exists two tanks of capacity 100m^3 each one built by Ministry of Water and the other by Saku Constituency Development Fund and they are served by 3"GI and 6inch Gravity Main and can be located at:-

Region 37N
Longitude 0388029E UTM
Latitude 0257765N UTM
Altitude 1392m
The tank supplies:-

-Lower and Upper Shauri Yako
-Nyayo Road and Part of town (Market Area)

2.2.3.10 Distribution System

The area covered with a distribution system measures about 14 km^2 and is served through a water rationing schedule using a normal supply interval of 5 days.

The Distribution System Consists of pipes ranging from diameter 80mm to 150mm GI and total length of 7.5km.

There are 7 direct lines in addition to the distribution main. They are:-

1. D.C
2. D.O. Central
3. Hospital
4. KWS
5. Prison and
6. Moi Girls.

The Distribution System is divided into 7 zones to allow rationing as follows:-

1. Lower Shauri Yako
2. Upper Shauri Yako
3. Nyayo Road
4. Town
5. AP
6. Technical and
7. Manyatta Ote.

The following pipe networks exist:-

1. Lower Shauri Yako 6"UPVC reducing to 3"
2. Muslim Agency 1 zone 6" reducing to 4" reducing to 2" 2No. Pipeline
3. Muslim Agency 2 zone, 6"UPVC reducing to 3"
4. Alidaya zone 6"UPVC reducing to 4" and reducing to 2"
5. Majengo Zone 6" reducing to 4"

Figure 2 has the layout of the existing distribution system.

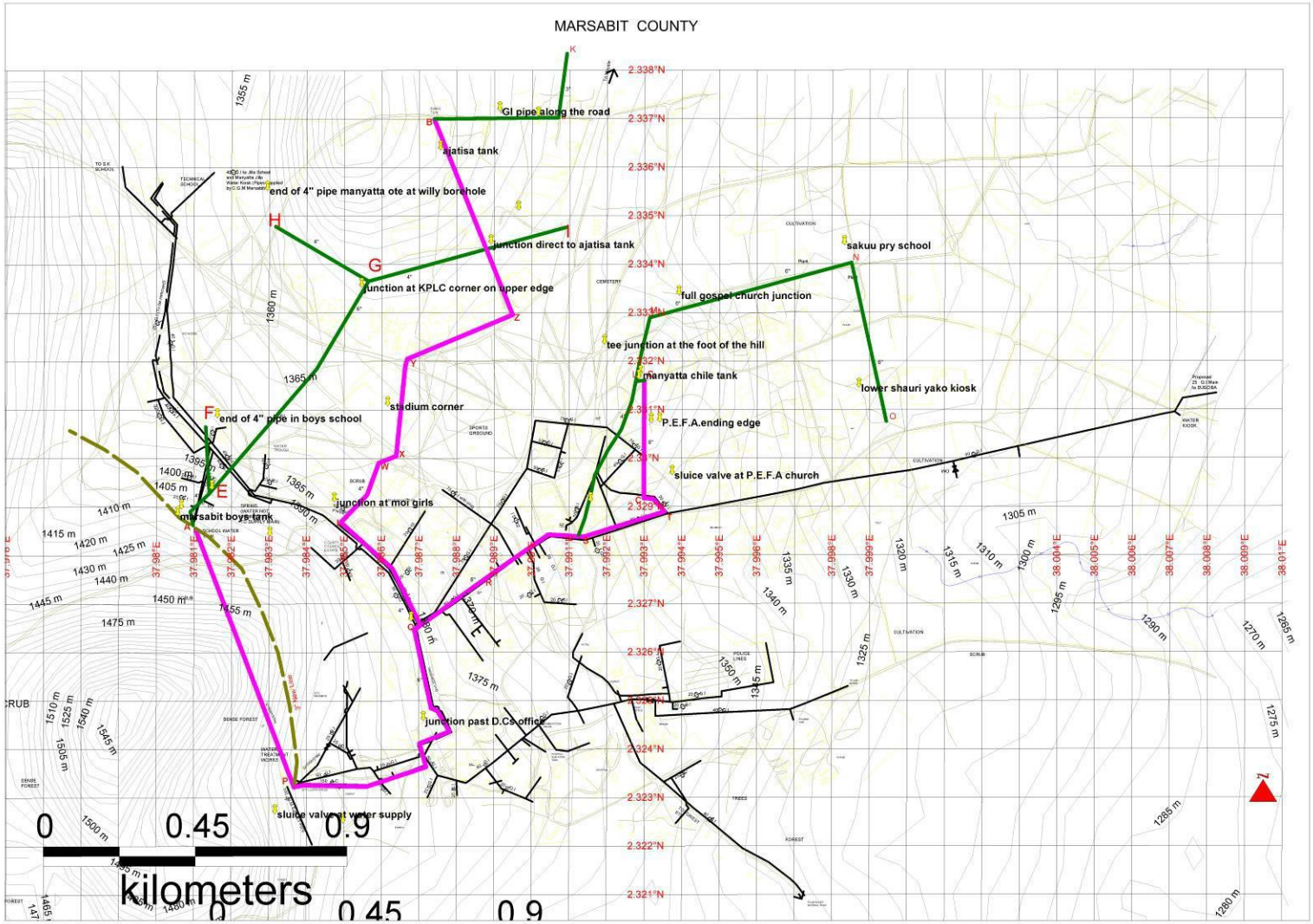


Figure 2: Existing Distribution System

Water is supplied through Individual connections and eight kiosks.

However, majority of the people at 75.71% use water kiosks (Water Vendors)

2.2.4 Rationing Programme

Water is rationed once per five days.

2.2.5 Constrains

The Water Supply is Phasing a number of challenges as follows:-

1) The Supply is grounding to a holt since it is understaffed and only one person is on duty at the treatment plant instead of the required 5 at any one given time. This has led to accumulation of leaves in the composite filtration Unit making treatment a dirtifying rather than cleaning.

2) Due to high head, the water supply is unsustainable.

3) Bakuli 1 is silted and requires desilting

4) About 1-2m depth of existing Bakuli 3Dam is silted.

5) No Standby Pumping Equipment and only one pump is functioning

6) There is no standby generator making the supply unreliable

7) The Water Supplied is not enough despite Bakuli 3 having eased the water shortage by 30-40%

8) Most of the water is supplied by Kiosks limiting the sanitation mode to pit latrines. For the Town to grow, it requires to embrace modern sanitation technology ie sewerage system.

9) The Supply is having Operational difficulties despite being operated by Marsabit Water Company. The Distribution of posts is being done arbitrary rather as recommended by the Ministry of Water and Irrigation Water Practice Manual, 2005. Further, the Company does not have paperwork of being a Company e.g. Stategic Plan, Registration Documents etc.

10) There is no master meter and current production is only estimated.

Arising from above, Marsabit County should act fast to forestall impending collapse of Marsabit Water Supply hence aboratating its responsibility in the constitution which makes Water a basic right.

2.2.6 Tankering

Due to water shortage, water tinkering is a booming business with 10,000 litre tanker selling at Kshs 10,000 i.e. 1 Litre per 1Kshs.

2.3 Sanitation

Marsabit Town depends on Pit latrines for its sanitation needs since 88.24% of the Household depend on Pit Latrines.

CHAPTER THREE

3.0 BASELINE INFORMATION

3.1 Physical and Ecological Conditions

Marsabit Town is located in Central Division, Marsabit Central Sub-County, Marsabit County.

It consists of 3 Locations and 6 sub locations

It can be located on SK Sheet No. NA-37-6 scale 1:250,000 at coordinates 38^0 East of Greenish and $2^0$20' North.

It is situated within Mount Marsabit Forest Reserve in the Northern Region of Marsabit County.

The population of Marsabit town is currently estimated at 20,273 people during wet seasons and 22,300 people during drought. The population is expected to increase at 2.43%p.a to 22859, 29062 and 36948 by the years 2017, 2027 and 2037 respectively.

Marsabit county is populated by various ethnic communities including the Cushitic Rendille, Gabbra and Borana as well as the Nilotic Samburu and Turkana which constitutes the population of Marsabit Town.

3.2 Topography

Mount Marsabit is an extinct volcano surrounded by expansive low lying arid plains formed of weathered lava flows ranging in altitude from 300 to 900m above sea level that slopes gently towards South East. The highest point of the mountain is 1920m above sea level.

Although Marsabit is the second largest and driest district in Kenya, the mountain area benefits from its high elevation and receives a biannual distribution of rainfall ranging from 600mm to 1000mm annually. The combined effect of high altitude and fairly good rainfall enables a tropical rainforest to thrive on nearly 80% of the entire mountain area. Over the past four decade, 60 %(40,000 Ha) of the riparian forest has been opened up for farming and settlement development (including the District Headquarters). The remaining 40% (15, 280 Ha) is the gazetted forest area, which is also the Marsabit National Park, which was home to legendary elephant Ahmed

Marsabit Town is founded on Mount Marsabit and it is embedded between three other hills. It generally slopes from North East to South Wes

3.3 Geology

The geology of Marsabit town and its environs consists of a massive alkaline basaltic rock system that overlies Precambrian basement rock complex at depth. These volcanic rocks referred to as the Marsabit Shield cover the entire mountain forming basaltic rapilli breccia volcanic ash cones, and cinder cones interlayed with extensive olivino basalt flows. These miorene-oliocene basalts unconformably overlie undifferentiated basement rock system at depth.

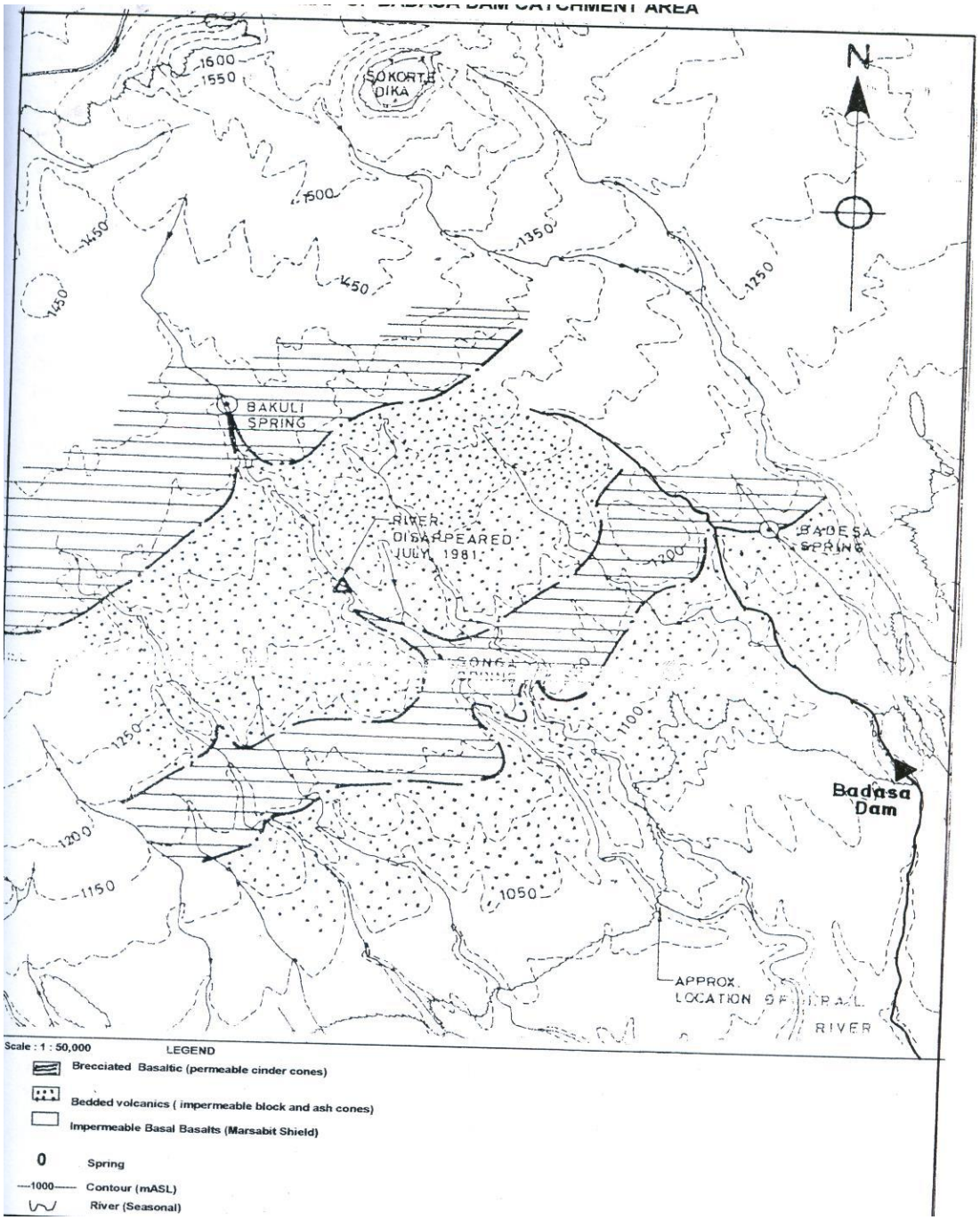
The formation of the Marsabit Shield (evolution of Marsabit Mountain), took place in a series of volcanic eruptions.

Volcanism in the Marsabit Shield commenced at the same time with the Rift system faulting in the Pliocene and continued into the Quaternary period according to the recorded basal basalt rock ages dated 2.5 and 0.5 million years respectively.

The volcanic centers comprising of cinder cones and block and ash cones (or maars) are concentrated trending northwest and northeast through the shield summit.

The initial lava flows are uniformly thin and laterally extensive fissure controlled basal basalts erupted during the late Miocene to Pliocene periods.

Subsequent violent eruptions during the Quaternary period produced intervals of pyroclastic accumulations from cinder cones and maars with faulting accompanying volcanism. The major faults were concealed by later volcanic flows with eruptions of narrow lava tongues of olivine basalts emerging from the cones (Refer Map 4 below)



Map 4: Geology of Marsabit Town

3.4 Soils

The higher parts of Mts. Marsabit have rich volcanic soils which are well developed and have high water retention capacity. On the lower slopes of the mountains, the soils are basically cambisols. In some areas they are moderately deep clay loams; in others, the soils are stony or rocky. These soils are generally suitable for agriculture and dairy farming in those places with sufficient rainfall..

3.5 Water Resource

The people and livestock in Marsabit Countyt rely on surface or ground water as there are no permanent rivers in the County.

There are three principal water horizons in the district; the upper horizon of mountains and hills, over 1500m to the summits of mount Marsabit and Kulai where there are a number of springs; the second horizon 1,200m to 1,500m still on the mountains, on mount Marsabit springs like Badassa, Songa and Balesa Bongole are at these levels. The rest of the district which generally lies between 400m-460m depends mostly on underground water. In these areas, the ground water table varies greatly.

According to investigation undertaken on Marsabit Town, the ground water potential is rated as low

3.6 Drainage

Marsabit Town has three distinct drainage as follows:-

1. Jaldesa lagga passing below the District headquarter. It drains most of Mountain Location which forms most of the Central Business District of Marsabit Town (Refer Figure 3-5).
2. Hari Henry Drainage –It drains Nagoya and Part of Dakabaricha locations.(Refer Figure 3-5)
3. Halbota Pan-Slaughter House/Senegai Airstrip drainages the remaining part of Marsabit Town constituting 25%..

3.7 The Marsabit Mountain Forest and its Resources

3.7.1 Protected areas in Northern Kenya and in Marsabit

The creation of protected areas in Northern Kenya dates back to as early as 1902 when the Northern Game Reserve (including Marsabit) was established. This decision was based on the realization of the potential for tourism and to conserve the forests and wildlife in the district.

According to Synott (1979: 5), the upper slopes of Marsabit Mt were set aside (or 'gazetted') as a protected forest area with an area of 152.8 km *(i.e.* 37,760 acres) in 19324 after the Administration became concerned about the effects of forest fires and grazing on the condition of the forest. The boundary of the Marsabit Forest Reserve was surveyed in 1947 and demarcated in 1951.

Refer table 3 and figure 3

Table 3: Locationn and size of special legal status areas in Marsabit District

Area	Altitude (m)	Location	Size (in km²)	Yr of establishment
Marsabit National Reserve[a]	1,836	2°23'N – 37°56'E	1,435	1949
Marsabit National Park	--	2°22'N – 37°59'E	395	1940
Losai National Reserve	2,637	1°38'N – 37°35'E	1,820	1976
Mt Kulal Biosphere Reserve	2,295	3°00'N – 36°05'E	410	1978
Sibiloi National Park	--	4°00'N – 36°19'E	1,420	1973
South Island Park[b]	--	2°39'N – 36°35'E	40	1985
Total area (% of the district)			5,520 (9.0 %)	

Notes:

a. *Marsabit Forest Reserve (approx. 153 km^2) is a part of the Marsabit National Reserve and in turn 80 km^2 of the reserve falls within Marsabit National Park. Mt Kulal has not yet been gazetted as a legally protected area or a reserve. For this reason Mt Kulal Reserve falls under trust land, and with the vested power of land tenure in hands of County Council.

b. The South Island Park is located on the southern wing of Lake Turkana, and is basically a Marine Park. Of the total lake area only about 7 per cent is in Marsabit District, and the rest is in Turkana District.

c. All the protected areas fall under management category II of the IUCN classification, apart from Sibiloi National Park which falls under Natural World Heritage site criteria I and IV, as inscribed on the list in 1997.

Source: IUCN (1994) and GoK (1991a: 78) Range Management Handbook of Kenya.

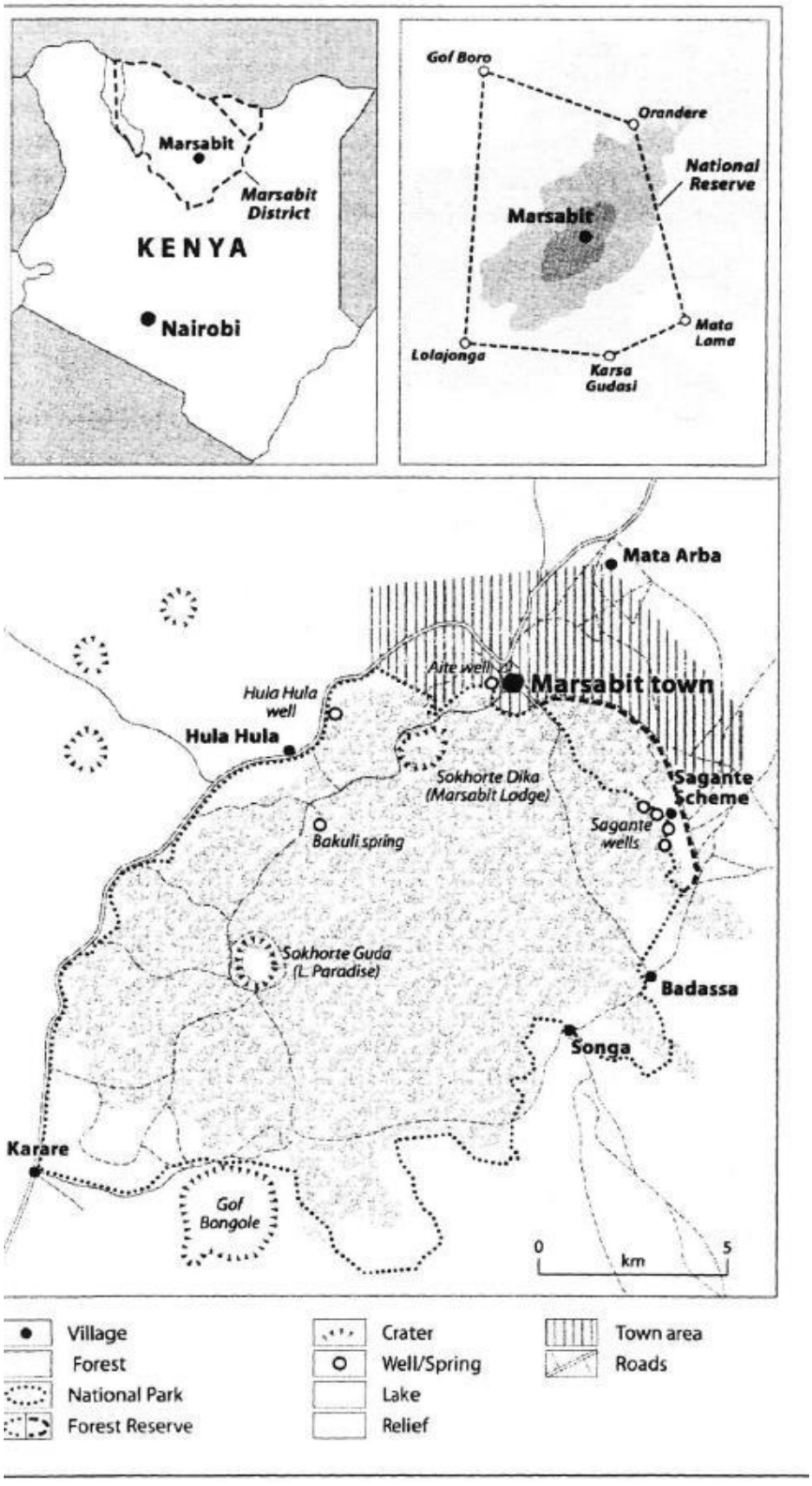


Figure 3: Marsabit National Park, Forest Reserve and Marsabit Town within National Reserve

Following the government's renewed interest in protection, the Marsabit National Reserve was established by Government Notice in 1948, extending eastwards from the southern end of Lake Turkana to Isiolo and including the Mathews Range and Marsabit, and it became managed under the National Park Ordinance (MDDP 1979: 57). The Marsabit National Reserve (1,435 km^2), encompassing the entire mountain area including the Marsabit Forest Reserve (152.8 km^2) that had already been created in 1932, came under IUCN protected category areas in 1949. A large part (70 per cent) of it - the protected area outside the Forest Reserve and National Park - serves as a buffer zone for the dispersal of migratory wildlife such as buffalo and elephant. The reserve is designated as a zone where all shooting and hunting of game is legally forbidden without a permit.

Other protected areas with a legal status in the Marsabit District of Northern Kenya are the Marsabit National Park (395 km^2), the Losai National Reserve (1,820 km^2), the Mt Kulal Biosphere Reserve (410 km^2), the Sibiloi National Park (1,420 km^2) and South Island Park (400 km^2) (see Table 3, Schwartz *et al.* 1991). Both Mt Kulal and Mt Marsabit are high altitude areas with important ecological links to the surrounding plains for providing underground water coverage for over 75 per cent of the district (MDAR 1986: 18). Mt Kulal Biosphere Reserve has been internationally recognized within the framework of UNESCO's Mann and Biosphere (MAB) programme since 1978. The Sibiloi National Park and the South Island have been inscribed in the Natural World Heritage Site since 1997 and 2001 Respectively (along with Central Island in Turkana District), under Lake Turkana National Parks.. While all the protected areas in the district are nationally or internationally recognized ecosystems, we mainly focus on the protected areas around Marsabit Mountain: Marsabit Forest Reserve, National Reserve and National Park.

3.7.2 Protected areas on Marsabit Mountain

Off the six protected areas with legal status in Marsabit District three are located on Marsabit Mountain with unclear overlapping boundaries, *i.e.* the Marsabit National Reserve (MNR), The Marsabit National Park (MNP) and the Marsabit Forest Reserve (MFR). The latter two Areas are subsets of the former (see Figure 3) and the original total size of the National Reserve as gazetted in 1949 was 2,020 km^2. The various categories of protected areas are supported by a disjointed legislative framework, which also contains implicit access rules and rights of use by the local community. According to subsidiary legislation of the Wildlife Act of Laws of Kenya, the National Reserve is managed as a National Park.

Thee MFR, is a mountainous forest and covers an area of about 153 km^2 (some sources Quote 141 km^2, others 144 km^2) within the National Reserve.The forest boundary is roughly 588 km long. The interior part of the forest, which is located partly outside the Forest Reserve, consists of 360 km^2 National Park and is surrounded by 1,001.2 km^2 of the National Reserve, which slopes down to the surrounding acacia scrub plains. The Park area, which is in practice managed as a National Park (Litoroh et al. 1994), includes about 80 km^2 of the Forest Reserve. The National Park was created in 1940, making it the

oldest parks in Kenya (Sobaniaa 1979; Salvadori 2000). The national reserve areas in the surrounding plains are designated as buffer zones and dispersal areas for migratory game.

3.7.3 Access rules for protected Areas

The special legal status areas on the mountain (the National Park, National Reserve and the Forest Reserve) are governed by different access rules for local utilization and subject to varying degrees of patrolling. Natural resource management and conservation Activities in Kenya are generally in the hands of the central government, private or parastatal Agencies.. Protected areas are managed in accordance with the Wildlife (Conservation and Management)) Act of the Laws of Kenya (Cap. 385) and the Forests Act. The Forest Department (FD) of the Ministry of Environment and Natural Resources and the Kenya Wildlife Service (KWS) - a parastatal - manage most protected areas in Kenya. The protected areas which are the responsibility of the FD are often broader in coverage than the areas with unique and diverse wildlife, which are of special concern to the KWS. The FD also oversees trees in areas settled by humans and non-gazetted forest areas, often entrusted by the central government to the County Council (e.g. Mt Kulal). In general, access rules under these agencies vary and conflict in terms of local community access rights and the associated use of resources.

Under the existing legislation, forest reserves in Kenya aim to ensure the protection of forest vegetation in the interest of soil, water and biological conservation (the Forests Act, Cap.. 385). The forest rules are determined centrally and management policies are characterized by a stern hierarchy that has always issued orders from the top - the headquarters in Nairobi. In effect, changes in regulation policies are made by a lengthy process and via an amendment of a Bill of Parliament. A National Park is legally characterized by rigid management and policing rules that generally restrict access rights relating to any consumptive use of resources to the local community. Thus they are mainly unavailable for the harvesting of firewood or livestock grazing apart from periods of critical distresses or drought when grazing access may be permitted under provisions of subsidiary legislation.. The granting of a 'last-resort' livestock concession depends on political will and the intensity of prevailing environmental conditions. Contrastingly, the Forest Reserve policies permit limited local access to collect dead wood for fuel wood, poles and livestock grazing during stress periods and use of water sources within the Forest Reserve. This use requires the possession of a permit conditional upon payment of a prescribed fee.

Confusion exists as to whether the mountain-protected area is a Park or a Reserve, but the forest never acquired full National Park status. However, about 80 km^2 of the National Reserve is *managed as* a Park by KWS. The current uncertainty about the legal status of the forest explains why communities still benefit from various goods and services provided by the forest. .

Legally, FD and KWS are recognized as being joint managers of the Marsabit Forest Reserve.. On a day-to-day basis, the agencies jointly man the Marsabit Forest in accordance with guidelines spelled out in a management agreement (MoU 1991). This note aims to strike Middle-ground conservation policies that allow regulated resource

access to local communities.. The blending of forest and park policies targets a flow of forest returns to local populations and aims at sustainable biodiversity development.

3.7.4 Boundary vagueness of the protected areas and its consequences

Mountain and forest resources were in the past used for grazing during dry seasons or critical periods. This practice has been changing during the last three decades because the mountain has become more attractive to settlers wishing to experiment with farming. Some fundamental questions regarding the limits of protected areas require urgent redress. Perceptions of what constitutes a protected area have implications for access to and use of resources. Yet confusions surround fixed boundaries of the protected areas on the ground. It has been remarked that 'Marsabitt Forest [station] boundary still remains a problem due to missing beacons...and unavailability of funds to employ casuals to trace the same' (MDAR 1993: 29).

For example different individuals have different ideas about what is a Park, a National Reserve or a Forest Reserve, to name but a few. Such vagueness creates confusion and is subject to abuse and the use of 'office' positions to pressure public advocacy in natural resource management practices. Gachanja *et al.* (2001) report stressed destruction of the forest ecosystem with partial information, without providing the evidence and with little regard to due consequences of their assertions for the rural households. Today, there is no clear division or a map spelling out categories of protected area to concerned parties of interest is missing. First, the local communities hardly seem to know the real status of the forest to date. Secondly, neither is the boundary of the forest accurately known to the officials off the agencies in charge of day-to-day management of protected areas. In other words, the distinctions between boundaries of protected areas are either altogether lacking or ambiguous too stakeholders in practice.

There are forest areas under the control of the County Council which have been settled over the last ten or so years but which formally are within the area of the forest reserve (Table 4).. These areas represent less than 1 per cent of the forest reserve area. They are all located along the forest border, well served by water supplies and electricity. The ease with which these services can be tapped attracts human settlement. Such allocations are controversial and a lot of political work is involved in establishing who is or who is not to be allocated, especially in the cases of individual allocation. However, the pressure of human settlement is high and lobbying actions against settlement remain weak. For example, in 1996 die District Development Committee nullified all land allocations (by men Harry Thuku Forest) by the County Council within the protected areas (Adano 2000: 121). This decision was later Revoked.. The land was subdivided and allocated to civil leaders, and mostly sold later at Ksh.. 80,000 per quarter of an acre plot20 to a private developer in 1999/00. The high market value,, a substantial amount by local standards, is based on the centrality of the plots in town. Moreover,, control and power as regards the allocation of residential plots are vested with the Council.. It suffices to say that these allocations arise in part due to the ambiguity of the protected area boundaries. Any problem relating to forest land conversion, population growth and indiscriminate use of

forest resources in the case of unclear protected area boundaries is therefore the responsibility of the government agencies.

Table 4: Settled areas that are formally still part of the forest reserve

Year of allocation	Site	Land area (ha)	Settlement status
1988	Ministry of Health	6.3	Public
1994	Ministry of Water	3.2	Public
1995	St. John Pry School	2.02	Public
1996	Ahmed Gate	4.2*	Private
1996	KWS – houses	3.62	Public
1996	KCB – staff houses	2.4	Public
1997	Ministry of Livestock	2.45	Public
1998	Around Karatina	7.4	Public/private
1998	Harry Thuku Forest	2.4	Individual
1999	Ministry of Public Works	5.37	Public
	Total (% of the reserve)	*39.36 (0.3)*	

Note:

a. * The size of the area allocated to this use is uncertain.

Source: Marsabit Physical Planner's Office, 2000.

3.7.5 The protected area of Marsabit Forest Reserve

3.7.5.1 Physical characteristics

The ecology of Marsabit Mountain is remarkably different from its surroundings owing to the presence of a small natural forest cover, the relatively higher altitude (approx. 1,836 m) and thee amount of rainfall. Marsabit Forest is a cloud mountain rain forest located amidst an arid and semi-arid environment. Characteristically, montane forests grow at a high altitude in Excess of 1,500 m where the weather is substantially windy and too wet for optimum tree Growth (Synott 1979: 1). However, Marsabit Forest Reserve has an unusual combination of Moderate size, isolation and comparatively high rainfall that differentiates it from other highland forest areas in East Africa and other montane forests at similar latitudes in Eastern and Northern Uganda (ibid.)- Although Marsabit is not the highest or largest mountain in the district,, it has the largest area of closed forest in the district .

Mount Marsabit experiences bi-modal rainfall. The western side of the mountain is considerably drier due to its leeward position. The mountain experiences an average of about 8000 mm annually and the eastern windward side is considered a truly sub-humid ecological zone unlike the western part. The forest ecosystem is not solely supported by rainfall, but is also supported by the dense mists and frequent cloud cover on the forest peaks in the early morning hours (cf. Maciel 1985). This mist is extremely important for the ecology of the vegetation on the mountain: the mist condenses through the presence of moss on the trees and trickles down, moisturizing the ground under the trees. The morning mists and relatively high rainfall jointly sustain the forest and help it maintain its diverse functions. In turn, the forest's unique location has an influence on a wide range of ecological functions: it protects catchment areas, permits arable farming and creates and modifies the microclimate of the mountain.

The relatively humid conditions on Mt Marsabit have an impact on the surroundings in the whole district. The stocks of underground water sources, as far as away as Logo-logo and Kargii and into Wajir District, are fed by underneath streams of groundwater coming from Marsabit Mountain (Lusigi 1983: 89; Schwartz et al. 1991). These observations emphasize the indirect ecological role and the way in which the forest supports the adjacent lowlands. The flow of water in the area is dependent on rainfall, the subsurface aquifers, evaporation rates and extraction of water by human activities, vegetation growth and the drinking behavior of animals.. All these variables are very dynamic by nature. According to the perceptions of people living adjacent to the forest, the early morning mists show a general decline (Adano 2000).. This may suggest worsening environmental conditions, as also shown by the frequent 'dust-bowl" conditions in Marsabit Town during dry seasons. Conversely, an examination of thee historical accounts of water supply in Marsabit Mountain in colonial times shows that the availability of water has greatly improved during recent decade.

3.7.5.2 The Marsabit Forest Reserve as custodian and habitat for biological species

The Marsabit mountain and the forest ecosystem has four main, and intricately conflicting and overlapping, functions: (i) it forms a custodian and habitat for biological species; (ii) it has an important function in watershed protection and erosion control; (iii) it provides several products which the local communities harvest either for indirect input into household production or for direct use (e.g. direct consumption of woods for fuel wood and timber poles for construction purposes); and (iv) it offers refuge for (growing) human settlement since the climatic conditions on the mountain are conducive to arable farming.

Figure 4 has the Marsabit National Park.

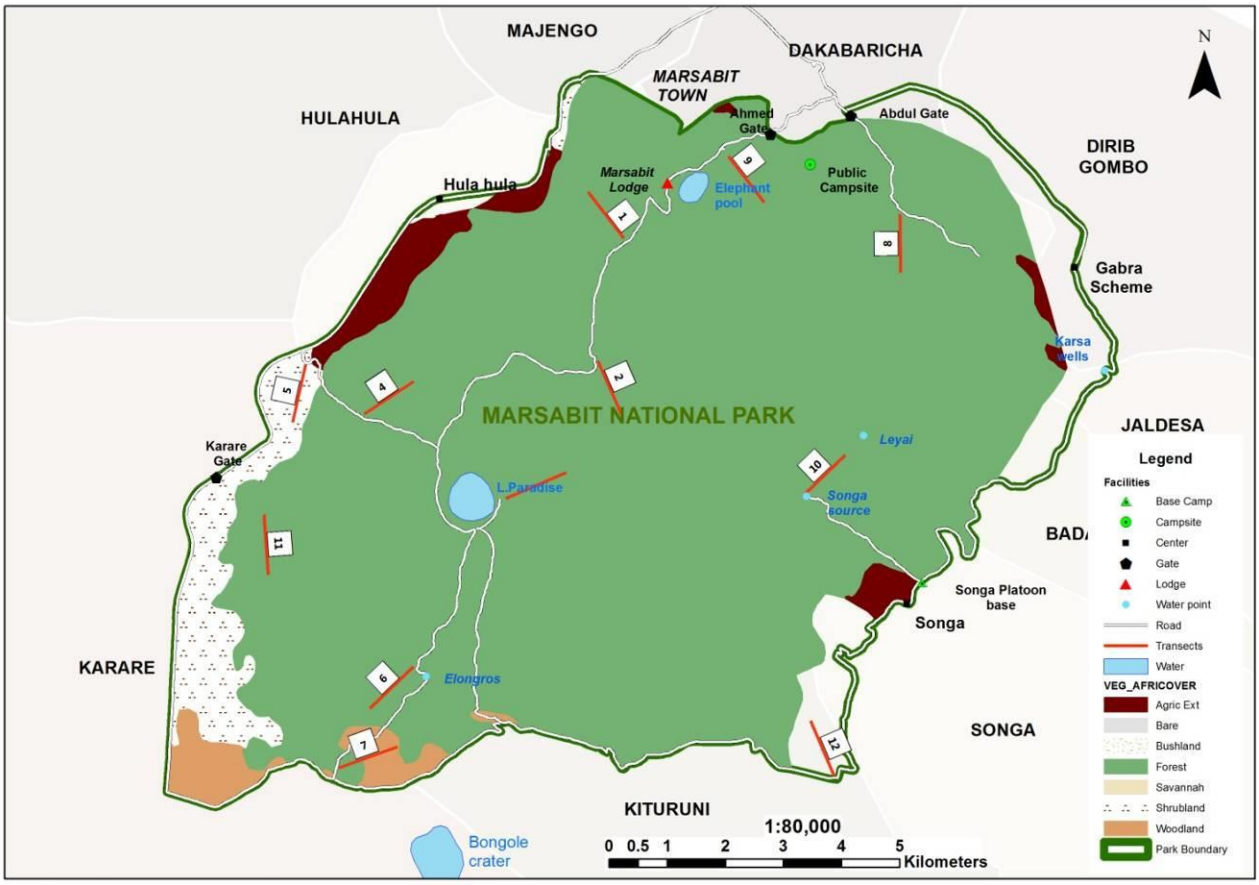


Figure 4: Marsabit National Park

3.7.5.2.1 Plant species

Marsabit Mountain is endowed with a small, spectacular forest (38°E/2°20'N). Mt. Marsabit mist forest is protected and its national park. Since the mountain lies in the line of the monsoon winds from the East and Southeast directions, the wind direction influences the altitudinal limit of the forest cover, which amounts to about 1,2200 m (or 4,000 ft) on the south-western side (PC/NFD5/4/1, 1933, Vol.39), and to 900 to 1,0000 m on the Southeast (windward) flanks of the mountain (Synott 1979: 10). The latter seems to suggest that the edges of the forest end lower down. The sides cover a total of 113 km^2 of the gazetted forest area (74 per cent of the forest reserve) associated with the rain shadow effect due the winds direction (Ochanda *et al.* 1981: 19).

The mountain covers 14,917 ha (36,859 acres) of demarcated forest (Synott 1979; MDARs,, 1979, 1981). Of the total forest area in northern Kenya, more than 228 km^2 are protected as a high forest productivity area, slightly more than 42 km^2 as bush land and 20km^2 as grassland within the forest. Of these areas in the region, Marsabit Forest Reserve accounts for about 53 per cent. The vegetation types of the forest reserve are presented in Table 5 with detailed list presented in Appendix 2.

Table 5: Vegetation types and water cover of Marsabit Forest

Vegetation type	Stocked forest[a]	Dwarf forest[b]	Bush[c] with grass	Bush with scattered trees	Water	Total area of the Forest Reserve
Size (ha)	10, 499	485	3, 225	671	37	14, 917

Notes: [a] Stocked forest refers to the mountain upper zone dominated by a mixture of trees (including brown olive), shrubs and climbers of all sizes. This zone of the forest is covered by dense evergreen vegetation.
[b] Dwarf forest is the middle zone forest suited for stable mixed broad-leaved tree species such as *Olea capensis*.
[c] Bush refers to bush with grass at the lower edge of the forest. This zone is too dry (affected by fire) for broad-leave trees and sustains thorn bush trees.
Sources: Synott (1979: 11), MDDP (1979: 12) and GoK (1991a: 93 and 96).

The mountain also has the largest number of indigenous tree species in the region. The most predominant tree species23 found in the Forest Reserve include: *Croton megalocarpus,OleaOlea africana, Juniperus procera, Strombosia schefflei, Cassippourea molasana, Diospyros abyssinica,abyssinica, Ekebargia capensis, Ekerbergia rueppaliana; and Premna maxima* (MDDP 1979; Marsabitt Forest Officer 1998, pers. com.). Some other common tree species include *Teclea nobilis,nobilis, Teclea simplicifolia, Ocotea usambareusis, Olea hochstetter, Olea capensis, Cordia abyssinica,abyssinica, Casearia* spp., *andApodytes dimidiata* (Synott 1979). Trees planted in the 1920s (MDARR 1928) are still not the most common ones in the 1990s (Schultka 1991: 25-38). Possibly they were planted on forest edges which are areas prone to intensive grazing, browsing and burning and are currently under settlement and cultivation

The main composition of the forests is species that form closed canopy.

Table 6 has the existing tree species and there status.

Table 6: Different tree species and status

Growth forms	Most common species	Status
Trees	Juniperus procera	Dominant in Kulal
	Croton megalocarpus	Dominant in Mt. Marsabit
	Olea Africana	Depleted in Mt. Marsabit
	Olea hochstetteri	Depleted in Mt. Marsabit
	Cassipourea malosana	Depleted in Mt. Kulal
	Teclea nobilis	Common in Kulal
	Diospyros abyssinica	Common in Kulal
Shrubs/bushes	Rytigynia neglecta	Common in Mt. Marsabit
	Psychotria kirti	Common in both
	Clausena anisata	Common Mt. Marsabit
Shrubs/bushes	Rytigynia neglecta	Common in Mt. Marsabit
	Psychotria kirti	Common in both

Growth forms	Most common species	Status
	Clusena anisata	Common in Mt. Marsabit
Grasses	Oplismenus hirtelus	Common in Mt. Marsabit
	Schoenoxiphium Lehmanni	Common in both

The Mt. Marsabit forest is for the most part devoid of large diameter tree classes except in areas where it is near the park security or in-accessible terrain such as near Ahmed gate. In some of the permanently wet parts of the park such as Elephant pool and Lake Paradise, there is the typical wetland graminoid dominated vegetation. Also, some threatened species such as the red listed *Hernsenia dierbielloides* were recorded in the Park. The vegetation of Mt Marsabit forest is mainly threatened by deforestation all around, pastoralism, conversion to farming and impending urban sprawl.

All trees is a forest offer ecosystem benefits such as sink for atmospheric carbon, habitat for wildlife, nesting areas for birds and primates, soil erosion control. The vegetation in the forest ecosystem helps conservation of soil, water and biological conservation on the mountain.

The trees have economic, ecological and social values to the wildlife species and the human population. In addition, the dead trees and other vegetation will decompose under water hence producing a lot of methane which is a green house gas. Below is a list of some of the tree species which will be submerged leading to loss of their value to the wildlife and human communities.

. *Cordia afrcana:* This is an indigenous tree usually deciduous, growing widely in the moist forests. This tree with large round leaves grows to reach a height of about 15 metres. The trees uses include furniture and bee hives making as well as general timber. It is a good source of firewood. Its gum is used as glue and its fruits are edible. The juice from its fruits is used to treat broken bones.

Croton megalocarpus: This is a dominant forest tree reaching a height of 35metres. The tree is common in moist upland forest. The tree is used in making good firewood, poles, and general timber needs. Their seeds have a high oil content and can be used to produce bio-fuels. The seed are used as food by birds and small mammals. the bark is boiled to treat intestinal warms, whoping cough and pneumonia.

Fucus sur: This indigenous tree is tall up to a height of 25 metres. Has a wide crown and buttressed trunk and found in well watered areas. The kikuyus call this tree the mugumo. The fruits are edible when ripe, however they always have wasp larvae. Its bark is used to treat stomachache and diarrhea. The tree produces milky sap used to treat toothache, while the roots treat coughs.

Ficus thonningii: Large indigenous tree growing 25metres in height. It has epiphytic characteristics where it uses other trees to climb, then produces its aerial roots which grow downwards to the ground and eventually its buttressed multi-stems strangle the support tree. Common in dry and wet upland forests. Its leaves are used as fodder, bark used for making strings. The roots are boiled to induce lactation and for treatment of

influenza. It is called the Mugomo by the kikuyus and they regard it as a sacred home of God.

Olea africana : Indigenous tree growing to a height of 15 metres. The tree produce very good wood used to make high quality furniture and wood carvings. Also make s good poles and posts and flooring sheets. It is also a very good source of firewood and charcoal.

Diopyros abyssinica: it is an indigenous tree growing to a height of 20 metres. It is common in highland forst. It is used to produce very good tough timber for furniture making as well as axle and knife handles. It produces good firewood and charcoal.

Teclea simplisicifolia: It is an indigenous tree growing to a height of 10 metres. Common in dry upland forest. It is used to roof beams and bows. Also makes good poles and general timber needs. It provides good firewood and charcoal for local use. The bark is used to treat hepatitis and malaria.

Cyperus latifolia: This is a common reed in the swamp vegetation. This large stands of reeds are especially significant in reducing soil erosion. The species will be able to migrate to higher ground where it will establish again.

3.7.5.2.2 Wildlife species-Large Mammals

Data from the historical sources suggests that the forest supported more wildlife species in the past than at present. Three personal memoirs in particular emphasise this assertion: Archer (1907-1913), a colonial administrator, once remarked that 'Marsabit forest must have contained more elephants, buffalo and rhino to the square mile than any other spot in Africa, particularly in the dry weather when the water on the plains had dried up. From one vantage point on the eastern slopes I have observed through field glasses as many as

four separate herds of elephants moving up the mountain side and converging on the forest' (cited in Salvadorii 2000: 5).

In around 1948, plenty of game was observed on the mountain: elephants, rhinos, buffalos, giraffes,, greater kudu, lions and leopards (MDAR 1948: 22). In 1949, the result of proclaiming Marsabit Mountain a National Reserve was assumed to be a direct reason for an enormous increase in the game population on the mountain, to the extent that they are becoming a nuisance (MDAR 1949: 22). On one occasion at Lake Paradise *(Sokorte Guda)* in 1956,, 67 elephants, 110 buffalo, 5 giraffe, 1 rhino and 9 Grevy's zebra were seen together (MDARR 1956: 32). In the past, large herbivores like giraffe only returned to stock up on water and did not reside on the mountain. Large herbivores can affect the forest due to the browsing intensity which increases the mortality of plant species that are intolerant to browsing *(cf.* Mclnness *et al.* 1992; Bond 2001). In response to game numbers and the related menace of human-wildlife conflicts, a proposal was made to try out the effectiveness of an electric fence running from Sagante to the *Boma24* (MDAR 1950). The quantity of game has reduced over the years and large game numbers are a thing of the past these days, except in the case of elephants,, buffalo and the greater kudu.

Currently,, the forest is home to a wide variety of wildlife species, In addition to the African elephant, other mammal species in Marsabit Protected Area include: the greater kudu (*Tragelaphus strepsiceros*), the African buffalo (*Syncerus caffer*), bushbuck (*Tragelaphusscriptus*), common duiker (*Sylvicapragrimmia*), common warthog (*Phacochoerus aethiopicus*), olive baboon (*Papio anubis*), vervet and syke's monkey (*Cercopithicus aethiops* and *C. mitis*), lion (*Panthera leo*), and leopard (*Panthera pardus*). Elephant and greater kudu are two animals on the IUCN list of endangered species.

Table 7 has the encountered wildlife in Marsabit Game Reserve.

Table 7: Large mammal species encountered in MFE: Encounter type DR=Direct Observation, D=Dung, OP-Opportunistic sighting

Species	Family	No of encounters	Type of encounter
Baboon (*Papio cynocephalus cynocephalus*)	Cercopithecidae	2	DR,
Vervet Monkey (*Cercopithecus pygerythrus*)		1	DR
Buffalo (*Syncerus caffer caffer)*	Bovidae	22	DR, D,
Bushbuck (*Tragelaphus scriptus*)		12	DR, D
Bush duiker (*Slyvicapra grimmia*)		3	DR
Grant's Gazelle Gazella *grantii*)		1	D
Cattle (*Bos taurus*)		7	DR
Guenters Dik dik (*Madoqua guenthari*)		3	DR, D
Hyena (*Crocuta crocuta*)	Hyaenidae	9	DR, D, OP
Grevy's Zebra (*Equus grevi*)	Equidae	2	DR, D
Aardvark (*Orycteropus afer*)	Orycteropidae	1	DR
Elephant (*Loxodonta africana africana*)	Elephantidae	2	D, OP
Leopard (*Panthera pardus*)	Felidae	1	OP
Camel (Camelus dromedaries)	Camelidae	1	DR

Buffalo and bushbuck are the most widely dispersed species, occurring in three of the vegetation types. Both species occur in cloud forest, dry forest and wetland. Dry forest has the highest species diversity with nine of the species recorded, while shrub-land vegetation type has the lowest diversity, with only cattle being encountered (Table 7).

Other wildlife species are only encountered in single specific vegetation types, where for instance, Aardvark, Grevy's zebra and Leopard only occur in the dry forest vegetation type, while Baboon, Grant's gazelle and Vervet monkey only occur in the cloud forest vegetation type (Table 8).

Table 8: Large **mammal encounter rates in the four vegetation types of MFE**

Species	Cloud forest	Dry forest	Shrub land	Wetland
Aardvark	0.0	100.0	0.0	0.0
Baboon	100.0,	0.0	0.0	0.0
Buffalo	27.3	50.0	0.0	22.7
Bush buck	25.0	66.7	0.0	8.3
Camel	100.0	0.0	0.0	0.0
Cattle	0.0	28.6	71.4	0.0
Dik dik	0.0	33.3	0.0	66.7
Duiker	66.7	33.3	0.0	0.0
Grant Gazelle	100.0	0.0	0.0	0.0
Grevy.zebra	0.0	100.0	0.0	0.0
Hyena	33.3	66.7	0.0	0.0
Vervet monkey	100.0	0.0	0.0	0.0
Leopard	0.0	100.0	0.0	0.0

The wildlife species found in large number then but now sustaining different levels of threats are as follows:-

Table 9: Wildlife Species and their status

Wildlife species	Habitat most found	Status report
Elephant	Marsabit forest and bush lands	Population drastically reduced by poaching
Rhinoceros	Mt. Marsabit and Kulal forests	Extinct in the county
Lion	Forests, woodland, bush/ shrub lands	Near extinctions
Leopards	Forest and ASAL's	Near extinction
Cheaters	ASALs	Near extinction
Buffalo	Marsabit National Park	Threatened
Oryx	Sibiloi and al ASAL areas	Threatened
Thomsone Gazelle	Plains and all ASALs	Threatened
Ostrich	Plains	Threatened
Spotted hyena	Plains and all ASALs	Population increasing
Gerenuk	Bush lands/shrub lands	Normal
Kudu	Marsabit National Park	Threatened
Giraffe	Plains and bush lands	Near extinct
Crocodile	Southern Island	Normal
Gravy zebra	Plains and bush lands	Threatened
Baboons	Forests and woodland	Thriving

Considering the status report above its important to clearly state that beside natural threats from draught and diseases, the wildlife population in Marsabit County is being decimated by poaching. In late 1990s the military regimes of Ethiopia and Somalia fell. These two events resulted in massive amount of weapons finding way into all districts bordering the frontiers. The pastoral population acquired the illicit guns for purposes of protecting livestock while other acquired to use for banditry and poaching. The pastoralists kill the big cats whenever their herd is attacked while the antelopes and gazelles are shot for the meat. The cases of elephant poaching have never relented given availability of markets in the Asian countries. The reduction of big cats also forced

scavengers like hyenas to move to urban centres to scavenge in dumpsites and are likely to threaten human population.

The forest also harbors different species of butterfly .

3.7.5.2.3 Small Mammals

A total of 20 species of small mammals from 13 families exist in Marsabit ecosystem comprising cloud forest, wetland within forest, dry forest and adjacent shrubland on the mountain. The 24 species are from 14 families representing five orders. Majority of these species are rodents (Order Rodentia) with 12 species, followed by Bats (Order Chiroptera) with seven species. Soricormorphs group (shrews and Hedgehogs) are represented by two species; White toothed shrew, *Crocidura* sp and Hedgehog, *Atelerix* same as small Carnivores groups which was represented by Blotched genet and White tailed mongoose.

Out of the 24 species of small and medium mammals recorded in Marsabit, none is ranked in any of the IUNC threat categories. Taxonomic identity of *Grammomys* (cf *ibeanus*) is not yet confirmed to be able to determine its conservation.

3.7.5.2.4 Birds

Marsabit forest ecosystem harbors a diverse range of habitats important for birds. The ecosystem is also a significant stop-over and dispersal area for palaearctic migrants .About 350 species of bird (including the rare Masked Lark) and 52 species of raptor (including eagles, buzzards and the rare Lammergeyer vulture) exist in Marsabit Forest. This latter information is stated repeatedly in records. (Full list is in Appendix 3).

According to recent transect walk in the forest concluded that atotal of one hundred and seventy two (171) species from 58 families were recorded of which, 23 species were waterbirds while the rest were land birds. Forty four (44) migratory species were recorded, thirty two (32) of these were long distance palaearctic migrants including Black Stork, Amur Falcon, Marsh Sandpiper, Common Cuckoo and Willow Warbler. Five (5) threatened species were recorded. Three of them, the Egyptian Vulture, Hooded Vulture and White-backed Vulture are Endangered. Thirty seven (37) species were forest dependent, out of which, nine (9) were forest specialists including; Black Cuckoo, Mountain Buzzard, Grey Cuckooshrike, Cabanis's Greenbul and Abyssinian Ground Thrush. A total of one hundred and two (102) birds comprising of twelve (12) species were ringed. A complete census of waterbirds in three major wetlands, Bongole Crater Lake, Lake Paradise and Elephant Pool yielded a total of nine hundred and forty three (943) waterbirds from twenty three (23) species. The Marsabit forest system

3.7.5.2.4 The forest as source of food for midlife and livestock

(a) Wildlife use of forest resources

There are no comprehensive counts of the number of wildlife in the district, except for selected years (Peden 1984; Grunblatt *et al.* 1996). The only available census data is for

elephant *(Loxodonta qfricana)* carried out using the dug-counts technique. Their population was estimated at 267 elephants (Litoroh *et al.* 1994). This means about two elephants per square kilometer for the Forest Reserve size and about one elephant for the National Reserve.277 Elephants' feeding habits follow dispersed patterns as they migrate between dry season grazing in the reserve and wet season grazing in the lowlands. While elephants have been noted to forage with a degree of selectivity, they are generally mixed feeders (Koch *et al.al.* 1995). Elephants either browse on tree leaves, fruits, barks of a variety of plants and branches during the dry season, or they graze on shrubs and grasses during the wet season for as much as 16 hours a day, exclusively on plant material. This suggests that the extent of elephant pressure on the habitat through their feeding habits and forage demands varies with the weather, especially with amounts and distribution of precipitation in the region.

Today, a large part of former wildlife dispersal areas on the mountain is not available anymore due to game being out-competed by livestock and displaced by human settlement. Thee National Reserve area stretching from Hula Hula, the Cereals Board Depot, Milima-tatu, Ollaa D'aaba, and Manyatta Jillo is on the North-eastern side of the mountain. Subsequently thiss region supports marginal vegetation growth and poor crop yields, even under average Rainfall conditions. The area extending further eastward around the mountain zone, the stretch from Manyatta Jillo, across Dirib and Sagante, Badassa and to Songa is densely settled and under cultivation. An area equivalent to about 60 per cent of the National Reserve29 and approximately 53 per cent of the mountain-protected areas is principally unavailable for wildlife dispersal all year round. The net effect is a reduced game dispersal area, partially closed dispersal routes and game confinement within the National Park and Forest Reserve for a good part of the year. This demonstrates heavy dependence of the game on forage and water resources within the forest reserve. The game also share reserve resources with human and livestock.

(b) Livestock use of forest resources

The human population and livestock estimates make clear that there is a growing demand for, and grazing pressure on, the forest resources. As Table shows, a relatively low share of the district's livestock population was on the mountain with averages off about 10 per cent for cattle, 4 per cent for small stocks and about 8 per cent for donkey populations.. On the whole and notwithstanding the short span of the data available to us, there is no systematic relationship between rainfall amounts and livestock population estimates on the mountain. That is, the changes in the number of livestock on the mountain are not significantly related to the amount of rainfall.36 This may point to other factors that could equally influence livestock population, herd mobility decisions and the spatial distribution of livestock on the mountain such as the spatial distribution of rangeland resources.. The livestock numbers on the mountain should be weighed against traditional, occasional and critical dry season grazing by the pastoral groups. Although, in formal terms, livestock grazing in the forest is strictly controlled, the livestock pressure is high considering the size of the current population on the mountain. This may also include opportunistic livestock use of forest for grazing around water sources in the reserve.

Table 10: Some livestock population estimates on the mountain, as a share (%) of the district

Year	Cattle	Camel	Small stock	Donkey	Absolute TLU*	Annual rainfall (Z-score)	
1977	8.5	1.0	6.7	17.5	11,985	846.3	(0.15)
1978	17.4	1.0	2.4	6.0	32,142	1,009.7	(0.67)
1981	8.7	1.6	13.8	4.6	5,968	1,139.8	(1.08)
1985	9.8	--	0.7	9.1	4,429	1,151.1	(1.11)
1987	15.4	0.7	0.9	5.0	15,050	687.0	(-0.35)
1990	9.4	1.6	0.7	0.5	18,010	877.3	(0.25)
1993	2.3	--	0.2	8.9	3,520	832.8	(0.11)
Mean	***10.21***	***1.18***	***3.63***	*7.37*	***13,014.86***	***934.86***	***(..)***

Note:

a. Double dash (--) means no data

b. * TLU measures are for estimates on the mountain only and the conversion ratios used are 1 cattle = 0.7 TLU; 1 camel = 1.2 TLU; 10 small stock = 0.1 TLU and 1 donkey = 1.4 TLU. Note in Chapter 8 we use 1 TLU for donkey after O'Leary (1985).

c. Rainfall standard deviations derived for the period 1969-1999, chosen to conform to about 30 years of climatological time-scale.

Source: Wargute (1994: 16).

3.7.5.2.5 The economics of protected areas

Among the several functions conferred on the mountain in general due to the implementation off protected areas, the forest in particular generates economic revenues for the government: firstly from charges imposed on the local communities for the harvest of forest products and secondly from entry fees charged in connection with the recreational use of the National Park.

The FD oversees the former set of charges and the KWS oversees the latter. Both of these revenue streams are considered in the sections below:-

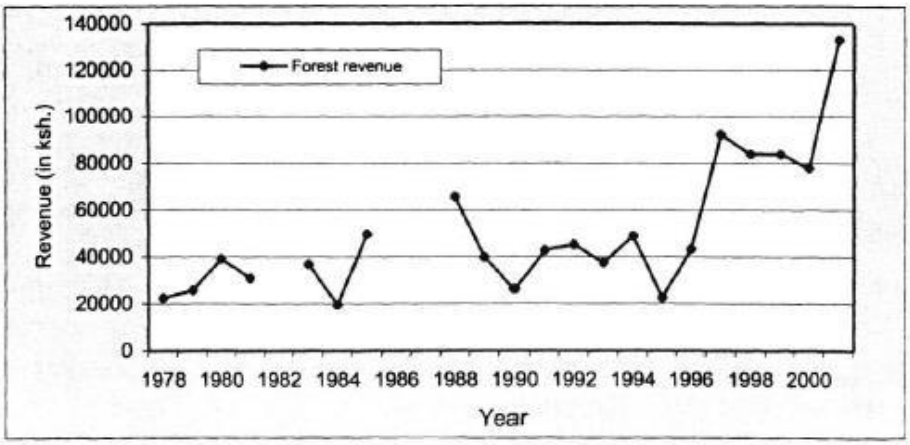
1. ***Revenues from the forest reserve***
   a. Tarriff

1. The Average tariff for timber and fuel wood materials from wayleave and fallen materials is Kshs 149,849/Ha.
2. The Average cost of tree harvesting s Khs 1,373.20/Ha.

Source:- Kenya Forest Service Annual Report 2010/2011 page19

b. Revenue Generated

Thee FD falls under the Ministry of Environment and Natural Resources (MENR for short). The department has mandates to maintain and enhance the vegetative cover as well as provision of tree cover in the densely populated areas, through rural a forestation schemes (MDARs,, various years). Exploitation of the forest reserve for timber was once issued to G.K. Prison,, and this utilization was banned in 1980 (MDAR 1981: 30). In descending order, the Revenues are mainly realized from the sale of firewood (both from monthly household fuel wood permit fee and from stacks41), compounding charges (penalties from illegal grazing of domestic animals in the reserve) and miscellaneous sources like the sale of seedlings (Figure 4).



Note: Discontinuity in trend indicate gap in data.
Sources: District Forest Office, Marsabit, 2000, and Marsabit District Annual reports.

Figure 5: Economic revenue proceeds of the forest

During the last decade the average forest revenue stood at about Ksh. 73,610 a year (or Ksh.. 6,134/month), which is equivalent to only an annual salary bill of a forest guard. The revenue earned by the department is remitted to the District Revenue Office, and from there forwarded to the Headquarters. These amounts of revenue generated from the forest are certainly insufficient to pay for the up keep and maintenance of the forest. In this end,, the forest cannot be regarded as an important source of economic revenue for government agencies, and not a main reason for its conservation.

2. Revenue earning from the Marsabit National Reserve/Park

a. Tarriff

KWS charges entry charges to the park as follows:-

Co-operate Pass	-	Kshs	120,000p.a.
Supply Vehicle	-	Kshs	120,000 p.a
Lorries	-	Kshs	35,000p.a.

People Staying in Camp

6 to 12 people	-	Kshs	1,200
3 to 4 people	-	Kshs	3,500

Entry Charges

Adult Kenyan and East Africans	-	Kshs	350
Adult Foreign Residents	-	Kshs	350

Security

2 Rangers minimum

Cost for each Ranger	-	Kshs 3,500
Total Cost for two Rangers	-	Kshs 7,000

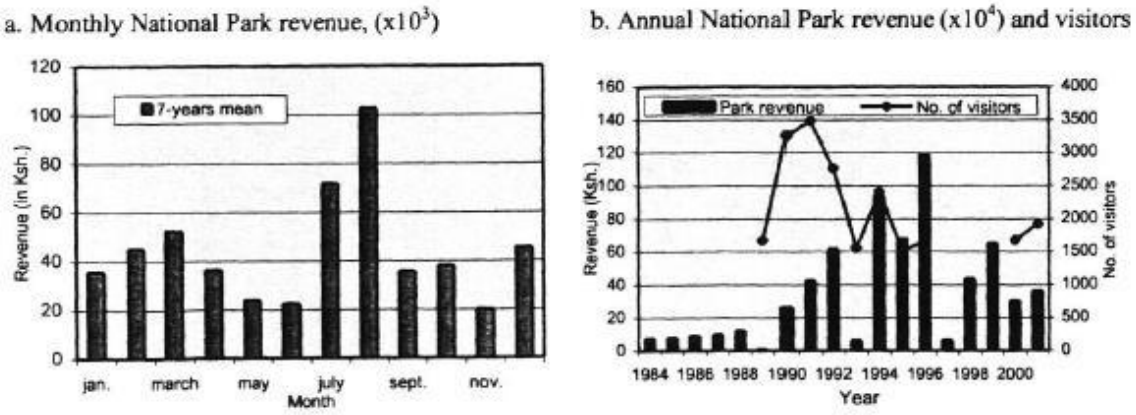
Lorries

1-3 Tonnes	-	Kshs 600
4-7 Tonnes	-	Kshs 2,500
Over 7 Tonnes	-	Kshs 3,500

b. Revenue Generated

Before its enactment as a parastatal body and an autonomous agency through an Act of Parliament in 1989, KWS existed as a Game Department under the Ministry of Environment and Natural resources (Emerton 1999). Prior to 1989 the revenues generated through the protected areas currently under KWS were remitted to the government exchequer, before being re-allocated again. The organization, to date, holds the parks and biodiversity rich areas inn trust for the central government, and is directly responsible for biodiversity conservation in Kenya.

One of the organization's approaches to achieve its conservation aims is through sustainable utilization of a variety of resources, and also it targets to reduce harmful environmental and social consequences of resource use. The organization's main sources of income are gate entrance entry fees to protected areas (park) and camping fees, from both resident and non-resident visitors (KWS, Marsabit office, 1999). Other sources of the revenue include those from Marsabit Wildlife Lodge, fuel (fallen dead wood collection) and bird shooting.. The revenue earned from collectors of fallen dead wood covers only for charges of vehicles for entry into the National Park, but not for the wood itself. Figure 9.3 illustrates aggregate monthly (Figure 9.3a) and annual revenues (Figure 9.3b) for KWS from Marsabit National Reserve (including the Park.



Source: Senior Warden's Office, Marsabit, 2000 and 2001.

Figure 6: Revenues from Marsabit National Reserve/Park

As Figure 5b shows, there are visible revenue increases of about 45 per cent in the period

1990-1992, and after a decrease in 1993 again in 1994 (75 per cent compared to the preceding year)) and 1996, and - again after a noticeable drop after 1996 - in 1998 and 1999, after which revenues seemed to stabilize at the level of the early 1990s. During the last decade, the agency realized an average revenue of nearly Ksh. 598,903 per annum (or a monthly mean revenue of about Ksh. 49,909) from the National Reserve (plus the park).

The total number of visitors dropped by one-fifth in 1992 and increased by about one-tenth in 1996, representing lower variability of the revenue. The increases in annual revenues, without necessarily corresponding increase in the number of visitors, were caused by changes inn the rate of entry fees (Biodiversity Officer, Marsabit 1997, pers. comrn.). The park received the largest number of visitors, ranging from 3,000 to 3,500 people, between 1990 and 1992. The monthly average revenue pooled for seven years, shows a high peak during July/August (mean:: Ksh. 87,229) and a low peak from December through to March (mean: Ksh. 44,499), which coincides with dry seasons in the area.

3.8 Climate

3.8.1 Rainfall

The annual Rainfall of Marsabit Town is estimated at 722.6mm which occurs in two rainy seasons. The long rains occur from March to May while the short rains occur from October to December. The rainfall is bimodal with a peak in April and November.

It should be noted that rainfall is usually poorly distributed in the Sub-County in any one given year.(Refer figure 7)

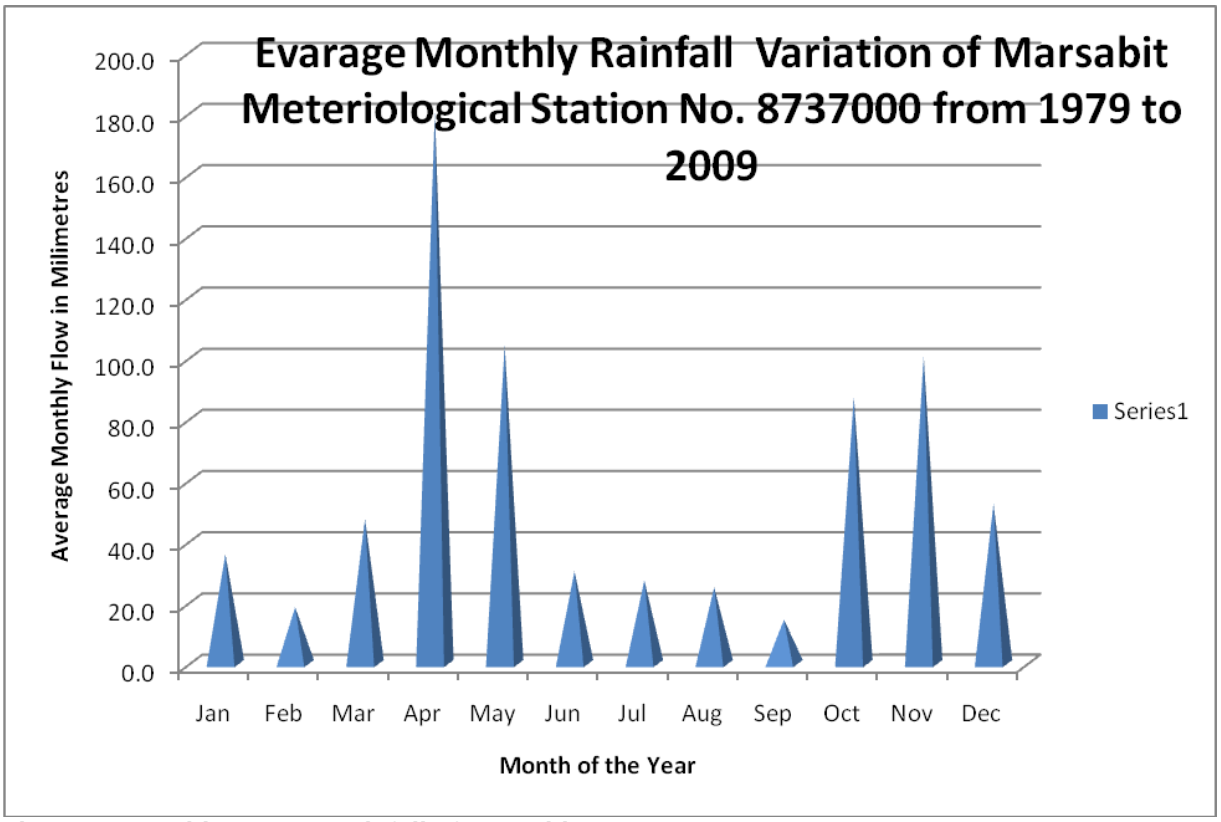


Figure 7: Monthly average rainfall of marsabit town

According to analysis undertaken during this study indicates that the Annual Rainfall is on the decline due to degradation and to a small extent climate change.

3.8.2 Temperature

Marsabit Town is located in Marsabit Mountain where the climate is generally cold with an average temperature of 24.7^{o}c. The coldest month is July with the daily maximum of 23.8^{0}c and minimum of 13.8^{0}c.The warmest month is February and March where the daily maximum temperature is estimated at 25.7^{0}c. The hot seasons fall between January and April when the temperatures can be as high as 23^{0}c. The cool season is between May and August when the temperatures are as low as 19^{o}c. From September to December, the district is fairly hot. After the cold spell between May and august, the temperatures starts rising from September and rising to over 20^{o}c in October. Seasonal variations of temperatures within the district may therefore be divided into three: Very hot, fairly hot and cool Seasons.

Monthly falling between January and April are very hot; those between May and August are relatively cool; and those between September and December are fairly hot.

3.8.3 Evaporation

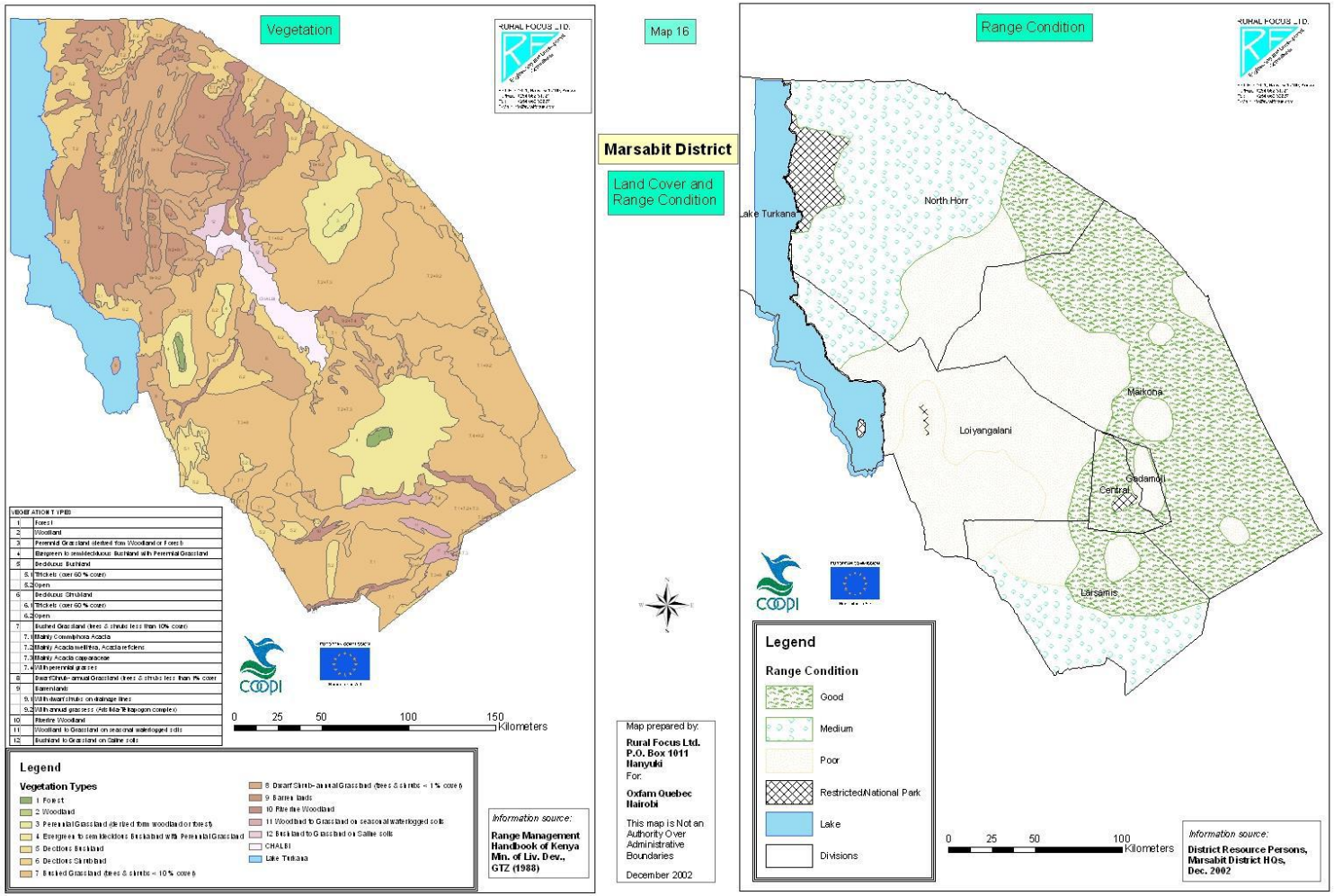
The annual Evaporation is estimated at 2421mm with a monthly average of 201mm.

3.9 Ecological Zones

The county can be categorized into 3 Agro-Ecological Zones. About 69% and 28% of the county is covered by Zone IV (Arid) and Zone V (Semi Arid) and can support livestock and wildlife, limited rain fed Agriculture and crop production is viable in regions covered by Zones IV and III (13%). Only 10% is considered cultivable making it a region of low agricultural potential.

Map 5 has the Ecological Zones while 6 has the Vegetation cover and range condition.

Map 5: Marsabit County Livelihood Zones



Map 6: Vegetation Cover and Range Condition

3.9.1 ECOLOGICAL ZONE II

Forest zones (sub-humid)

Characterized by high rainfall amounts of up to 1000mm per annum, low evapo-transpiration and high suitability for agricultural activities. The soils are well developed and fertile hence supporting agriculture. Includes parts of Mt. Marsabit above 1500m and Mt. Kulal above 1700m which supports dense evergreen forests. It's an important water catchment area.

Covering an area of just about one percent of the county, the sub-humid areas face the challenge of sustaining the increasing population that is settling down.

3.9.2 ECOLOGICAL ZONE IV

Woodland zone (semi-arid area)

Is semi-arid and has medium potential. The zone has become an area of sedentarized agro-pastoral activities. It constitutes the lower slopes of Mt Marsabit, the middle slopes of Mt Kulal and the top of Huri hills. Also included are areas of Sololo and Moyale.

3.9.3 ECOLOGICAL ZONE V

Bushland zone (arid),

It includes the lower slopes of volcanic and basement piles lying between 700 and 1000m. The soils are shallow and stony with rock outcrops as well as clay loams in places. The flatter areas are covered by grass. The zone consists of the plains of Dida Galgallo, Bure Dera, Milgis and parts of the slope of Mt Marsabit and Huri hills. These areas are characterized by steeper slopes which may favour greater surface runoff and hence may experience greater sheet wash erosion.

3.9.4 ECOLOGICAL ZONE VI

Dwarf scrubland zone (very arid)

It's an extensive zone in the whole county. The typical vegetation is dwarf-shrub grassland, or a very dry form of bushed grassland. In the very dry areas it may be properly termed "bushed stone land". It includes all the foot hills and plains below 700m. Grazing season in these areas is extremely short, lasting not more than two months after the rains. When the rains fall, the area cannot be used by cattle but only by goats and camels, if the dwarf shrubs are abundant.

3.10 Land Use

The County's land use is largely pastoral in the low lying arid and semi-arid zones (300 – 900m), and agricultural in the semi-humid mountainous zones. There are also forest reserves on the forest zones of Mt Marsabit and Mt Kulal, which apart from providing wood products, also act as habitat for wildlife. Wildlife conservancy is also gaining ground with a number of community conservancies planned for launch in the immediate future.

3.11 Important Sites in Marsabit Town

3.11.1 Ramsar Sites

There are two Ramsar Sites namely:-

- Lake Paradise and (Plate 11)
- Sokorte Elephant Pool (Plate 12)

Plate 11: Lake Paradise now

Plate 12: Sokorte-Elephant Pool

3.11.2 Cultural Sites

There are two Cultural Sites for Boranas namely:-

1. Kubi Gadamoji and
2. Kubi Dibayu

Sacrifices, meetings and ceremonies are held here.

3.11.3 Archeological Site

Illeret is the only archeological site in Marsabit County.

3.12 Population Projection

3.12.1 Growth Rate

Between 1979 to 2009, the Population of Marsabit town increased highest in 1979 to 1989 census by recording a growth rate of 2.4%p.a. and least in 1989 to 1999 census by recording a growth rate of 0.76%p.a.

3.12.3 Human Population

The population of Marsabit town is currently estimated at 20,273 people during wet seasons and 22,300 people during drought. The population is expected to increase at 2.43%p.a to 22859, 29062 and 36948 by the years 2017, 2027 and 2037 respectively.

3.13 Water Demand and Sewerage Generation Projection

3.13.1 Water Demand Projection

The summary total Water Demand is given in Table 11.

Table 11: Summary of projected water demand in m^3/day

Summary of Projected Total Water Demand in m^3/day						
Location	**Sub location**	**Current 2012**	**Initial 2017**	**Future 2027**	**Vision 2030**	**Ultimate 2037**
	Nyayo Road	398	448	570	612	724
	Majengo	966	1,089	1,384	1,488	1,760
Nagayo		**1,363**	**1,537**	**1,954**	**2,100**	**2,484**
	Mataarba	191	216	274	295	349
	Dakabaricha	548	618	786	845	1,000
Dakabaricha		**740**	**834**	**1,061**	**1,140**	**1,348**
	Township	993	1,170	1,456	1,552	1,836
	Wabera	700	789	1,003	1,078	1,276
Mountain		**1,693**	**1,959**	**2,459**	**2,630**	**3,112**
Marsabit Town		**3,795**	**4,330**	**5,474**	**5,870**	**6,944**

3.13.2 Sewage Generation Situation

The projected sewerage generation is as per table 12.

Table 12: Summary of Projected Sewage Generated in m^3/day

Summary of Projected Sewage Generated in m^3/day							
Location	**Sub location**	**Correlation factor/(%)**	**Current 2012**	**Initial 2017**	**Future 2027**	**Vision 2030**	**Ultimate 2037**
	Nyayo Road	0.8	318	359	456	490	580
	Majengo	0.8	772	871	1,107	1,190	1,408
Nagayo		0.8	**1,090**	**1,230**	**1,563**	**1,680**	**1,987**
	Mataarba	0.8	153	173	219	236	279
	Dakabaricha	0.8	439	495	629	676	800
Dakabaricha		0.8	**592**	**667**	**848**	**912**	**1,079**
	Township	0.8	794	936	1,165	1,242	1,469
	Wabera	0.8	560	631	803	863	1,021
Mountain		**0.80**	**1,354**	**1,567**	**1,968**	**2,104**	**2,489**
Marsabit Town		**0.80**	**3,036**	**3,464**	**4,379**	**4,696**	**5,556**

3.14 Disease Prevalence

3.14.1 Prevalence

The following is the order of the top 10 diseases prevalent in Marsabit Town in order of decreasing morbility:-

01. Diarrhoes
02. Lymonea
03. Urinal Track Infection
04. Accidents
05. Eye Infection
06. Ear Infection
07. Dental Disorder
08. Skin Diseases
09. Rhematism and joints and
10. Typhoid

3.14.2 Waterborne diseases

Due to lack of water, water borne diseases are prevalent. They account for 3 of the top 10 diseases in Marsabit Town and in total costed Kshs 9,122,280 in the first six month of 2015 to treat (Refer table 13)

Table 13: Water Borne Diseases Prevalence in Marsabit Town

Disease	Morbidity of Diseases				Cost of Treatment Per Person (Kshs)	Total Cost (Kshs)
	2013	**2014**	**2015**			
Diarrhea	3,181	20,953	15,630		380	5,939,400
Dysentry	819	942	630		380	239,400
Clinical Malaria	5,302	6,435	3,712		350	1,299,200
Confimed Malaria	1,585	1,833	1,078		350	377,300
Typhoid Fever	141	341	132		440	58,080
Disease of Skin	4,214	5,333	3,454		350	1,208,900
Cholera	0	0	0		1,500	0
Total	**15,242**	**35,837**	**24,636**			**9,122,280**
Note	**The above are the six months values for each year**					
Source:	CEO, Marsabit County Referal Hospital , August, 2015					

3.15 Existing Physical Development Plan of Marsabit Town

Marsabit Town does not have an upto date Physical Development Plan (PDP) to guide the Development.

However, it relies on Physical Development Plan developed in 1969 with continuous development of Part development Plans to guide the land use as per the 1969 PDP.

3.15.1 1969 PDP

This PDP No. 276/69/1 was approved on 27th February, 1969 and covered about 3.6km^2 (Length 2.4km and width 1.5km).

A look at current Developments and a perusal of the PDP reveals that this PDP provided the Framework of Land use in Marsabit Town and has been followed almost 80-90%. The only deviation is the Industrial area which has been converted to residential.

A close look at current administrative units as per 2009 census reveals that the 1969 PDP covers Mountain Location consisting of Township and Wabera Sub-locations, Nyayo road of Nagayo Location and a small part of Majengo and Dakabaricha Sub locations.

Map 7 below has the 1969 PDP.

3.15.2 Marsabit Part Development Plan No 74-Wabera Settlement dated 9th

This Part Development Plan was made to legalise Wabera Settlement. It expanded on size of land per each plot and covered the area below road to Sagante on left and Saku Primary School on the right.
This area was classified as a future high residential density area -0_9 as per the 1969 PDP.
It covered an area of 0.21km^2 of existing area of Wabera Sub-location of total area of 0.9km^2.(Refer Map 9 below)

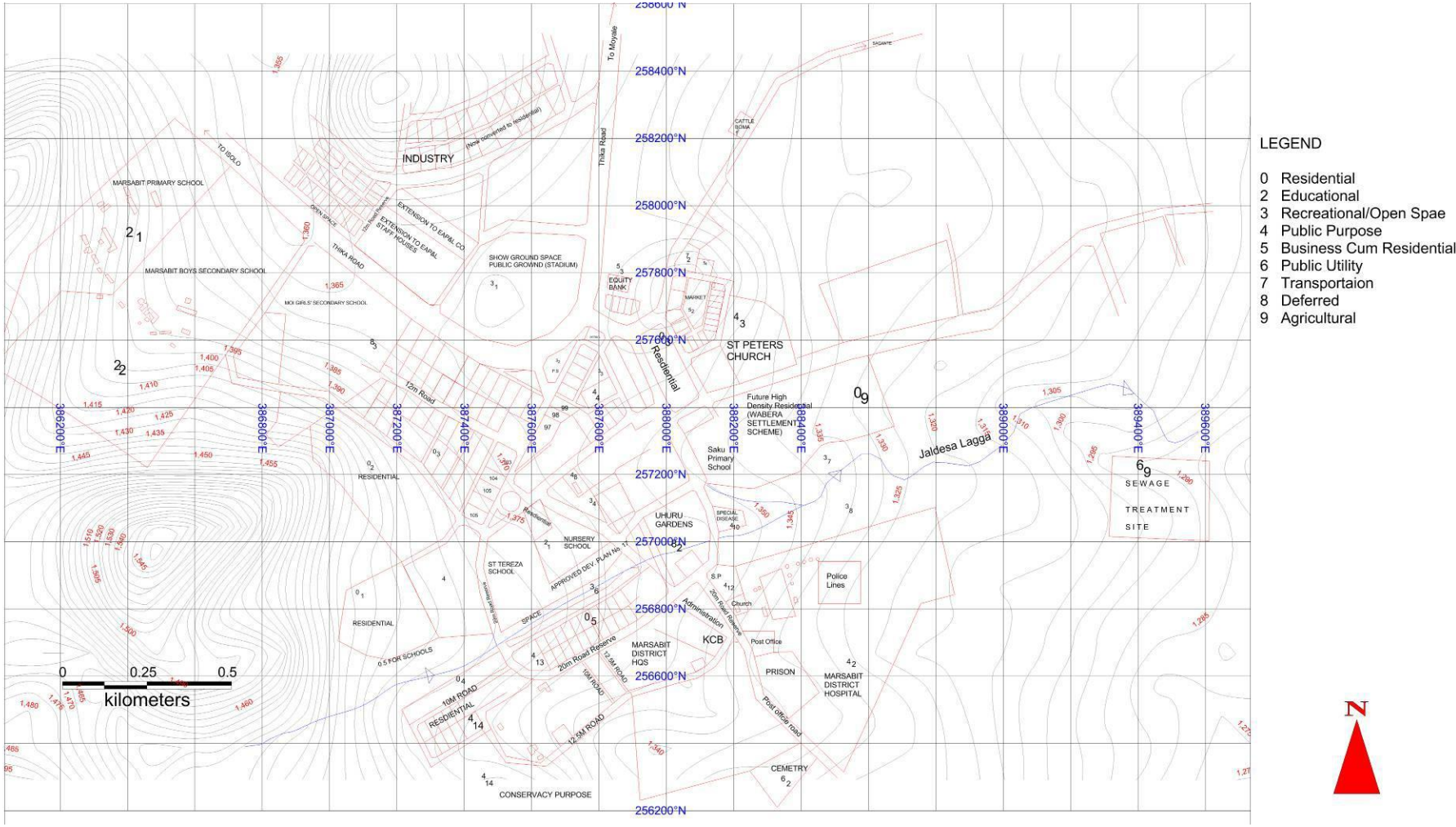
3.15.3 Marsabit Part Development plan no. 276/99/7

This Part Development plan no. 276/99/7 was made on 15th March, 1999 and was aimed at defining the land use to the left side of Saku Primary School in the Township Sub location.
It covered an area of 0.84km^2 of the existing area of 1.3km^2 of township sub location (Refer Map 8).

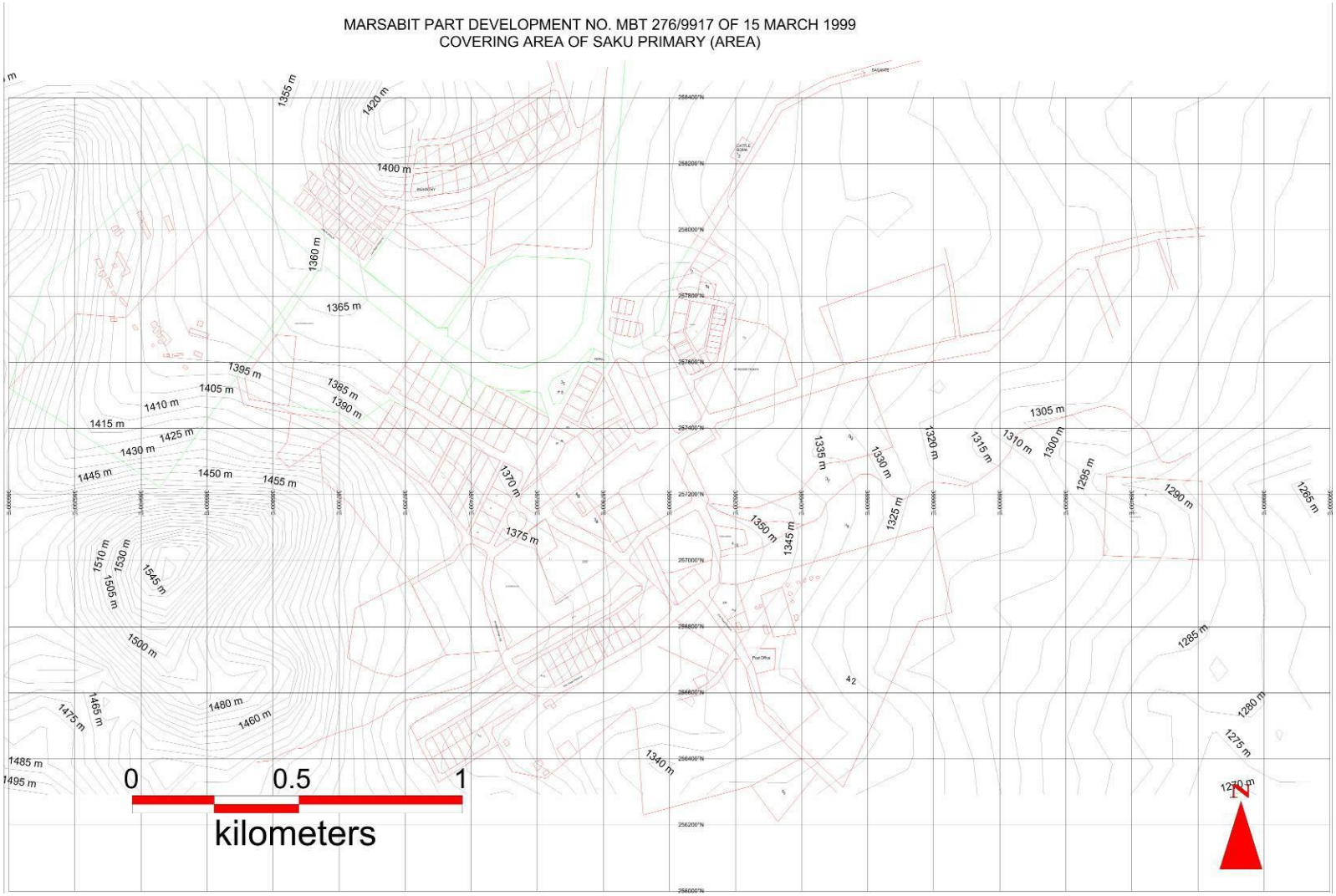
3.15.4 Marsabit Part Development No. 276/91/12

This Part Development Plan was made on 7th October, 1991 for Public Works area and expanded on the Land Use. It covered an area of 0.45km^2(750m by 600m). It also clearly **indicated the location of Sewage Works.**

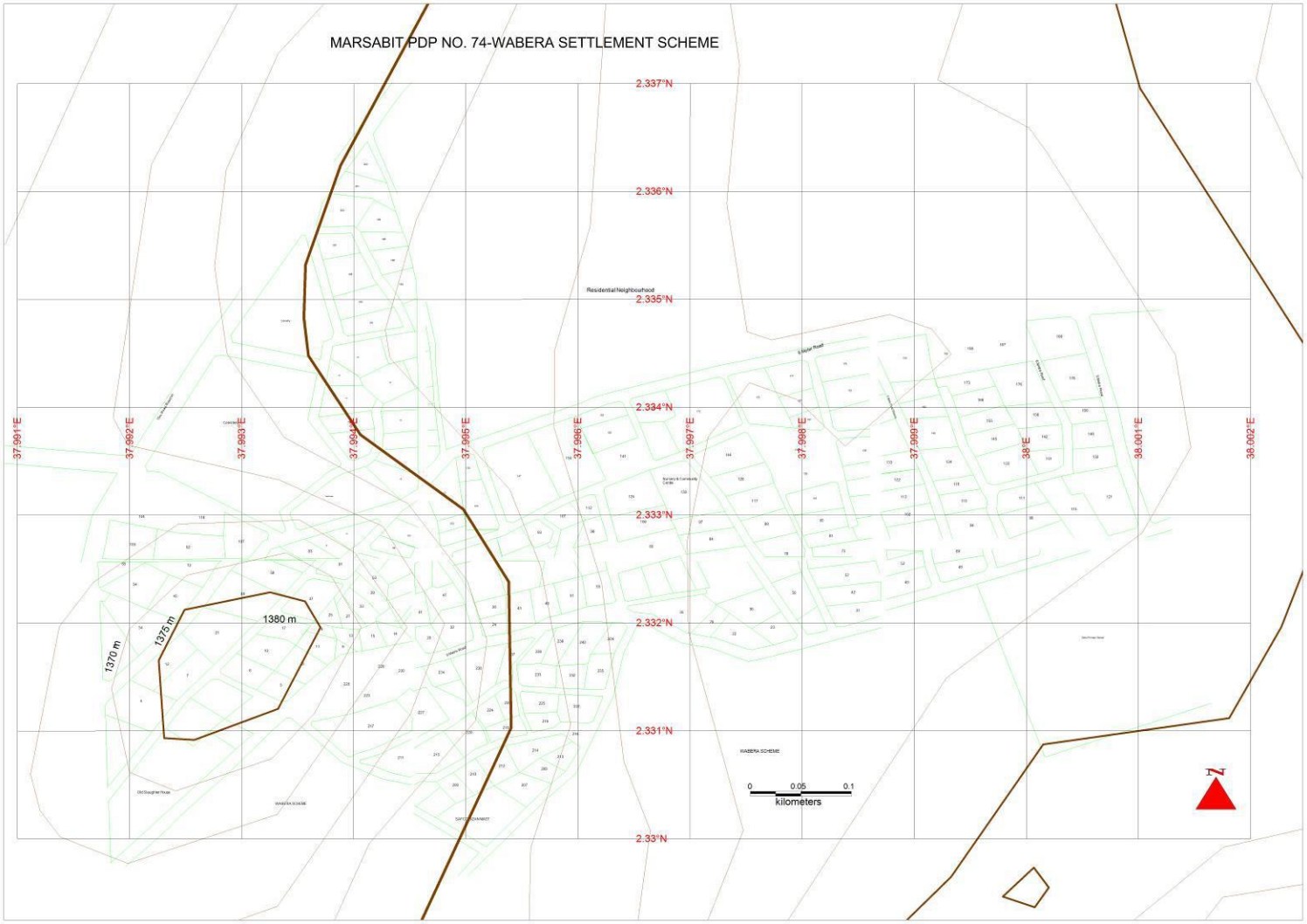
Map 10 has the details.



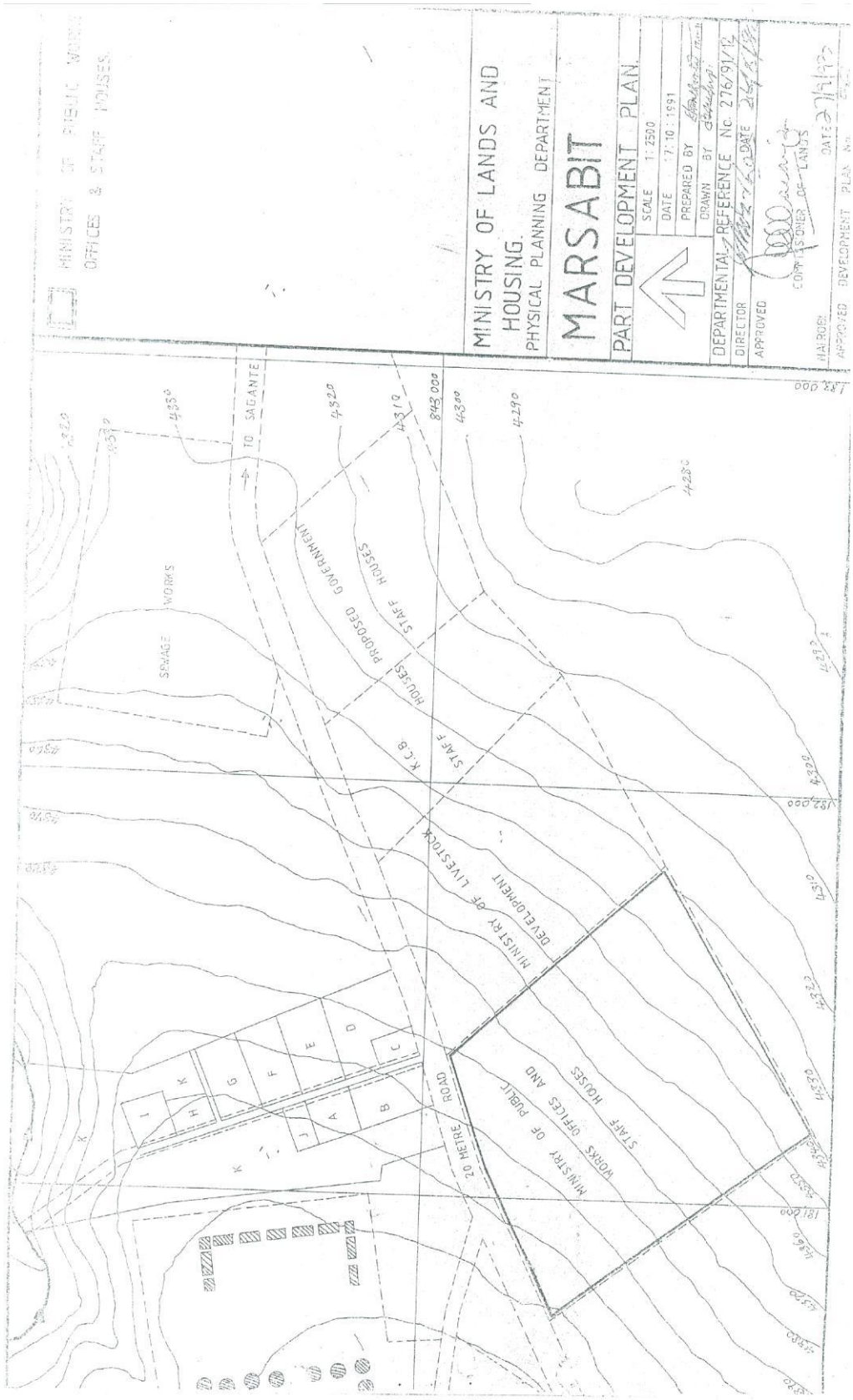
Map 7:- 1969 Physical Development Plan of Marsabit Town



Map 8:- Marsabit Part Development No. MBT 276/9917 of 15th March, 1999 Covering Area of Saku Primary



Map 9:-1969 Part Physical Development Plan No. 74 - Wabera Settlement



Map 10: 1969 Part Physical Development Plan No. 276/991/12 - Public Works Area

CHAPTER FOUR

4.0 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

4.1 International Conventions and Treaties

Kenya is a party to sixteen International Environmental Treaties. These are:-

01. **Convention on Biological Diversity (CBD)**
02. **African Convention on the Conservation of Nature and Natural Resources**
03. Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region (Nairobi Convention)
04. Viena Convention for the protection of the Ozone Layer
05. Montreal Protocol and (London Amendment) on substances that deplete the Ozone Layer
06. **Comvention on Wetlands of International Importance Especially as as Waterfowl Habitat (Ramsar Convention**)
07. **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)**
08. **Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention or CMS)**
09. Convention of the Prevention of Marine Pollution by Dumping of Wastes and other matter (as amended)
10. International Convention for the Prevention of Pollution from Ships
11. United Nations Convention on the Law of the Sea (UNICLOS)
12. **Lusaka Agreement on Cooperative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora (Lusaka Agreement)**
13. **United Nations Convention to Combat Desertification in those countries Experiencing serious Drought and/or Desertification, particularly in Africa**
14. **Convention concerning the Protection of the Wolrd Cultural and Natural Heritage**
15. Convention for the Establishment of the Lake Victoria Fisheries Organization and
16. **United Nations Framework Convention on Climate Chenge**

The applicable International Conventions and Treaties include:

- The Ramsar Convention on wetland of International Importance of 1971.This convention is important as the construction of dams and sewerage plants deals with wetlands.
- The convention on Biological Diversity of 1999 is important because the water and sanitation project will impact on flora and fauna. The project implementation should take into account the uniqueness of the various ecological zones, while avoiding the environmentally sensitive areas.

- United Nations Framework Convention on Climate Chenge since damming will have to be replenished from runoff dependent on climate change

- United Nations Convention to Combat Desertification in those countries Experiencing serious Drought and/or Desertification, particularly in Africa due to its locality and

- Marsabit Forest Reserve is both a Gazetted Forest and Wildlife Sanctuary which is rich in Biological Diversity. Further, part of the project is going to be located in Marsabit Forest.

  In view of the above, this will trigger the following International Conventions:-

  a. **African Convention on the Conservation of Nature and Natural Resources**

  b. **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)**

  c. **Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention or CMS)**

  d. **Lusaka Agreement on Cooperative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora (Lusaka Agreement)**

  e. **Convention concerning the Protection of the Wolrd Cultural and Natural Heritage and**

  f. **United Nations Framework Convention on Climate Chenge**

4.1.1 The Ramsar Convention

The Convention on Wetlands of International Importance especially as Waterfowl Habitat. Sometimes known as the Ramsar Convention from its place of adaption in 1971 in Iran, is an Intergovernmental treaty which provides the framework for international cooperation for the conservation of wetland habitats.

Because wetlands are very important for ecological processes as well as for their rich flora and fauna, the broad objectives of the convention are to stem the loss of wetlands and to ensure their conservation. To meet these objectives, the convention places general

obligations on contracting parties relating to the conservation of wetlans throughout their territory and special obligations pertaining to those wetlands which have been designated in a list of wetlands of International Importance.

The Convention entered into force in late 1975 following the accession of the seventh party, Greece. It now has contracting parties from all regions throughout the world.

4.1.2 The Convention on Biological Diversity of 1999

1. Biodiversity refers to the infinite variety of life forms; genetic diversity – variation of genes within individual species, species diversity – variety of species in flora and fauna, and ecosystem diversity – variety of ecosystems, such as rainforests, coral reefs and deserts, that exist on our planet. This biological diversity is the *sine qua non* for the resilience of ecosystems and life forms and their ability to prevent and to recover from disasters and adverse conditions. Activities of microbial and animal species lead to soil creation, the maintenance of its quality and detoxification and decomposition of wastes. Appropriate plant cover can prevent catastrophic inundations, landslides and avalanches, mitigates soil erosion, and contributes to air and water quality, as well as to climate stabilization. The maintenance of species diversity facilitates natural pest control, pollination, crop production and food security. Furthermore, biological diversity plays an important role in the spiritual and cultural life of human societies.

2. The Convention on Biological Diversity is probably the most all-encompassing international agreement ever adopted. It seeks to conserve the diversity of life on Earth at all levels - genetic, population, species, habitat, and ecosystem - and to ensure that this diversity continues to maintain the life support systems of the biosphere overall. It recognizes that setting social and economic goals for the use of biological resources and the benefits derived from genetic resources is central to the process of sustainable development, and that this in turn will support conservation.
3. The Convention on Biological Diversity was negotiated under the auspices of the United Nations Environment Programme (UNEP). It was opened for signature at the June 1992 UN Conference on Environment and Development (UNCED) and entered into force on 29 December 1993, ninety days after the 30th ratification. As of October 1998, more than 170 countries including Kenya had become Parties . The three goals of the CBD are to promote the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising out of the utilization of genetic resources. The CBD Secretariat is located in Montréal, Canada.

   The Subsidiary Body on Scientific, Technical and Technological Advice(SBSTTA), which advises the Conference of the Parties (COP), meets several months prior to each COP. Negotiations on the first protocol to the Convention, conducted by the *Ad Hoc*Working Group on Biosafety (BSWG), concluded in January 2000.

4. The *Earth Negotiations Bulletin* has covered each COP, SBSTTA and BSWG session plus two sessions prior to the CBD's entry into force and an intersessional workshop. *ENB* coverage of biodiversity issues also includes several sessions of the Commission on Plant Genetic Resources for Food and Agriculture, which meets under FAO auspices (see the *ENB* CBD Archives for all biodiversity coverage; see also the Linkages Homepage on Genetic Resources). The following discussion focuses on decisions taken by the CBD COP, SBSTTA and the BSWG.

4.1.3 African Convention on the Conservation of Nature and Natural Resources

The **African Convention on the Conservation of Nature and Natural Resources** is a continent-wide agreement signed in 1968 in Algiers. It supersedes the Convention Relative to the Preservation of Fauna and Flora in their Natural State of 1933 and has been superseded by the African Convention on Conservation of Nature and Natural Resources (revised) signed in Maputo in 2003.There are 42 Countries which have signed the convention while 30 have ratified.

The Contracting States undertake to adopt the measures necessary to ensure the conservation, utilisation and development of soil, water, floral and faunal resources in accordance with scientific principles and with due regard to the best interests of the people (art. II). They agree to take effective measures to conserve and improve the soil and to control erosion and land use (art. IV). Furthermore, they are to establish policies to conserve, utilise and develop water resources, prevent pollution and control water use (art. V). Parties also undertake to protect flora and ensure its best utilization, the management of forests and control of burning, land clearance and overgrazing (art. VI). They are to conserve faunal resources and use them wisely, manage populations and habitats, control hunting, capture and fishing, and prohibit the use of poisons, explosives and automatic weapons in hunting (art. VII). Protected species in list A enjoy full total protection, while those in list B may be taken only with authorization (art. VIII). Traffic in trophies is to be tightly controlled, to prevent trade in illegally killed and obtained trophies (art. IX). Conservation areas are to be established and maintained (art. X), while customary rights are to be reconciled with the Convention (art. XI). Conservation education is to be undertaken at all levels (art. XIII) and conservation and ecological factors are to be considered in development plans (art. XIV). Parties undertake to cooperate wherever necessary in implementing the Convention (art. XVI). The Organization of African Unity (now the African Union) is to carry out the function of Secretariat to the Convention. Regular meetings of the parties are not provided for.

4.1.4 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that

international trade in specimens of wild animals and plants does not threaten their survival.

Widespread information nowadays about the endangered status of many prominent species, such as the tiger and elephants, might make the need for such a convention seem obvious. But at the time when the ideas for CITES were first formed, in the 1960s, international discussion of the regulation of wildlife trade for conservation purposes was something relatively new. With hindsight, the need for CITES is clear. Annually, international wildlife trade is estimated to be worth billions of dollars and to include hundreds of millions of plant and animal specimens. The trade is diverse, ranging from live animals and plants to a vast array of wildlife products derived from them, including food products, exotic leather goods, wooden musical instruments, timber, tourist curios and medicines. Levels of exploitation of some animal and plant species are high and the trade in them, together with other factors, such as habitat loss, is capable of heavily depleting their populations and even bringing some species close to extinction. Many wildlife species in trade are not endangered, but the existence of an agreement to ensure the sustainability of the trade is important in order to safeguard these resources for the future.

Because the trade in wild animals and plants crosses borders between countries, the effort to regulate it requires international cooperation to safeguard certain species from over-exploitation. CITES was conceived in the spirit of such cooperation. Today, it accords varying degrees of protection to more than 35,000 species of animals and plants, whether they are traded as live specimens, fur coats or dried herbs.

CITES was drafted as a result of a resolution adopted in 1963 at a meeting of members of IUCN (The World Conservation Union). The text of the Convention was finally agreed at a meeting of representatives of 80 countries in Washington, D.C., the United States of America, on 3 March 1973, and on 1 July 1975 CITES entered in force. The original of the Convention was deposited with the Depositary Government in the Chinese, English, French, Russian and Spanish languages, each version being equally authentic.

CITES is an international agreement to which States (countries) adhere voluntarily. States that have agreed to be bound by the Convention ('joined' CITES) are known as Parties. Although CITES is legally binding on the Parties – in other words they have to implement the Convention – it does not take the place of national laws. Rather it provides a framework to be respected by each Party, which has to adopt its own domestic legislation to ensure that CITES is implemented at the national level.

For many years CITES has been among the conservation agreements with the largest membership, with now 181 Parties.

4.1.5 Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention or CMS)

1. The **Convention on the Conservation of Migratory Species of Wild Animals** - more commonly abbreviated to just the Convention on Migratory Species (CMS) or the **Bonn Convention**-aims to conserve terrestrial, marine and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale. Since the Convention's entry into force, its membership has grown steadily to include over 100 Parties from Africa, Central and South America, Asia, Europe and Oceania. The Convention was signed in 1979 in Bad Godesberg, a suburb of Bonn(hence the name), and entered into force in 1983. The depositary is the government of the Federal Republic of Germany. The CMS is the only global and UN-based intergovernmental organization established exclusively for the conservation and management of terrestrial, aquatic and avian migratory species throughout their range. CMS and its daughter agreements determine policy and provide further guidance on specific issues through their Strategic Plans, Action Plans, resolutions, decisions and guidelines. All maintain on their websites a list of all decisions taken, guidelines issues and Action Plans adopted by the Member States.
2. Fundamental Principles of the Convention are set out in Article 2. The Parties acknowledge the importance of migratory species being conserved and of Range States agreeing to take action to this end "whenever possible and appropriate", "paying special attention to migratory species the conservation status of which is unfavourable and taking individually or in cooperation appropriate and necessary steps to conserve such species and their habitat." Further in Article 2(2) The Parties "acknowledge" [but do not commit in stronger language, cf Art 2(3) "shall"] "the need to take action to avoid any migratory species becoming endangered".
3. In Article 2(3) the Convention states that "the Parties: (a) should promote, cooperate in and support research relating to migratory species; (b) shall endeavour to provide immediate protection for migratory species included in Appendix I; and (c) shall endeavour to conclude AGREEMENTS covering the conservation and management of migratory species included in Appendix II."
4. The Parties acknowledge the importance of conserving migratory species and agree that Range States – those countries through which migratory species pass or

spend part of their lives - should take joint action. At August 2015, there were 121 Parties to the Convention.

5. The CMS Family covers a great diversity of migratory species. The Appendices of CMS include many mammals, including land mammals, marine mammals and bats; birds; fish; reptiles and one insect. Among the instruments, AEWA covers 255 species of birds that are ecologically dependent on wetlands for at least part of their annual cycle. EUROBATScovers 52 species of bat, the Sharks MOU seven species of shark, the IOSEA Marine Turtle MOU six species of marine turtle and the Raptors MoU 76 species of birds of prey.

6. Migratory species threatened with extinction are listed on Appendix I of the Convention, with relevant provisions outlined in Article III, paragraphs 4 and 5. Parties that are Range States to Appendix I species are obliged to afford them strict protection. CMS Parties strive towards strictly protecting these animals, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them. Besides establishing obligations for each State joining the Convention, CMS promotes concerted action among the Range States of many of these species.

7. Migratory species that need or would significantly benefit from international co-operation are listed in Appendix II of the Convention. These species, either individually or by taxonomic group, are the basis for establishing instruments – regional or global – under CMS.For this reason, the Convention encourages the Range States to conclude global or regional Agreements.

In this respect, CMS acts as a framework Convention. The Agreements may range from legally binding treaties (called Agreements) to less formal instruments, such as Memoranda of Understanding, and can be adapted to the requirements of particular regions. The development of models tailored according to the conservation needs throughout the migratory range is a unique capacity to CMS.

Several Agreements have been concluded to date under the auspices of CMS. They aim to conserve:

- Populations of European Bats (EUROBATS)
- Cetaceans of the Mediterranean Sea, Black Sea and Contiguous Atlantic Area (ACCOBAMS)
- Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS)
- Seals in the Wadden Sea (Wadden Sea Agreement)
- African-Eurasian Migratory Waterbirds (AEWA)
- Albatrosses and Petrels (ACAP)
- Gorillas and Their Habitats (Gorilla Agreement)

In addition, several Memoranda of Understanding (MoU) have been concluded to date under the auspices of CMS. They aim to conserve:

- High Andean Flamingos MoU
- Aquatic Warbler MoU
- Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia (Raptors MoU)
- Bukhara Deer MoU
- Dugong MoU
- South Andean Huemul MoU
- Marine Turtles of the Indian Ocean and South-East Asia (IOSEA)
- Mediterranean Monk Seal MoU
- Middle-European Population of the Great Bustard MoU
- Pacific Islands Cetaceans MoU
- Ruddy-headed Goose MoU
- Saiga Antelope MoU
- Migratory Sharks MoU
- Siberian Crane MoU
- Slender-billed Curlew MoU
- Grassland Birds MoU
- Western African Aquatic Mammals MoU (Small Cetaceans and Manatees)
- West-African Populations of the African Elephant
- Marine Turtles of the Atlantic Coast of Africa MoU

4.1.6 Lusaka Agreement on Cooperative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora (Lusaka Agreement)

The Lusaka Agreement on Co-operative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora was the brain-child of Wildlife Law Enforcement Officers from eight Eastern and Southern African countries meeting in Lusaka, Zambia in December 1992, under the auspices of Zambia's Ministry of Tourism.

This was followed up with working group meetings involving CITES, Interpol and US Fish & Wildlife Service special agents, as well as London University lawyers of the Foundation for International Environment Law Development (FIELD). The development of this African initiative a year later led to formal inter-governmental negotiations under the auspices of the United Nations Environment Programme (UNEP). This led to the adoption of the Lusaka Agreement on Co-operative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora on 8th September 1994 in Lusaka, Zambia. The

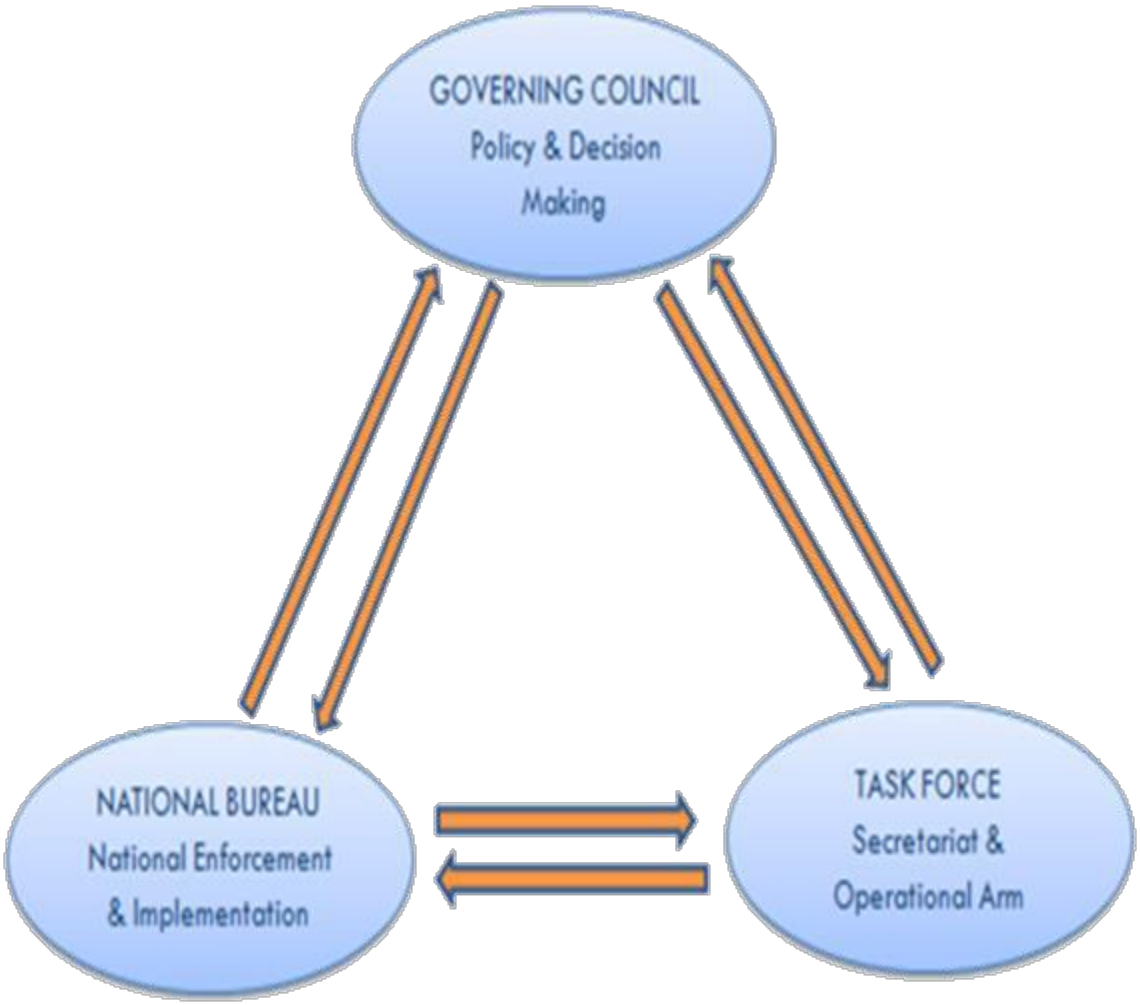
Agreement is deposited with the Secretary General of the United Nations, New York and categorized as a UN Treaty (Environment) no. XXVII.11.

Co-operative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora on 8th September 1994, with UN Secretary General, New York the Depositary.

The Agreement came into force on 10th December 1996 with the ratification, or formal acceptance, by four signatories. Currently, there are Seven Parties to the Agreement: The Republics of Congo (Brazzaville), Kenya, Liberia, Tanzania, Uganda, Zambia and the Kingdom of Lesotho. Republics of South Africa, Ethiopia and the Kingdom of Swaziland are signatories.

The Agreement provides for setting up of a permanent Task Force that would implement its objectives. Consequently, the Lusaka Agreement Task Force (Task Force) was launched on 1st June 1999, with its headquarters located in Nairobi, Kenya.

The Lusaka Agreement establishes a three-tier institutional mechanism:



Governing Council

A Policy and decision making organ comprising a Minister or alternate from each Party State that oversees the Task Force operations.

Task Force

A permanent law enforcement institution established to facilitate co-operative activities among the National Bureaus in carrying out investigations pertaining to illegal trade in wild fauna and flora. It comprises seconded law enforcement officers from Party States and locally recruited support staff.

National Bureau

An established or designated governmental entity to co-ordinate with the Task Force on investigation and co-operative activities pertaining to illegal trade in wild fauna and flora. The National Bureaus to the Agreement are the Bureau National de l'Accord de Lusaka (BNAL, Congo), Kenya Wildlife Service (KWS), Tanzania Wildlife Division (TWD), Uganda Wildlife Authority (UWA) and Zambia Wildlife Authority (ZAWA). The Kingdom of Lesotho have yet to designate a National Bureau but in the meantime the National Environment Secretariat is handling matters pertaining to the Agreement.

4.1.7 United Nations Convention to Combat Desertification in those countries experiencing serious Drought and/or Desertification, particularly in Africa

By resolution 49/239 of 23 December 1994, the General Assembly welcomed the adoption of the United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, by the Intergovernmental Negotiating Committee, and welcomed also the signing of the Convention in Paris on 14 and 15 October 1994 by a large number of States and one regional economic integration organization. The Convention entered into force on 26 December 1996, in accordance with its article 36, paragraph 1.

Desertification was identified as one of the greatest challenges to sustainable development during the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992, and a request was made for the General Assembly to establish an "Intergovernmental Negotiating Committee for the elaboration of an international convention to combat desertification in those countries experiencing serious drought and/or desertification, particularly in Africa". The Intergovernmental Negotiating Committee was established by the General Assembly by resolution 47/188 of 22 December 1992. The Intergovernmental Negotiating Committee held five sessions in 1994 and the final draft text of the United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, was adopted on 17 June 1994.

The Convention contains forty articles, divided into six parts: Part I (introduction); Part II (general provisions); Part III (action programmes, scientific and technical cooperation and supporting measures); Part IV (institutions); Part V (procedures); and Part VI (final

provisions). There are five regional implementation annexes to the Convention regarding Africa; Asia; Latin America and the Caribbean; the Northern Mediterranean; and Central and Eastern Europe.

The Convention opens an important new phase in the battle against desertification, but it is just a beginning. In particular, governments are regularly reviewing the action programmes. They also focus on awarenessraising, education and training, in both developing and developed countries.

Desertification can be reversed only if farreaching changes are made in local and international behavior. Step by step, these changes will ultimately lead to sustainable land use and food security for a growing world population. Combating desertification, then, is really just part of a much broader objective: the sustainable development of countries affected by drought and desertification.

4.1.8 Convention concerning the Protection of the Wolrd Cultural and Natural Heritage

The World Heritage Convention, whose full title is "The Conve*,tion Concerning the Protection of the World Cultural and Natural Heritage," was adopted by UNESCO in 1972. The Convention today has 131 countries that are party to it. Through this instrument nations of the world have agreed to inverltory, recognize and protect unique and irreplaceable properties of univers al value. For the first time, the Convention provides a permanent framework -- administrative and financial --for international cooperation in safegua f ding gaI, mankind's cultural and natural heritage, and introduces the specific notion of a "world heritage" whose importance transcends alI political and geogr phic boundaries.

The Convention is the bedrock document of World Heritage Sites, and sq this first chapter is devoted to an examination of it and how it works.

The site administrator mayor may not have a role in the proce~s of nominating a site to the World Heritage List. Nevertheless, it is important that the site manager have a basic knowledge of the legal relationship of national, state (provincial) and local governments to the World Heritage Convention. These legal relationships to a large extent govern how a particular level of governmen~ can influence or control tourism at World Heritage sites.

The full text of the Convention can be found in Appendix A.

The World Heritage Lists

On signing the Convention, each country pledges to conserve the cultural and natural sites within its borders that are recognized by the Convention as being of exceptional and univers al value. In return, the international community helps to protect the se treasures. To define these significant sites the Convention has established the World Heritage List. The cultural and natural properties propos J d to the list must meet specific criteria defined by the World Heritage Commit tee, The first eight sites were inscribed on the list

in 1978, Currently there are 358 sites l'sted în 82 countries: 260 cultural sites, 84 natural sites and 14 mixed cultural and natural sites.

The World Heritage Commit tee also prepares and publishes a List of Heritage in Danger. It includes World Heritage properties threatened ;1 rld ith destruction, major alteration or abandonment. These threats may be caused by any one or combination of dangers including: accelerated deterioration, large-scale public or private projects, rapid urban and tourist development, changes iq use or ownership, armed conflict, fires, earthquakes, landslides, volcanic eruptions) floods, tidal waves and changes in water levels. Bach time the commit tee makes a new entry on the List of World Heritage in Danger, it is required to publicize the fact immediately.

N ational and International Protection Member countries recognize that it is primarily their own responsibility to safeguard World Heritage properties in their countries. They agree to do alI they can with their own resources and with international assistance. This includes agreement to:

-adopt a general palicy giving cultural and natural heritage a functian in the life of the cammunity and ta integrate the protection of that heritage inta camprehensive planning programs.

-set up services for the protection, conservation and interpretation of that heritage.

-develop research studies and operating methods of counteracting dangers that threaten that heritage.

-take appropria te legal, scientificT technical, administrative and ftnancial measures to preserve and present that heritage.

-foster national or regional centers for training and research in the ~ields of conservation and interpretation.

It is the dut y of the international community as a whole to cooperate in protecting world heritage; therefore member countries agree to help when other countries ask for assistance in identifying, protecting and conserving their sites of outstanding universal value. Also each country agrees not to take deliberate measures that might directly or indirectly damage World Heritage properties in another country.

4.1.9 United Nations Framework Convention on Climate Chenge

The UNFCCC entered into force on 21 March 1994. Today, it has near-universal membership. The 195 countries that have ratified the Convention are called Parties to the Convention.

The UNFCCC is a “Rio Convention”, one of three adopted at the “Rio Earth Summit” in 1992. Its sister Rio Conventions are the UN Convention on Biological Diversity and the Convention to Combat Desertification. The three are intrinsically linked. It is in this

context that the Joint Liaison Group was set up to boost cooperation among the three Conventions, with the ultimate aim of developing synergies in their activities on issues of mutual concern. It now also incorporates the Ramsar Convention on Wetlands.

Preventing “dangerous” human interference with the climate system is the ultimate aim of the UNFCCC.

The Convention:

Recognized that there was a problem.

- This was remarkable for its time. Remember, in 1994, when the UNFCCC took effect, there was less scientific evidence than there is now. The UNFCCC borrowed a very important line from one of the most successful multilateral environmental treaties in history (the Montreal Protocol, in 1987): it bound member states to act in the interests of human safety even in the face of scientific uncertainty.
- The ultimate objective of the Convention is to stabilize greenhouse gas concentrations "at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system." It states that "such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner."
- The idea is that, as they are the source of most past and current greenhouse gas emissions, industrialized countries are expected to do the most to cut emissions on home ground. They are called Annex I countries and belong to the Organization for Economic Cooperation and Development (OECD). They include 12 countries with "economies in transition" from Central and Eastern Europe. Annex I countries were expected by the year 2000 to reduce emissions to 1990 levels. Many of them have taken strong action to do so, and some have already succeeded.
- Industrialized nations agree under the Convention to support climate change activities in developing countries by providing financial support for action on climate change-- above and beyond any financial assistance they already provide to these countries. A system of grants and loans has been set up through the Convention and is managed by the Global Environment Facility. Industrialized countries also agree to share technology with less-advanced nations.

4.2 Policy

The Kenya Government’s environmental policy aims at integrating environmental aspects into national development plans. The broad objectives of the national environmental policy include:

- Optimal use of natural land and water resources in improving the quality of human environment;

- Sustainable use of natural resources to meet the needs of the present generations while preserving their ability to meet the needs of future generations;
- Integration of environmental conservation and economic activities into the process of sustainable development;
- Meeting national goals and international obligations by conserving bio-diversity, arresting desertification, mitigating effects of disasters, protecting the ozone layer and maintaining an ecological balance on earth.

Kenya has approximately 77 statutes which relate to environmental concerns. Most of these statutes are sector specific, covering issues such as public health; soil erosion; protected areas; endangered species; water rights and water quality; air quality, noise and vibration; cultural, historical, scientific and archaeological sites; land use; resettlement; etc.

Previously, environmental management activities were implemented through a variety of instruments such as policy statements and sectoral laws and also through permits and licences. For example, the Physical Planning Act of 1996 empowers local authorities to request existing facilities to conduct environmental assessments, while under the Local Government Act of 1998; it is an offence to emit smoke, fumes or dust which may be a source of danger, discomfort or annoyance.

With the enactment of the Environmental Management and Co-ordination Bill in December 1999, the institutional framework for environmental management was strengthened. The Environmental Management and Co-ordination Act (EMCA) of 1999 provided for the establishment of a National Environment Management Authority (NEMA), which became operational in July 2002, with the statutory mandate to co-ordinate all environmental activities.

4.3 Legal Framework

4.3.1 Environment

4.3.1.1 The Constitution of Kenya

The Constitution of Kenya in spite of being the supreme law of the land does not contain specific provisions regarding the environment. Section 70 however lists the right to life as one of the fundamental rights an individual is entitled to. The right life guaranteed by the Constitution can be interpreted to include the right to a clean and healthy environment.

4.3.1.2 Environmental Management and Coordination Act (EMCA, 1999)

This Act empowers stakeholders to participate in sustainable management of natural resources. It calls for Environmental Impact Assessment (EIA) under Section 58 to guide the implementation of environmentally sound decisions. It is under this provision that the current study is being undertaken

4.3.2 Water and Sanitation

4.3.2.1 The Water Act (Cap 372).

The Ministry of Water is vested with the duty to conserve and regulate the use of natural resources i.e. (estuaries, surface, ground and marine water).A section of the act relates to the environment and prohibits the release of water without a permit and also spells out penalties for pollution of water. The ministry through the District Water Boards and recently the water and sewerage companies regulate the use of water and the drilling of boreholes.

- ✓ Section three part 11 page 945 vests the ownership of every water resource in the state, subject to any rights of user being granted by or under the water act, 2002 or any other written law.
- ✓ Section six part five page 946 requires acquisition of water rights to use certain water resource through water permit obtained under water act, 2002.
- ✓ Section twenty part one page 958 gives the state scheme like Isiolo Water Supply precedence over all other schemes for the use of water
- ✓ Section thirty two part one page 966 sub-section two gives domestic purposes precedence over the use of water

In view of the above; it implies that other water uses like irrigation will be controlled according to the water available especially during drought. Isiolo Water Supply will receive first priority in allocating water.

4.3.2.2 Local Government Act (Cap 265)

Section 160 helps Local Authorities ensure effective utilization of the sewerage systems. It states in part that the municipal authorities have powers to establish and maintain sanitary services for the removal and destruction of, or otherwise deal with all kinds of refuse and effluent and where such service is established, compel its use by persons to whom the services are available.

The Act under section 176 gives powers to local authorities to regulate sewage and drainage, fix charges for use of sewers and drains and require connecting premises to meet the related costs. Section 264 of the Act also requires that all charges due for sewage, sanitary and refuse removal shall be recovered jointly and severally from the owner and occupier of the premises in respect of which the services are rendered. This in part allows for application of ‘ polluter-pays-principle’.

4.3.2.3 The Penal code

Section 191 of the penal code states that if any person or institution that voluntarily corrupts or foils water for public springs or reservoirs, rendering it less fit for its ordinary use is guilty of an offence. Section 192 of the same act says that a person who makes or vitiates the atmosphere in any place to make it noxious to health of persons/ institutions,

dwelling or business premises in the neighborhoods or those passing along public way, commits an offence.

4.3.3 Public Health

4.3.3.1 Public Health Act (Cap 242).

The Public Health Act is the principal instrument for ensuring health and safety of the people. Its core functions include the prevention of disease, treatment and care of the sick (curative services) and control of nuisance. The Act therefore makes regulations and lays standards for a healthy living environment. It specifically deals with building, sanitation; refuse disposal, water quality for human and industrial use, vector control and many other aspects that impact on the health of the populace. The Ministry of Health is responsible of the administration of the Act. However, where a local authority is capable of discharging responsibilities under the Act, such an authority is designated a local health authority and the relevant powers under the Act are delegated to it

Part IX, Section 115, of the Act states that no person/ institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires that Local Authorities take lawful, necessary and reasonably practical measures to maintain within their areas of jurisdiction a clean and sanitary environment to prevent occurrence of nuisance or condition liable to be injurious or dangerous to human health. Such nuisance or conditions are defined under section 118 as waste pipes, sewers, drainers or refuse in such state, situated or constructed as in the opinion of the medical officer of health to be offensive or injurious to human health. Any noxious matter or waste water flowing or discharged is also deemed as nuisance.

At the same time Section 130 provides for making and imposing regulations by the local authorities and others the duty of enforcing rules in respect of prohibiting use of water supply and or erection of structures draining filth or noxious matter into water as mentioned in section 129 .Section 129, vests authority on local authorities to prevent pollution of water sources for public use.

4.3.4 Land

4.3.4.1 Sessional Paper No. 3 of 2009 on National Land Policy dated August, 2009

Clause 3.3.1 categorizes the type of Land in Kenya

Clause 56: Land in Kenya is currently designated as Government land, Trust Land and Private Land.

Clause 57: This Policy designates all land in Kenya as Public land, Community Land and Private Land.

Clause 58: The Government shall enact a 'Land Act" to govern all categories of land.

Sect. 3.3.1.2: Defines Community Land as land lawfully held, managed and used by a given community as shall be defined in the "Land Act"

Clause 66: To secure community land, the Government shall:-

(a) Document and map existing forms of communal tenure.
(b) Repeal the Trust land act (Cap 288)
(c) Define, in the "Land ct, the term "community" and vest ownership of community land in the community
(d) Lay out, in the "Land Act", a clear framework and procedures for:-

- *The Recognition, protection and registration of community rights to land based resources taking into account multiple interests of all land users, including women (Refer National Land Policy page 17)*

4.3.4.2 Kenyan Constitution dated 6th May, 2010 (Page 45)

Clause (1): Community Land shall vest in and be held by communities identified on the basis of ethnicity, culture or similar community of interest.

(2) (a) Community land consists of: Land lawfully transferred to a specific community by any process of law;
(b) (i) Land that is lawfully held as Trust Land by the County Governments.
(3) Any unregistered Community land shall be held in Trust by County Governments on behalf of the communities for which is held

4.3.4.3 The Land Act, 2012

The Land Act, 2012 is an ACT of Parliament that give effect to Article 68 of The Constitution, to revise, consolidate and rationalize land laws; to provide for the Sustainable administration and management of land and land based resources, and for Connected purposes.

The act applies to all land declared as:-

(a) Public land under Article 62 of the Constitution;

(b) Private land under Article 64 of the Constitution; and

(c) community land under Article 63 of the Constitution and any other written law relating to community land.

Clause 37 clarifies that community land shall be managed in accordance with the law relating to community land enacted pursuant to Article 63 of the Constitution (Refer the Land Act, 2012 page 253 clause 37).

Section II defines how public land will be managed and acquires new ones while section II defines how it should be administered.

4.3.4.4 The Land Registration Act, 2012

This is AN ACT of Parliament to revise, consolidate and rationalize the registration of titles to land, to give effect to the principles and objects of devolved government in land registration, and for connected purposes.

Clause 3 specifies that the Act Applies to:-

(a) Registration of interests in all public land as declared by Article 62 of the Constitution;

(b) Registration of interests in all private land as declared by Article 64 of the Constitution; and

(c) Registration and recording of community interests in land.

4.3.4.5 Community Land

Kenya has not had a clearly defined or codified National Land Policy since independence. This, together with the existence of many land laws, some of which are incompatible, has resulted in a complex land management and administration system.

- Institutions managing land in Kenya are many and varied but performing poorly
- Community Land refers to land lawfully held, managed and used by a specific community.
- Eminent domain, or compulsory acquisition, is the power of the State to extinguish or acquire any title or other interest in land for a public purpose, subject to prompt payment of compensation and is provided for in the current Constitution. The constitution permits a modified form of acquisition in the case of trust land which may be activated by the President or Local Authorities. This is referred as "**Setting Apart**"

The **Trust Land Act** and the **Land (Group Representative) Act** are the two laws which entrust the management of community land to representatives of the community. A County Council is the trustee of Trust Land while Group Representatives are entrusted with members' group land.

4.3.4.6 The Trust Land Act, Chapter 288 of the Laws of Kenya

The constitution vests all land which is not registered under any act of parliament under the ownership of local authorities as trust land. Section 117 of the Constitution of Kenya provides that the Trust Lands Act may empower a county council to set apart an area of trust land vested in that county council for use and occupation by a public body or authority for public purposes, or by any person for a purpose likely to benefit the persons

within the jurisdiction of the county council or for the purpose of prospecting or extraction of minerals or oil.

Trust land consists of areas that were occupied by natives during the colonial period and which have not been consolidated, adjudicated and registered in individual's or group names
It also includes native land not taken over by the Government. Trust land is governed by the Trust Lands Act and is vested in local authorities designated as councils. The councils manage all resources within trust land and regulate land use such and conservation within their jurisdictions. The land in the project area has not been adjudicated and largely falls under this Act. This includes the land comprising the Waste Stabilization Site.

4.3.4.7 Physical Planning Act (Cap 286).

The Local Authorities are empowered under section 29 of the Act to reserve and maintain all land planned for open spaces, parks, urban forests and green belts. The same section, therefore allows for the prohibition or control of the use and development of land and buildings in the interest of proper and orderly development of an area.

4.3.5 Flora and Fauna

4.3.5.1 The wildlife Conservation and Management Act, Chapter 376

Section 3(1) Part II-Administration establishes the Kenya Wildlife Service.

Section 3A defines the function of Kenya Wildlife as:-

(a) Formulate policies regarding the conservation, management and utilization of all types of fauna (not being domestic animals) and flora;
(b) Advise the Government on establishment of National Parks, National Reserves and other protected wildlife sanctuaries;
(c) Manage National Parks and National Reserves;
(d) Prepare and implement management plans for National Parks and National Reserves and the display of fauna and flora in their natural state for the promotion of tourism and for the benefit and education of the inhabitants of Kenya;
(e) Provide wildlife conservation education and extension services to create public awareness and support for wildlife policies;
(f) Sustain wildlife to meet conservation and management goals;
(g) Conduct and co-ordinate research activities in the field of wildlife conservation and management; (h) identify manpower requirements and recruit manpower at all levels for the Service for wildlife conservation and management;
(i) Provide advise to the Government and local authorities and landowners on the best methods of wildlife conservation and management and be the principle instrument of the Government in pursuit of such ecological appraisals or controls outside urban areas as is necessary for human survival;

(j) Administer and co-ordinate international protocols, conventions and treaties regarding wildlife in all its aspects in consultation with the Minister;
(k) solicit by public appeal or otherwise, and accept and receive subscriptions, donations, devises and bequests (whether movable or immovable property and whether absolute or conditional) for the general or special purposes of the Service or subject to any trust; (l) render services to the farming and ranching communities in Kenya necessary for the protection of agriculture and animal husbandry against destruction by wildlife

First Schedule defines Game Animals, second schedule defines Game birds , third schedule defines protected area while Fourth schedule gives the rank of Game Wardens.

4.3.5.2 The Forest Act, 2005

Part III creates Kenya Forest Service and put procedures of creation and management of Forests.
Part IV clarifies on how Community will participate in the management of Forest.

Part V deals with Enforcement.

4.4 Institutional Framework

4.4.1 Institutions under the EMCA 1999

4.4.1.1 The National Environmental Council

The National Environmental Council (the Council) is responsible for policy formulation and directions for the purposes of the Act. The Council also sets national goals and objectives and determines policies and priorities for the protection of the environment.

4.4.1.2 The National Environmental Management Authority

The responsibility of the National Environmental Management Authority (NEMA) is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of Government in the implementation of all policies relating to the environment.

In addition to NEMA, the Act provides for the establishment and enforcement of environmental quality standards to be set by a technical committee of NEMA known as the Standards and Enforcement Review Committee (SERC).

4.4.1.3 Provincial and District Environmental Committees

The Provincial and District Environmental Committees also contribute to decentralised environmental management and enable the participation of local communities.

These environmental committees consist of the following:

- Representatives from all the Ministries;
- Representatives from Local Authorities within the province/district;
- Two farmers / pastoral representatives;

- Two representatives from NGO's involved in environmental management in the province/district;
- A representative of each regional development authority in the province/district.

4.4.1.4 Public Complaints Committee

EMCA also establishes a Public Complaints Committee, which provides the administrative mechanism for addressing environmental harm. The committee has the mandate to investigate complaints relating to environmental damage and degradation. Its members include representatives from the Law Society of Kenya, NGOs and the business community.

4.4.2 Institutions under the Water Act 2002

The main functions of the Ministry of Water and Irrigation are to develop and formulate Water Resources Management Policy, Water and Sanitation Services Policy, Water Quality and Pollution Control Policy, Flood Control and Land Reclamation Policy, Waste Water Treatment and Disposal Policy, National Irrigation Policy and a policy on Water Schemes and Community Water Projects.

The relevant institutional framework for water and sanitation in Kenya was set up under the Water Act 2002. Institutions under this Act are presented in the following sections.

4.4.2.1 Water Resources Management Authority

The Water Act 2002 provides for a Water Resources Management Authority (WRMA) to manage water in an integrated way. WRMA is charged with responsibility for managing, regulating, protecting, apportioning and conserving water resources naturally, including trans-boundary waters.

Some of these powers and functions of WRMA include:

- Developing principles, guidelines and procedures for the allocation of water resources;
- Monitoring the national water resources management strategy;
- Receiving and determining applications for permits for water use;
- Monitoring and enforcing conditions attached to permits for water use;
- Regulating and protecting water resources quality from adverse impacts;
- Managing and protecting water catchments.

WRMA may prosecute any offences arising under the Water Act.

4.4.2.2 Water Services Regulatory Board and Water Appeals Board

The Water Services Regulatory Board (WSRB) and Water Appeals Board (WAB) are independent institutions to regulate and deal with disputes respectively. The WSRB regulates the seven Water Services Boards in Kenya. The Water Appeals Board is established with the responsibility of hearing and determining appeals concerning a permit or licence.

4.4.2.3 Water Services Boards

In the case of water supply, the Act gives responsibility for service delivery to eight Water Services Boards one of which is the Northern Water Services Board (NWSB). The Boards in turn, retain service provider(s) such as water companies, NGOs, institutions and community owned schemes.

4.4.2.4 Water Service Providers

These are mandated to provide day-to-day service within their areas of responsibilities. They include water companies, NGOs, institutions and community owned schemes.

4.5 Regulatory Framework

In order to assist in the assessment and determination of the significant environmental impacts, various International, National and local planning guidelines and regulations can be used as reference points upon which the threshold of impacts can be assessed. The pertinent national legislation, national regulations and standards, the International guidelines, conventions and treaties will be adopted.

4.5.1 Environmental Regulations

4.5.1.1 Environmental Impact Assessment and Audit Regulations

The Environmental Impact Assessment and Audit Regulations state in Regulation 3 that "….the Regulations shall apply to all policies, plans, programmes, projects and activities specified in Part IV, Part V and the Second Schedule of the EMCA….."

Regulation 4(1) further states that:

"…no proponent shall implement a project:

(a) Likely to have a negative environmental impact; or

(b) For which an environmental impact assessment is required under the Act or these Regulations;

Unless an environmental impact assessment has been concluded and approved in accordance with these Regulations…"

Where standards are yet to be established, the local authority standards or standards promulgated under sectoral legislation apply.

4.5.1.2 Environmental Management and Coordination, (Water Quality) Regulations 2006

These are described in Legal Notice No. 120 of the Kenya Gazette Supplement No. 68 of September 2006. These Regulations apply to drinking water, water used for agricultural purposes, water used for recreational purposes, water used for fisheries and wildlife and water used for any other purposes. This includes the following:

- Protection of sources of water for domestic use;
- Water for industrial use and effluent discharge;
- Water for agricultural use.

These Regulations outline:

- Quality standards for sources of domestic water;
- Quality monitoring for sources of domestic water;
- Standards for effluent discharge into the environment;
- Monitoring guide for discharge into the environment;
- Standards for effluent discharge into public sewers;
- Monitoring for discharge of treated effluent into the environment

4.5.1.3 Environmental Management and Coordination, (Waste Management) Regulations 2006

These rules are described in Legal Notice No. 121 of the Kenya Gazette Supplement No. 69 of September 2006. These Rules describe the following:

- Waste description;
- Waste transportation;
- Responsibility of waste transporters;
- Waste disposal facility;
- Description and handling of industrial wastes;
- Description and handling of hazardous and toxic wastes;
- Description and handling of pesticides and toxic substances;
- Description and handling of biomedical wastes;
- Description and handling of radioactive substances;
- List of schedules on waste management.

4.5.1.4 Fossil Fuel Emission Control Regulations 2006

These regulations are described in Legal Notice No. 131 of the Kenya Gazette Supplement no. 74, October 2006. These regulations include internal combustion engine emission standards, emission inspections, the power of emission inspectors, fuel catalysts, licensing to treat fuel, cost of clearing pollution and partnerships to control fossil fuel emissions. The fossil fuels considered are petrol, diesel, fuel oils and kerosene.

4.5.1.5 Environmental Management and Coordination, (Conservation of Biological Diversity (BD) Regulations 2006

These regulations are described in Legal Notice No. 160 of the Kenya Gazette Supplement No. 84 of December 2006. These Regulations apply to conservation of biodiversity which includes conservation of threatened species, inventory and monitoring of BD and protection of environmentally significant areas, access to genetic resources, benefit sharing and offences and penalties.

4.5.1.6 Occupational Health and Safety Regulations

The Occupational Health and Safety Act (OSHA) 2007 repealed the Factories and Other Places of Work Act. Anything done under the provisions of the Factories and Other Places of Work Act or the Minister under the provisions of Factories and Other Places of Work Act, including subsidiary legislation issued before the commencement of the OSHA 2007 shall be deemed to have been done under the provisions of this Act.

The Factories and Other Places of Work Act had over the years passed several subsidiary rules and regulations for effective implementation of the Act. All shall, as long as it is not inconsistent with OSHA 2007 remain in force until repealed or revoked by subsidiary legislation under the provisions of OSHA 2007 and shall for all purposes be deemed to have been made under this Act.

These regulations include:

- The Factories (Cellulose Solutions) Rules 1957;
- The Factories (Wood Working Machinery) Rules 1959;
- The Factories (Dock) Rules 1962;
- The Factories (Eye Protection) Rules 1978;
- The Factories (Electric Power) (Special) Rules 1978;
- The Factories (Building Operations and Works of Engineering Construction) Rules 1984;
- The Factories and Other Places of Work (Health & Safety Committees) Rules 2004;
- The Factories and Other Places of Work (Medical Examination) Rules 2005;
- The Factories and Other Places of Work (Noise Prevention and Control) Rules 2005.
- The Factories and Other Places of Work (Fire Risk Reduction) Rules

2007;

- The Factories and Other Places of Work (Hazardous Substances) Rules 2007.

4.5.1.7 Noise and Excessive Vibration Pollution (Control) Regulation, 2009

It forbids any person of using or operating any radio or receiving musical instrument, phonograph, television set, any other machine or device from producing or reproducing of sound or any other sound amplifying equipment in a loud, annoying or offensive manner such that the, noise from the device:-

a) interferes with the comfort, repose, health or safety of members of the public;
b) creates a risk thereof, within any building or, outside building, at a distance of 30 meters or more from the source of such sound; or
c) Interferes with the conversation of members of the public who are 30 meters or more from the source of such sound.

4.5.1.8 Ministry of Water and Irrigation, Water Practice Manual, 2005

The Ministry of Water and Irrigation has adopted water standards from Kenya Standard-150(KS 150) which was prepared by the Kenya Bureau of Standards in 1996 and World Health Organization guideline limits.

The tables below summarize the limits for different parameters in the sector:-

Table 14: Guideline standards for Water Quality of Domestic Water Sources

Parameter	**Guide Value** (Max. Allowable)
pH	6.5-8.5
Suspended Solids (SS)	30 mg/L
Conductivity (25^{o}C)	1500 µS/cm
Nitrate (NO_3)	10 mg/L
Ammonia (NH_3)	0.5 mg/L
Nitrite (NO_2)	3.0 mg/L
Total Dissolved Solids (TDS)	1,200 mg/L
E.Coli (Coliforms)	NIL/100 ml
Fluoride (F)	1.5 mg/L
Phenols	NIL (mg/L)
Arsenic (Ar)	0.01 mg/L
Cadmium (Cd)	0.01 mg/L
Lead (Pb)	0.05 mg/L
Selenium (Se)	0.01 mg/L
Sulphates (SO_4)	400 mg /L
Sodium Absorption Ratio	6.0

Parameter	**Guide Value** (Max. Allowable)
Copper (Cu)	0.05 mg/L
Zinc (Zn)	1.5 mg/L
Alkyl benzyl sulphonates	0.5 mg/L
Permanganate Value	1.0 mg O_2/L

Table 15: Microbiological Limits for Drinking and Containerised Water

Type of microorganism	**Drinking Water**	**Containerized Water**
Total viable counts at 37^{o}C per mil, max	100	20
Coliforms in 100 ml	NIL	NIL
E. coli in 100 ml	NIL	NIL
Staphylococcus aureus in 50 ml	NIL	NIL
Sulphite reducing anaerobes in 50 ml	NIL	NIL
Pseudomonas aeruginosa fluorescence in 100 ml	NIL	NIL
Streptococcus faecalis	NIL	NIL
Shigella in 100 ml	NIL	NIL
Salmonella in 100 ml	NIL	NIL

Table 16: Physical Water Quality Guidelines for Irrigation

Parameter	**Permissible Level**
pH	6.5-8.5
Aluminum (Al)	5 mg/L
Arsenic (Ar)	0.1 mg/L
Boron (Bo)	0.1 mg/L
Cadmium (Cd)	0.5 mg/L
Chloride (Cl)	0.01 mg/L
Chromium (Cr)	1.5 mg/L
Cobalt (Co)	0.1 mg/L
Copper (Cu)	0.05 mg/L
E. Coli	NIL/100 ml
Fluoride (F)	1.0 mg/L
Iron (Fe)	1.0 mg/L
Lead (Pb)	5 mg/L
Selenium (Se)	0.19 mg/L
Sodium Absorption Ratio (SAR)	6.0 mg/L
Total Dissolved Solids (TDS)	1200 mg/L
Zinc (Zn)	2 mg/L

Table 17: Microbiological water Quality Guidelines for Irrigation Water

Reuse Condition	Exposed Group	Intestinal Nematodes (MPN/L)	Coliforms (MPN/100 ml)
Unrestricted Irrigation (crops likely to be eaten uncooked)	Workers and Consumers	< 1	<1000
Restricted Irrigation (Cereal crops, industrial crops, fodder crops, and pasture	Workers and Consumers	< 1	No standard recommended

Table 18: Guideline Values for Raw Water

Coliforms organisms (number / 100ml)

0-50	Bacterial quality requiring disinfection only
50-5,000	Bacterial quality requiring full treatment (coagulation, sedimentation, filtration and disinfection)
5,000-50,000	heavily polluted, requiring extensive treatment
Greater than 50,000	Very heavily polluted, unacceptable as source unless no alternatives exists. Special treatment needed/

Source: (Adopted Water Practice Manual, 2005, Ministry of Water and Irrigation)

4.5.1.9 Ministry of Water and Irrigation, Draft Practice Manual for Sewerage and Sanitation Services, 2008

Lack of a National Standard for the Planning and Design, Operation and Maintenance of Sewerage and Sanitation Systems has been singled out as one of the contributors of most sewerage and sanitation services falling into a serious disrepair. Most of the sewerage infrastructure has not been compatible with Kenyan conditions generally and more particularly with specific site conditions. This resulted in a wide variety of methods and designs often leading to the selection of inappropriate technology unsuitable for local conditions, difficult and expensive to operate and maintain.

Consequently**,** the Practice Manual for Sewerage and Sanitation in Kenya has been compiled with the aim of providing guidelines and criteria for all those involved in the Water Sector.

The objective is to streamline the Sewerage and Sanitation Sector and guarantee that NEMA standards in Sewerage and Sanitation are achieved.

The aim is to eliminate past mistakes and that resources can be used more effectively if the framework within which they are deployed is clearly defined.

To safeguard aquatic life, NEMA has prepared a standard to which all sewerage works have to treat their wastes before discharging into any water course.

The characteristics of the standard are as per table 19 below.

Table 19: **Recommended Effluent Standard that can be released to the Environment**

BOD5 at 20^0c	-30mg/l
COD	-50mg/l
Suspended Solids	-30mg/l
Coliform	-1,000 per 100ml
Helmith Eggs	-1,000 per llitre
Dilution at Discharge Point	-8 to 150 times dry weather flow (Adopted from Royal Commission 8^{th} Report, England requirement)

4.6 World Bank Safeguards

4.6.1 Why Safeguard Policies?

- At planning stage it is important to anticipate the potential problems that can arise from development intervention

- Knowing the impacts beforehand helps taking informed decision to deal with these

- Ignoring the impacts on human and its surrounding environment may lead to poor outcome of development project and deteriorate the situation even more

4.6.2 WB Safeguards

- The objective of these policies is to prevent and mitigate negative impacts of projects on people and their environment
- These policies provide guidelines for the bank & borrowing country in the identification, preparation, & implementation of programs & projects
- Safeguard policies provide a platform for stakeholder participation in decision-making at different project levels
- The policies have been an important instrument for building ownership among local populations

4.6.3 Do Safeguards Matter?

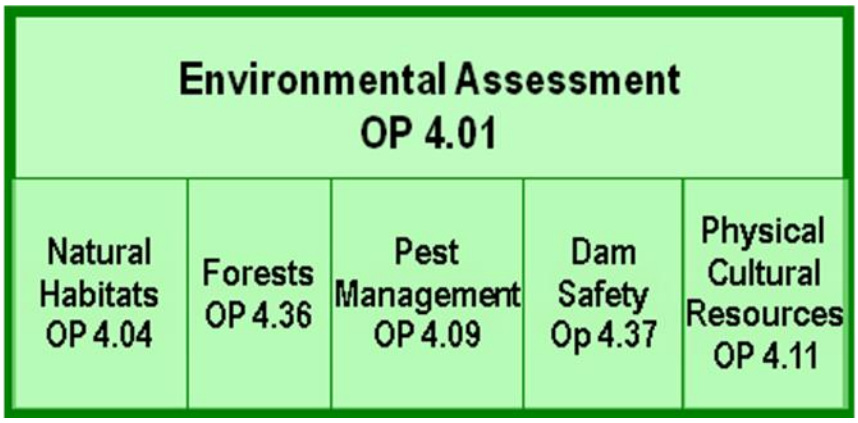
- Safeguard policies are instruments to identify and minimize key social and environmental risks
- Safeguards allow thinking beyond "*do-no-harm*" approach
- Mainstreaming social and environmental aspects in project design are contributing to enhance sustainability
- The effectiveness and development impact of projects and programs supported by the Bank have substantially increased as a result of attention to these policies

4.6.4 Safeguards policies

The following are World Bank Safeguard Policies:-

4.6.4.1 Environmental Assessment OP 4.01

There are five environmental safeguards.



With OP 4.0.4, 4.36 and 4.37 applicable

4.6.4.1.1 OP 4.04 Natural Habitats

- The conservation of natural habitats that protect and enhance the environment is essential for long-term sustainable development
- The Bank supports the protection, maintenance & rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue
- The Bank supports & expects borrowers to apply a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development

4.6.4.1.2 OP 4.36 Forests

The objective of this policy is to assist borrowers to:

- harness the potential of forests to reduce poverty in a sustainable manner
- integrate forests effectively into sustainable economic development
- protect the vital local and global environmental services and values of forests

policy applies to the following types of Bank-financed projects:

- projects that have or may have impacts on the health and quality of forests
- projects that affect the rights and welfare of people and their level of dependence upon or interaction with forests
- projects that aim to bring about changes in the management, protection, or utilization of natural forests or plantations, whether they are publicly, privately, or communally owned

4.6.4.1.3 Op 4.37 Dam Safety

Key Issues

- For the life of any dam, the owner is responsible for ensuring that appropriate measures are taken & sufficient resources provided for the safety of the dam, irrespective of its funding sources or construction status
- As there are serious consequences if a dam does not function properly or fails, the Bank is concerned about the safety of new dams it finances and existing dams on which a Bank-financed project is directly dependent
- The bank requires borrower to adopt and implement certain dam safety measures for the design, bid tendering, construction, operation & maintenance of the dam and associated works

4.6.4.2 Social Safeguards

Addresses social risks and quality enhancement.

There are 3 in Number:-

1. Involuntary Resettlement OP 4.12
2. Indigenous People OP 4.10 and
3. Gender and Development OP 4.20

Of this, only two i.e. OP 4.12 and 4.20 are applicable.

4.6.4.2.1 OP 4.12 Involuntary Resettlement

Key Issues Addressed

- Avoid or minimize resettlement through alternative project design
- Mitigate impacts from land acquisition or use of affected persons' land
- Restore livelihoods of displaced persons
- Assist displaced people regardless of tenure
- Compensate for affected assets at replacement cost

4.6.4.2.2 OP 4.20 Gender & Development

- The Bank oversees Gender Assessment for a member country and results are incorporated in Country Assistance Strategy (CAS)
- Projects in sectors and thematic areas where the CAS identified the need for gender-responsive interventions are designed to adequately take into account the gender implications of the project.

Key Issues

- Address the gender disparities and inequalities that are barriers to development
- Assist borrowing countries in formulating and implementing their gender and development goals

4.6.4.3 Legal

None is applicable out of the existing two.

CHAPTER FIVE

5.0 PROPOSED PROJECT AND REASONABLE ALTERNATIVE

5.1 Bakuli 4 Dam Project

5.1.1 Damming at Bakuli Springs

01. Bakuli is a Borana word borrowed from Kiswahili wod " Bakuli" implying the crucial role this valley plays to the residence of Marsabit Town. Towards this end the Design Team has proposed nurturing this valley to supply more water probably to its full potential.
02. The Best Dam will be to raise Bakuli 3 to 20m from current 11.50m. However, in between Bakuli 3 and 4, there is unstable section prone to hill/rock fall which can be worsened by being oiled by stored watered if this section is flooded.

    However, construction of a retaining wall of height 5m and length about 30m is envisaged.

    Arising from above, it is anticipated that Enhancing existing Bakuli 3 dam by raising the current height from 11.5m to 20m, storage from 89,600.609m^3 to 299,931.2875m^3 and enhanced yield of 1,375m^3/day from current 258.43m^3/day will be undertaken.(Refer Figure 8)

Proximity

Enhanced Bakuli 3 is located in Marsabit Game Reserve, in Bakuli Valley, about 8km West of Marsabit Town, the Headquarter of Marsabit County.

Size of Catchment

The area demarcated as the catchment is approximately 7.80km². The catchment rises from an altitude of 1429masl to 1366masl. The average catchment slope was found to be 3%. This slope has been used in the determination of flood from the catchment.

5.1.2 Buildings

1. Demolish Bakuli 1 pump house
2. Built another Grade 9 house upstream of existing staff house
3. Built a pump house of size 7m by 5m downstream of Bakuli 2
4. Provide portable water to staff houses
5. Built VIP latrine for new double 9 house
6. Move rainfall station to higher grounds
7. Built generator house size 7m by 5m downstream of existing
8. Upgrade the transformer at existing high lift pump from 50KVA to 200kva
9. Move the existing transformer at staff house to higher ground to serve staff houses of capacity 50KVA

5.1.3 Rerouting

- Reroute the walkway of Bakuli 3 to about 20m upstream to a higher ground
- Upgrade existing 100mm GI Rising Main to 150mm GI

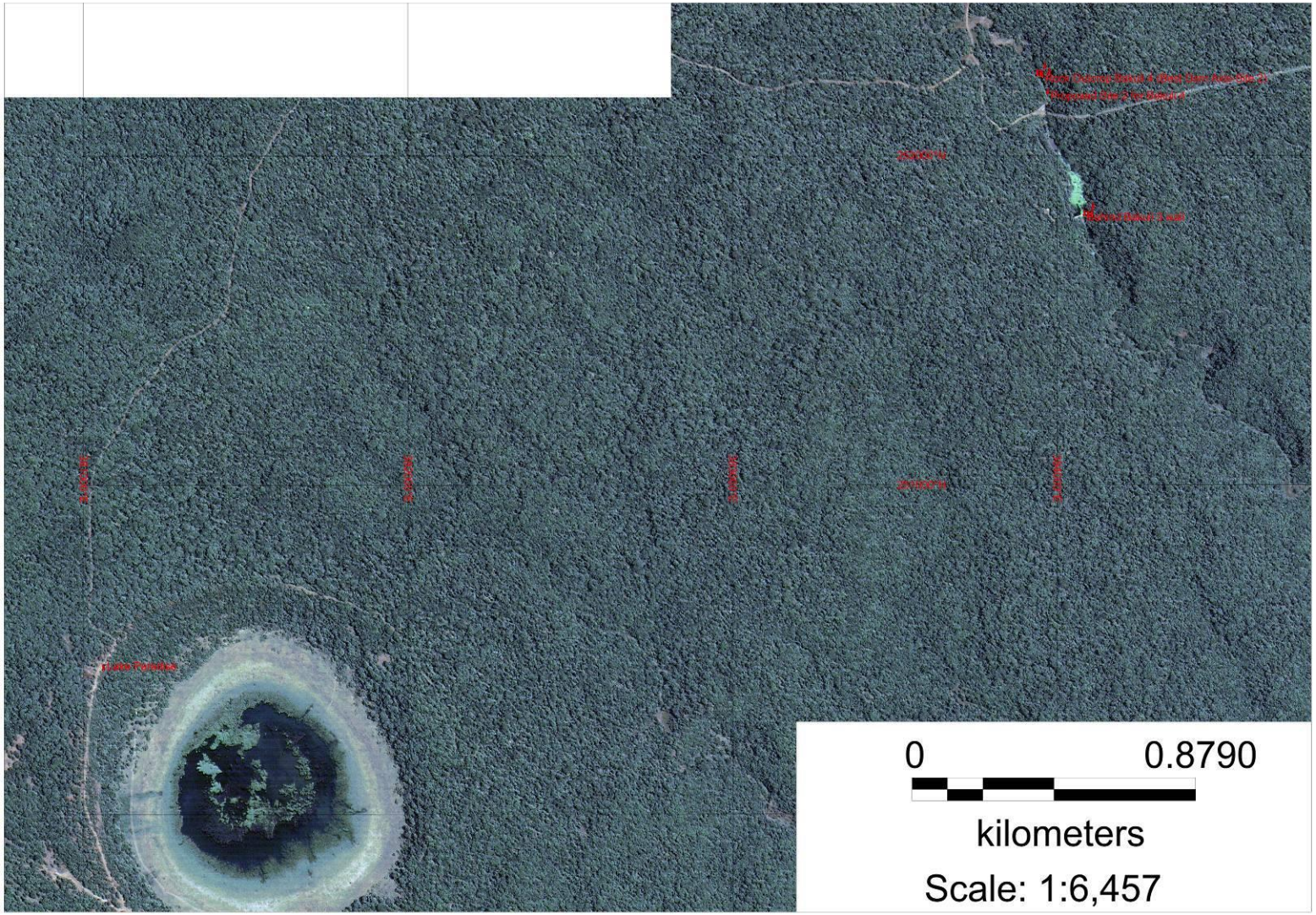


Figure 8: Location of Existing Bakuli 3 Dam

- Remove it from the area which will be submerged in the LHS to RHS to higher grounds

5.1.4 Laying of a new parallel pumping rising main

Allow for lying of a new, parallel rising main of diameter 200mm and length 6.5km

5.1.5 Rehabilitations

- ✓ Allow for Rehabilitation of existing Rising Main by repairing the bursts which are currently losing 30% of the Water
- ✓ Purchase a new pumping equipment to act as standby for current aging system(Q=50m^3/hr, H=170m , power 30/36KW)

5.1.6 Treatment plant

- ➢ Allow for Construction of two additional CFU capacity 20-25m^3/hr with associated Infrastructure

- ➢ Rehabilitate existing Backwash system to service the existing and additional CFU.

5.1.7 Extension of distribution system to Karantina

- ❖ Lay a new gravity main of diameter 150mm GI from existing unused steel ground tank to 225m^3 sump to be constructed at Marsabit Boys Tank of length about 3km and also enhance flows at Marsabit Boys and serve the governor's residence an environments
- ❖ Lay 6inch GI Gravity Main from Marsabit Boys tank to Karantina (Executive Offices, Pastoral Centre, Manyata Gida and Kari, a total length of about 3km
- ❖ Take 3 phase power to Marsabit Boys Tank
- ❖ Construct a new booster station of Q=150m^3/day and pump to Altitude 1490, a difference of 66m meteres to 100m^3 masonry tank to serve Governor's Residence and Environs through Pumping
- ❖ Investigate possibility of looping in Karantina and other areas.
  (Refer Figure 12 and 13)

5.1.8 Existing Dams

There are three existing Dams viz:- Bakuli 1, 2 and 3 named according to the valley and order of building. Bakuli 1 was the first to be built followed by 2 and lastly 3.

Figure 9 has their locations on google image.

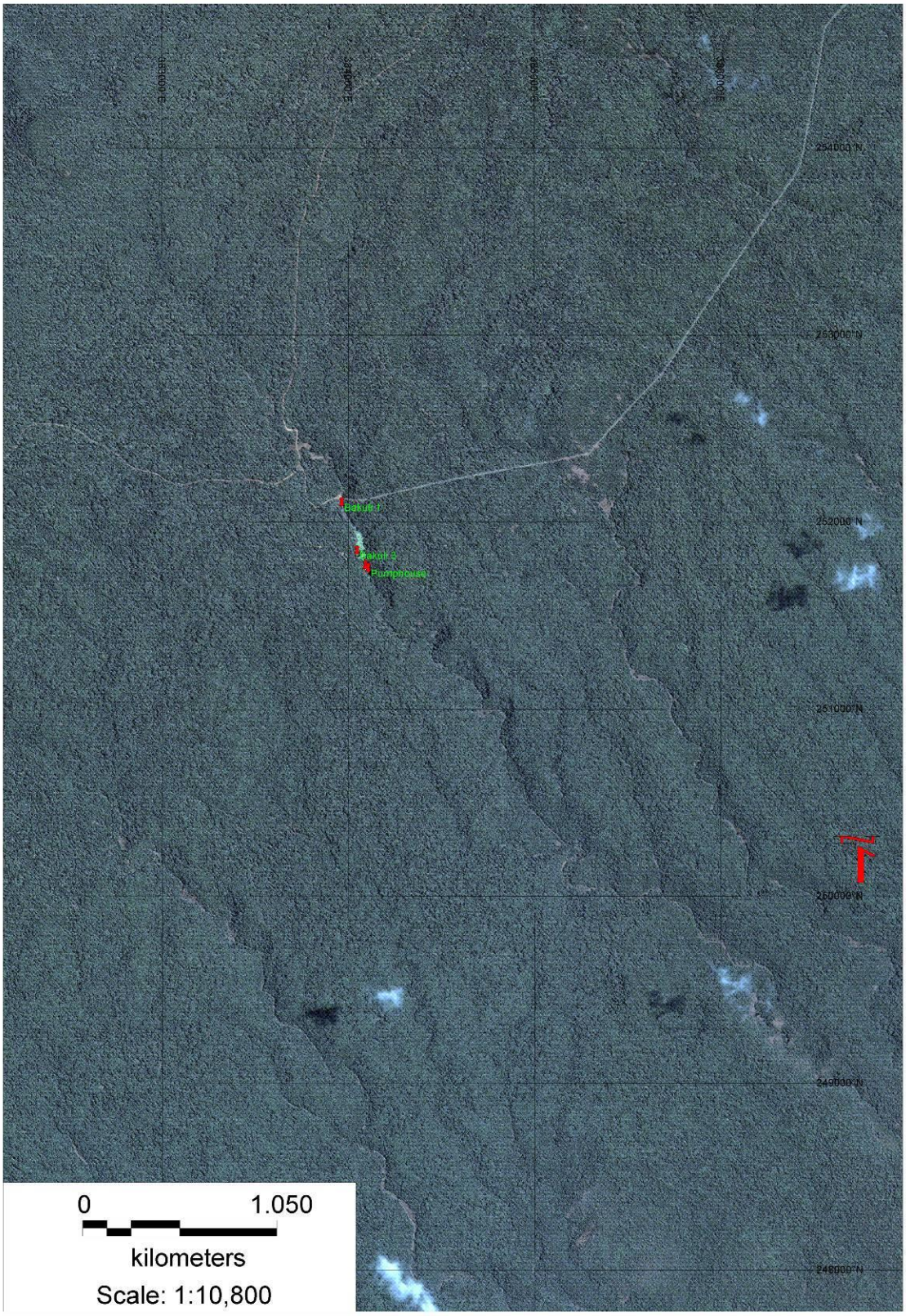


Figure 9: location of Bakuli 1 and 3 on google image

5.1.8.1 Bakuli 1

Bakuli 1 was the first storage and was constructed in 1950's (Plate 13) with a sole aim of
Storing Water in extreme droughts when flows of Bakuli Spring are low
Providing Storage of at least 2 minutes to stabilize the pumping equipments.
Bakuli 1 is the first dam in the series of three and can be located at:-

Region	37N
Longitude	0383962E UTM
Latitude	0252100N UTM
Altitude	1331m

The Dam is Tapping with top being of width about 0.3m, bottom 0.60m and height about 1.5m. It is currently acting as a silt rap of Bakuli 3 and hence silted.

There is a pump house which is equipped but was abandoned because of limitation of the Rising Main.

5.1.8.2 Bakuli 2

Bakuli 2 is located downstream of Bakuli 1 and 3 and was constructed in 1995.(Plate 14)
Bakuli 2 is located about 0.5km downstream of Bakuli 1.

The Dam has similar dimensions to Bakuli 1 and has a capacity of 570m^3.

It can be located at:-

Region	37N
Longitude	0384108E UTM
Latitude	0251747N UTM
Altitude	1307m

There is a pump which used to pump from Bakuli 2 and combine with Bakuli1 using diameter 4"GI pipeline before combining to 6"GI.

Water is opened from Bakuli 1 to 3 and to 2 before it is pumped to Marsabit Treatment Plant.

Plate 13: Bakuli 1 of Capacity 870m^3 and Silted

Plate 14: Bakuli 2 of Capacity 570m^3

5.1.8.3 Bakuli 3

Bakuli 3 harvests its storage from Flood flows. It is a Reinforced Concrete dam of capacity about 89,600.609m^3 (Length of Dam Axis - 68,927m, width dam structure sloping from 0.60m at top to 1.2m at bottom and depth - 11.5m). The dam is made of reinforced concrete and is located between Bakuli 1 and 2 , about 400m from Bakuli 1 at elevation 1321m, longitude 037^0 57.448'East and latitude 020 16.667'North).(Refer Figure 8 and 10 for its location).

It was constructed from year 2008 to 2011 under Government of Kenya and Japan funding at a cost of Kshs70million. The dam water is stinking because of fallen and washed leaves. The dam has top width of 0.6m, height of 11.5m and bottom of 1.2m with apron thickness of 1m.

The dam has brought relieve to Marsabit Town since it satisfies the current water demand by about 30-40%.

The Dam has the following characteristics:-

Length of Reach	270m
Average width	30m
Silt Accumulation	1-2m per year

It can be located at:-

Region	37N
Longitude	(0)384091E UTM
Latitude	(0)251817 N UTM
Altitude	1328m

Plate 15: Rear Elevation of Bakuli 3 Dam Spillway

Plate 16:: Rear Elevation With

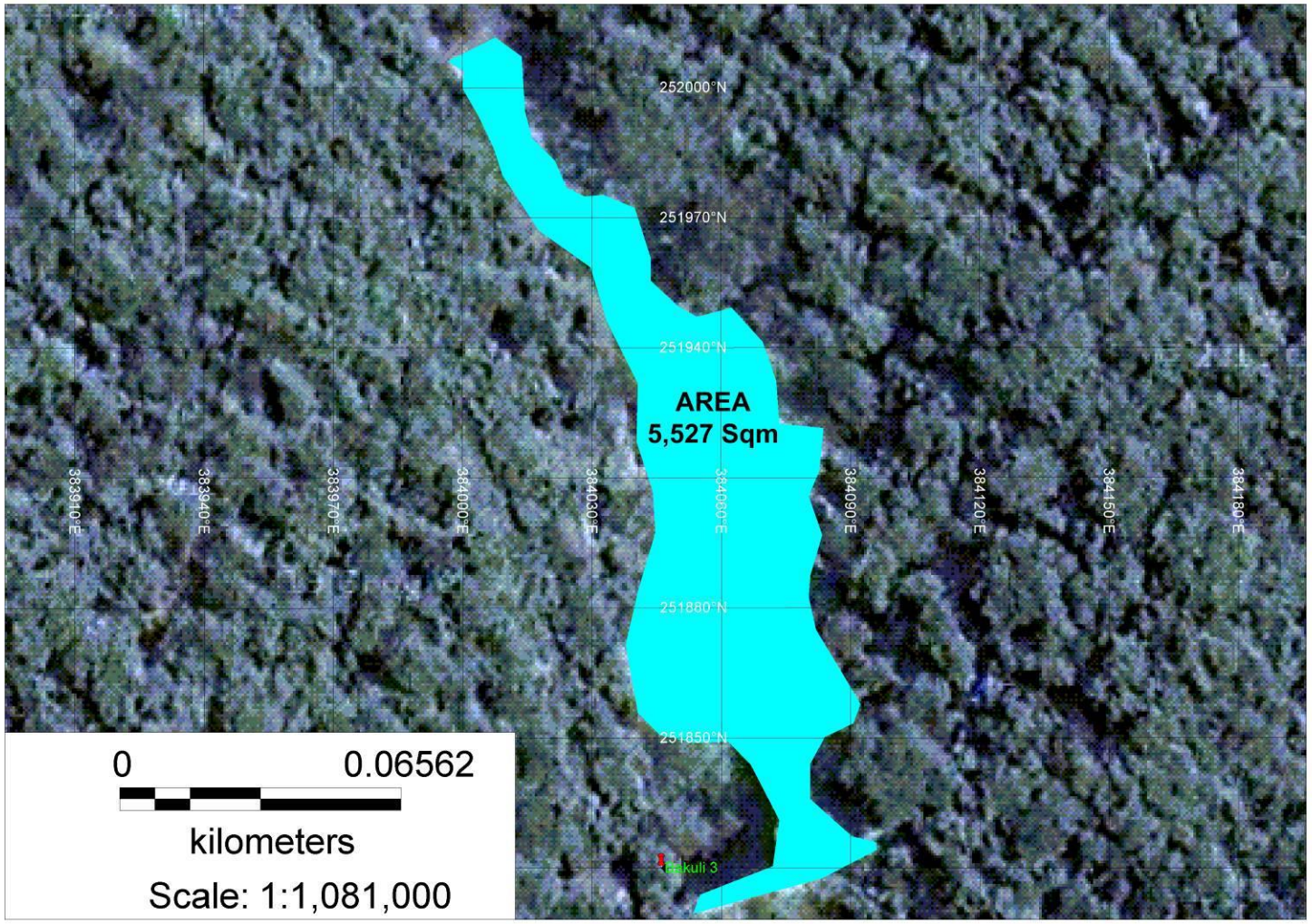


Figure 10: Existing Area of Bakuli 3 Dam

5.1.9 Capital Cost

The Construction of Bakuli 4 Dam Project is estimated at Kshs **598,003,193.**
Table 20 has the details.

Table 20: COST SUMMARY OF BAKULI 4 DAM PROJECT

BILL OF QUANTITIES- AUGMENTATION OF MARSABIT TOWN WATER SUPPLY					
BAKULI 4 DAM PROJECT					
SUMMARY OF THE BILLS OF QUANTITIES					
BOQ No.	**DESCRIPTION**				**TOTAL AMOUNT**
					KSHS
	SUMMARY OF DAYWORKS				4,461,525
1	PRELIMINARY AND GENERAL ITEMS				116,665,807
2	BAKULI RETAINING WALL				16,895,728
3	ENHANCED BAKULI 3 DAM				128,392,259
4	INTAKE WORKS				47,027,625
5	BAKULI RISING MAIN				52,446,105
6	TREATMENT PLANT				16,319,973
7	50M GRAVITY MAIN				7,954,500
8	GRAVITY MAIN FROM TREATMENT PLANT TO MARSABIT BOYS TANK				3,420,550
9	229m³ MASONRY TANK TO BE CONSTRUCTED AT MARSABIT BOYS				4,233,860
10	GOVERNOR'S BOOSTER STATION				6,161,790
11	GOVERNOR'S RISING MAIN				3,123,200
12	GOVERNOR'S TANK-100M³ Masonry Tank				1,695,330
13	GOVERNOR'S DISTRIBUTION MAIN				1,625,400
14	GRAVITY MAIN FROM MARSABIT BOYS TANK TO KARANTINA TANK				9,358,100
15	225m³ MASONRY TANK TO BE CONSTRUCTED AT KARANTINA HILL				4,233,860
16	KARANTINA DISTRIBUTION LOOP				8,864,650
17	REHABILITATIONS				1,805,731
18	CAPACITY BUILDING				63,650,000
	SUB-TOTAL				**498,335,994**
	ADD 10% FOR PRICE EXCALATION				49,833,599
	ADD 10% FOR CONTINGUENCIES				49,833,599
	GRAND TOTAL				**598,003,193**

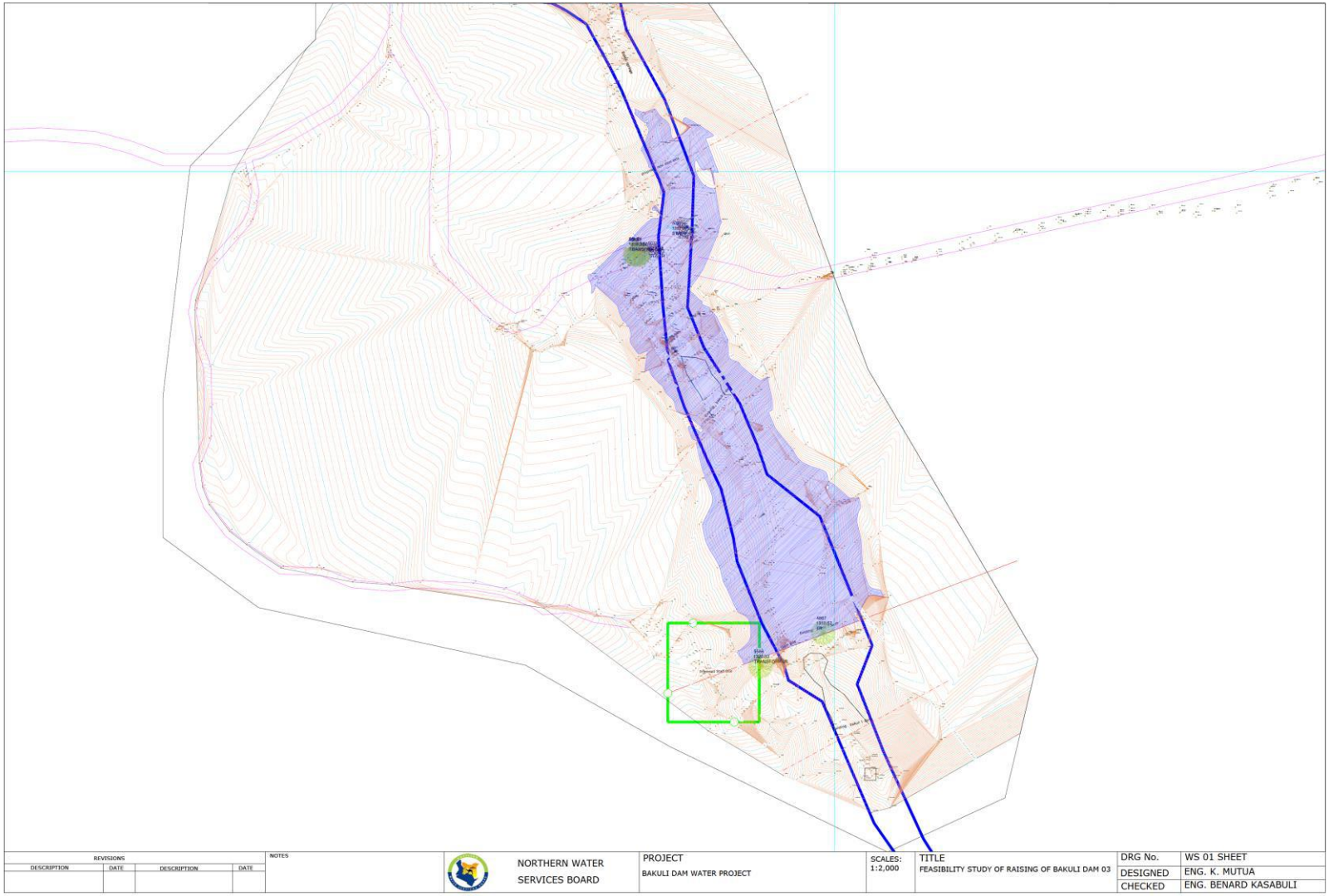


Figure 11: Layout of Proposed Bakuli 3 Dam

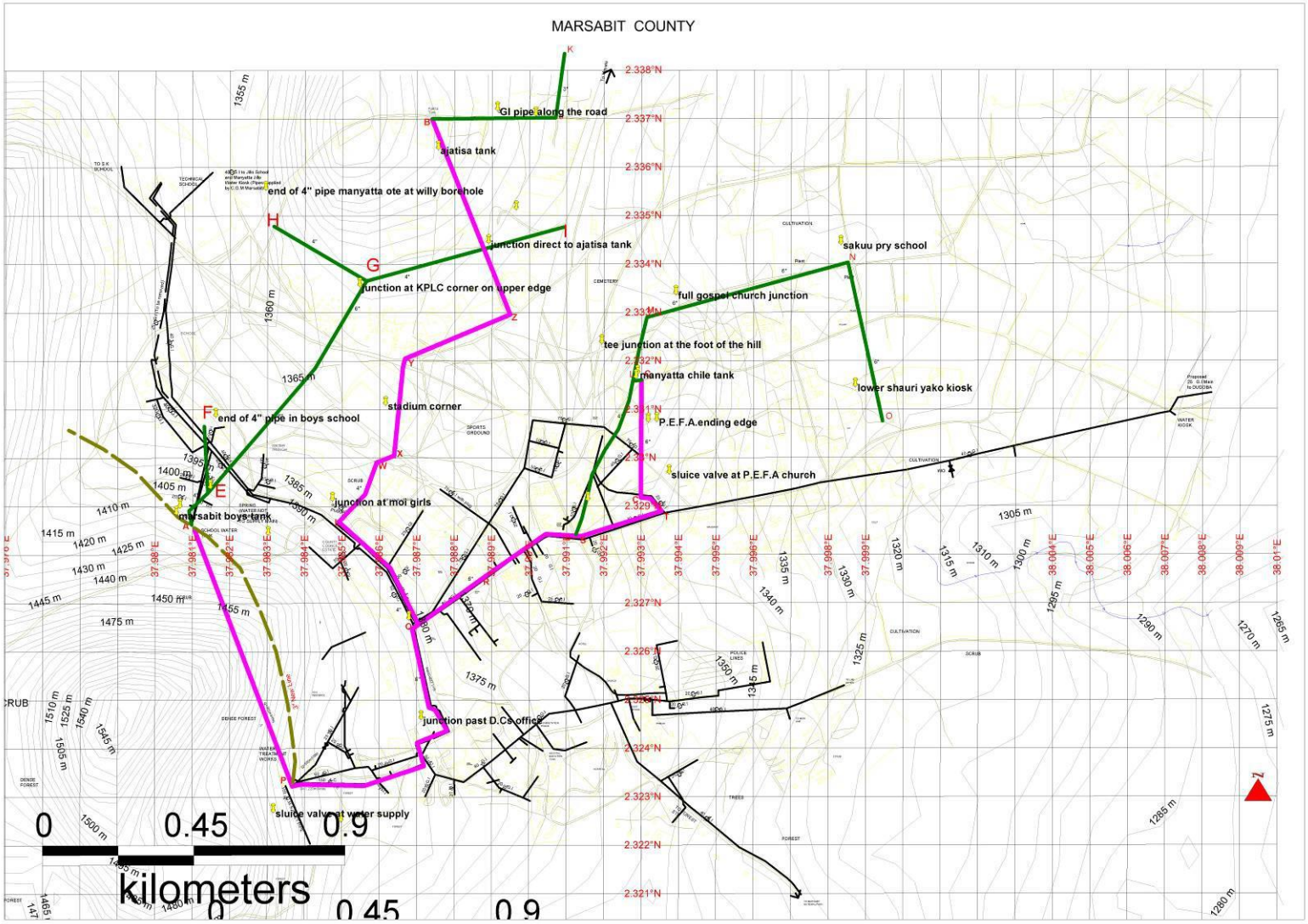


Figure 12: Existing Distribution System in Marsabit Town

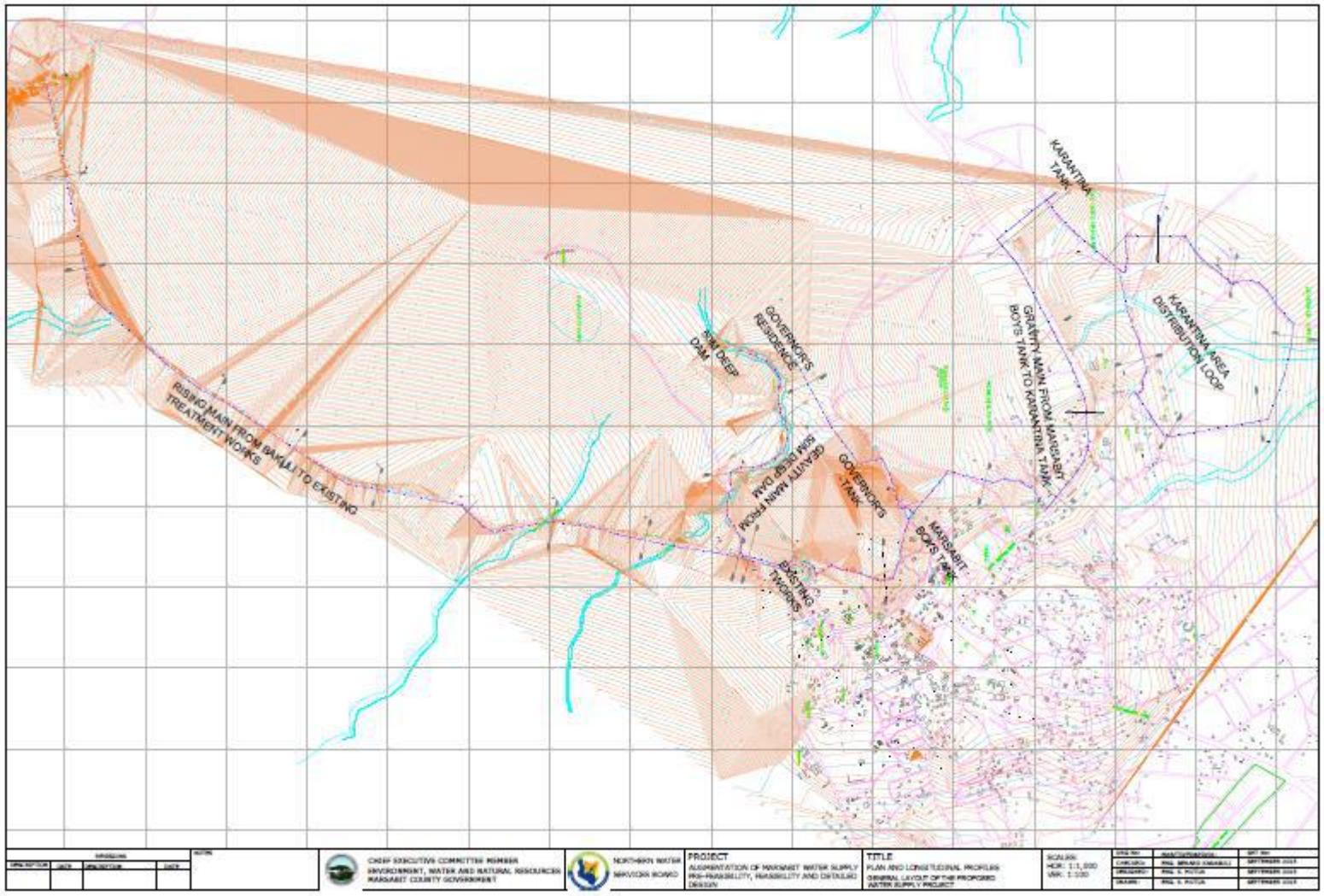


Figure 13: Layout of proposed Pipelines

5.1.10 Reasonable Alternative

5.1.10.1 No Action

1. The population of Marsabit town is still growing at an alarming rate escepecially due to ongoing tarmacing of the great North Road, against the background of the severe water scarcity.

   Efforts towards proportionate economic growth, private investment, public services improvement and infrastructure provision are all being constrained by the seemingly lack of a lasting solution to the prevailing problem of water scarcity for example, the Marsabit county Government is yet to have Marsabit Town housing development plan. The public health department's environment health inspection staffs are fatigued by the genuine excuse of water scarcity by public service business as their reason of failure to maintain appropriate hygiene and environmental health standards, etc.

2. Marsabit Town relies on Marsabit Water Supply which is limited due to source and the rising main. . No traditional sources exist and hence everybody depends on Marsabit Urban Water Supply which is the only public piped water supply system. The source of the public water system is Bakuli spring whose discharge is not constant and is on the decline due to human activity in the Catchment. During drought, the flow reduces by over 80%. During rainy season it ranges from 9 to 11 litres per second while dry season it is 3.1 to 2 litres per second.

   The water coverage is estimated at about 14.76% since the average water produced is 800m^3/day of which about 30% is lost as leakages enroute against a water demand of about 3,795m^3/day. This situation is expected to worsen with time if no immediate action is taken.

3. Karantina Estate is a newly identified area where the land has been demacarted and title deeds are in the process. To set the pace for development, the county government is constructing an executive office which will house county ministers, their staff and the Governor.

   There are executive apartments and high class hotels. Occupation of these newly constructed structures will be amyth unless the area is supplied with piped water which cannot be sourced from current Marsabit Water Supply due to limitation of capacity unless it is augmented.

5.1.10.2 Badesa Dam Water Supply Project

5.1.10.2.1 Introduction

Badesa Dam Project is a stalled vision 2030, triple pumping/Gravity Water Supply Project which is 64.9% complete. The project was to provide to Marsabit Town and environs 4,870m^3/day of water to a population of 54,090 people in the future year of

2020 during phase 1 and rising to 7,349m^3/day to a population of 81,135people in the ultimate year of 2030 during Phase 2.

The source of water was supposed to be Badesa Dam with capacity of 5million m^3. Water was suppose to be abstracted from Badesa Dam located about 10km from Marsabit Town through 250mm diameter GI pipe, 300m long and pumped through 250mm GI pipe, length 300m and head 70m into a full water treatment plant where it will undergo full treatment before being pumped through a 4km long, 250mm diameter GI pipe and head 205m to a booster station where it will further be pumped 5.7km away through 250mm diameter GI pipe and head 205m into storage tanks located upstream of the current water treatment plant from where it will be connected to augmented current distribution system.

The following were the proposed facilities that were being developed:-

5.1.10.2.2 Source

Badasa dam site is located on Buji River between co-ordinates; 390290 Easting, 10249373 Northing at the centre of dam axis and about 10 km South East of Marsabit town.

The dam to be constructed is earth fill of the following particulars:-

Capacity	-	5million M^3
Catchment size	-	13km^2
Maximum Height of the Dam	-	52m
Crest Width	-	15m
Crest Length	-	330m

Plate 17: Stalled Badasa Dam

The dam has been grouted due to the pervious nature of the soil.
Of the required 52m, only 13m of the dam wall has been constructed.

Plate 18:Badasa dam area with intake tower

5.1.10.2.3 Intake Works

The Intake works consists of a 250mm diameter gravity ductile iron pipe of length 300m.

5.1.10.2.4 Raw Water Pumps

The design period for raw water pumps is 10 years (2020) and the recommended installation is of three pump sets each of capacity 102m^3/hr against head of 70m operating two on duty and are stand by. The required raw water main to the treatment is of length 300m and 250mm diameter ductile iron pipe.

5.1.10.2.5 Treatment Works

The treatment work will consist of chemically aided sedimentation, rapid gravity filtration, chlorination and pH correction with soda ash. The capacity of treatment plant will be 306m^3/hr operating 24hrs daily.

5.1.10.2.6 Treated Water Pumps

There will be two booster pumping stations for treated water. First booster station will be at the treatment works and the second one at height of 1205masl, along the road to KWS headquarters. The design period for the pumps is 10 years (2020) and the recommended installation at each station is of three pump sets each of capacity 102m3/hr against 250m head, operating two on duty and one standby.

5.1.10.2.7 Treated Water Rising Main

The rising main from the treatment works to the proposed site for the ground level reservoir, will be of diameter 250mm and length 9.7km. This rising main is design for the ultimate water requirement which is 7349m^3/day or 306m^3/hr.

5.1.10.2.8 Water Storage Facilities

The total storage capacity required by the year 2030 is 5510m^3 and for year 2020 is 3655m^3. The existing storage capacity is 595m^3. It is recommended to construct storage facilities to meet the difference of between the required storage for year 2020 and the existing capacity, which amounts to 3060m^3. The extra storage of 1850m^3 will be constructed after the year 2020.

5.1.10.2.9 Source of Power

Electricity will be extended from KWS headquarters to the dam site which is distance of 8km. Total power requirement is 1068Kw.

5.1.10.2.10 Project Cost Estimate

The Scope of Works consists of the following:-

i) Construction of 52m high embankment **Earth fill Dam** (of total storage 5,000,000m^3) including a 15m wide x 300m long crest and 18m high **Cofferdam**,
ii) Construction of Dam **Foundation** including **Grouting** works,
iii) Construction of reinforced concrete **Diversion Channel** (2.2 x 2.2 x 322m long) including a 2.2m diameter x 42m high **Reinforced Concrete Tower** with draw off (250mm dia.) and scour (500mm dia.) pipes,
iv) Construction of **Spillway**-side Channel (approximately 30m wide x 511m long),
v) Construction of **Raw water Pump House, draw off pipe** and laying of **Raw water** and **Treated water rising mains** (250mm dia.-10,770m approx. length) and associated connection fittings,
vi) Construction of all weather **Bypass and Crest Road** approximately 1.5km long,
vii) Construction of conventional water **Treatment Works** of capacity 306m^3/hr consisting of **Chemical House**, **2no**.**Hopper Clarifiers**, **4no. Rapid Sand Filters**, filter **pipe work** gallery and **Treated Water Sump (300m^3) and Pump Room**,
viii) Supply and installation of **Raw Water Pumps (3no.)**, T**reated Water Pumps (3no.), Booster Water Pumps (3no.) and Backwash Pumps (2no.)** with associated Electrical Works,
ix) Construction of **1no. 100m^3 elevated Steel tank**, **2no. 1600m^3 Reinforced Concrete storage tanks**
x) Construction of **Site Offices** and **Materials Laboratory**,
xi) Construction of **2no. Type II** and **6no. Type III** Residential Staff Houses

The Contract value of the works was KSH 2,389,846,058.83

The works was being undertaken by **Midroc Water Drilling Company Ltd** and it was expected to be completed in early 2014.

5.2 Sanitation

The provision of sanitation is a key development intervention – without it, ill-health dominates a life without dignity.

The term **sanitation** in its widest sense covers excreta disposal, sullage and storm water drainage, solid waste management and hygiene and stresses the need to go beyond a concern with the provision of the facilities to consider the services that people receive.

Simply having access to sanitation increases health, well-being and economic productivity. Inadequate sanitation adversely impacts individuals, households, communities and countries.

Despite its importance, achieving real gains in sanitation coverage has been slow. Scaling up and increasing the effectiveness of investments in sanitation need to be accelerated to meet the ambitious targets of Millennium Development Goals.

Nearly 40% of the world's populations (2.4 billion) have no access to hygienic means of personal sanitation. Globally, WHO estimates that 1.8 million people die each year from diarrhoeal diseases, 200 million people are infected with schistosomiasis and more than 1 billion people suffer from soil-transmitted helminth infections. A Special Session on Children of the United Nations General Assembly (2002) reported that nearly 5,500 children die every day from diseases caused by contaminated food and water.
Increasing access to sanitation and improving hygienic behaviors are key factors to reducing this enormous disease burden. In addition, such changes would increase school attendance, especially for girls, and help school children to learn better. They could also have a major effect on the economies of many countries – both rich and poor – and on the empowerment of women. Most of these benefits would accrue in developing nations.

In Kenya, environmental sanitation coverage declined in the decade up to 1990 and saw modest gains thereafter. In 1983, the national sanitation coverage was estimated at 49%., 45% in 1990 and 46% in 1996. Difference in access to adequate sanitation between urban and rural environments still persist, with the formally planned urban areas being better served than rural areas, urban slums, and informal settlements. In Kenya, 72% of the excreta disposal facilities are simple pit latrines providing varied degrees of safety, hygiene and privacy.

5.2.1 Proposed Introduction of Sewerage System in Marsabit Town

5.2.1.1 Drainage Regime

Marsabit Town has three distinct drainage as follows:-

1. Jaldesa lagga passing below the District headquarter. It drains most of Mountain Location which forms most of the Central Business District of Marsabit Town.

2. Hari Henry Drainage –It drains Nagoya and Part of Dakabaricha locations and
3. Halbota Pan-Slaughter House/Senegai Airstrip drainages the remaining part of Marsabit Town constituting 25%.

5.2.1.2 Zoning

The proposed Sewers were designed starting from the Public Works Sewerage Site moving upwards with emphasis on gravity mode of conveyance.

Arising from above, three zones were identified. Zone 1 with an area of 3.25km^2 was found could drain with ease to Public Works Sewerage Site. Zone 2 and 3 were forced using three pumping stations and hence it is strongly recommended that another site be identified in Majengo area of about 5hectares to serve Zones 2 and 3 while Public Works Site serve Zone 1.

Table 21 below has the details.

Table 21: Identified Zones

Zoning						
Zone Number	**Description of the Area**	**Squares Covered (Nos.)**	**Area of Square in Km^2**	**Area of Zone (KM^2)**	**Unit Sewage Generation in m^3/day /km^2**	**Average Sewerage to be Generated in M^3/day**
1	Graveyard, Central Business District, Mountain Location and upto Moi Girls High School	13	0.25	3.25	1132	3,679.00
2	Nagayo Location and Majengo Estate	5	0.25	1.25	896	1,120.00
3	Part of Mountain Sublocation Bordering Marsabit Mixed and Primary School Near Power Station	1.5	0.25	0.375	1132	424.50
	Marsabit Town	**19.5**		**4.875**		**5,223.50**

5.2.1.3 Introduction of Sewerage System in Marsabit Town

The proposed Sewerage Works will consist of:-

- Preliminary Treatment consisting of screening, Grit Chambers and measuring Parshal Flume
- Grit Chambers at the start of Sewers
- Sewers of sizes ranging from 225mm to 450mm and total length 16.911km and consisting of 18 sewer lines.
- Five Pumping Stations with discharge of 40litres/Second and head ranging from 5 to 45m with four in Majengo Area and one at Waste Stabilization Ponds
- Five Rising main of diameter 250mm Bitumen Coated and total length about 3km (Refer Figure 16) and
- A total of 10 waste stabilization ponds are proposed to be constructed in two trains and covering an area of 19.84hectares (418.16m by 412.28m) and capacity to treat 3,600m^3/day of waste water. The ponds consist of Anearobic (52.92M by 30.92m and depth 3.0m), Facultative (218.08 by 112.7m and depth 1.5m) and three number maturation ponds.

About 5 Hectares of land exist at Public Works Area in Mountain location

The particulars of the site are:-

Altitude	1329m
Longitude	0388612UTM East
Latitude	0257281UTM North
Region	37N

The proposed sewage treatment site is currently used as a farm land and is close to Jaldesa Lagga.
However, an extra 10 Hectares will have to be acquired.

Figure 15 below has the details.

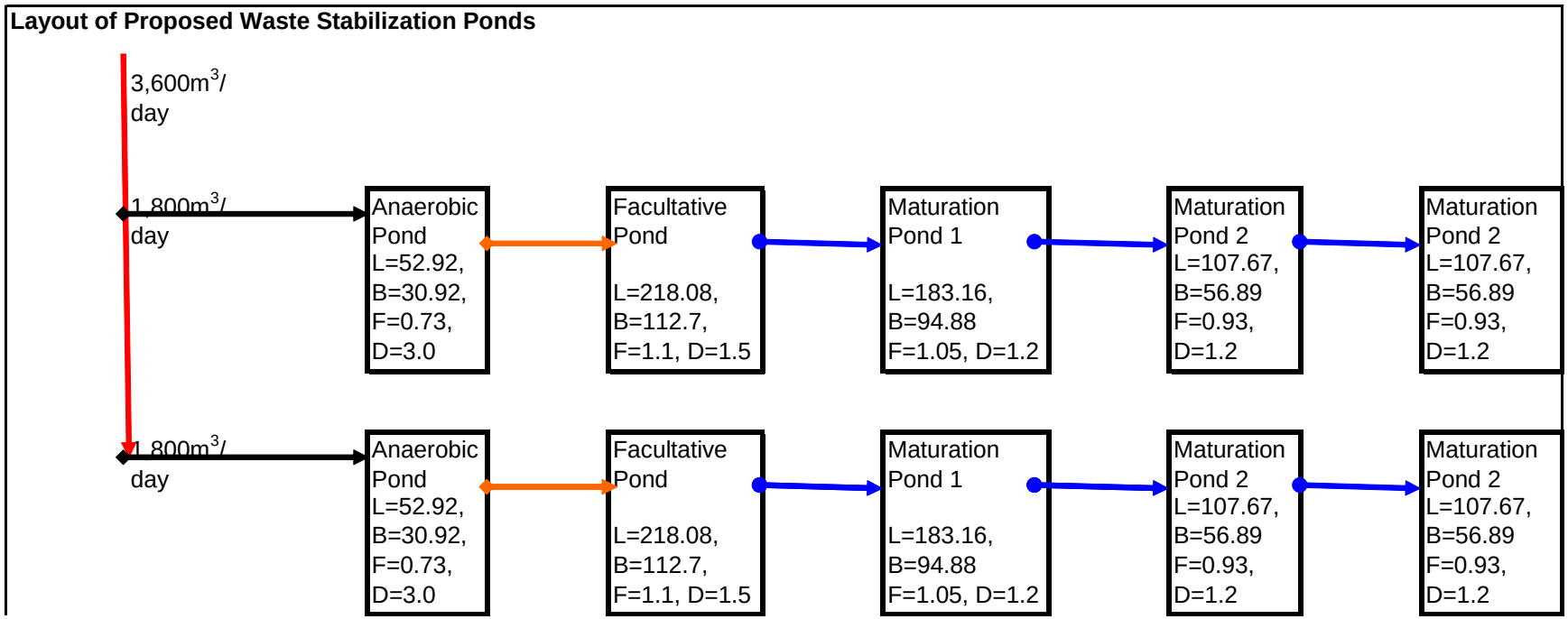


Figure 14: Layout of proposed Waste Stabilization Ponds

Total Area of Ponds=481.16x412.28=19.84Ha

1Hectare=10,000m^2

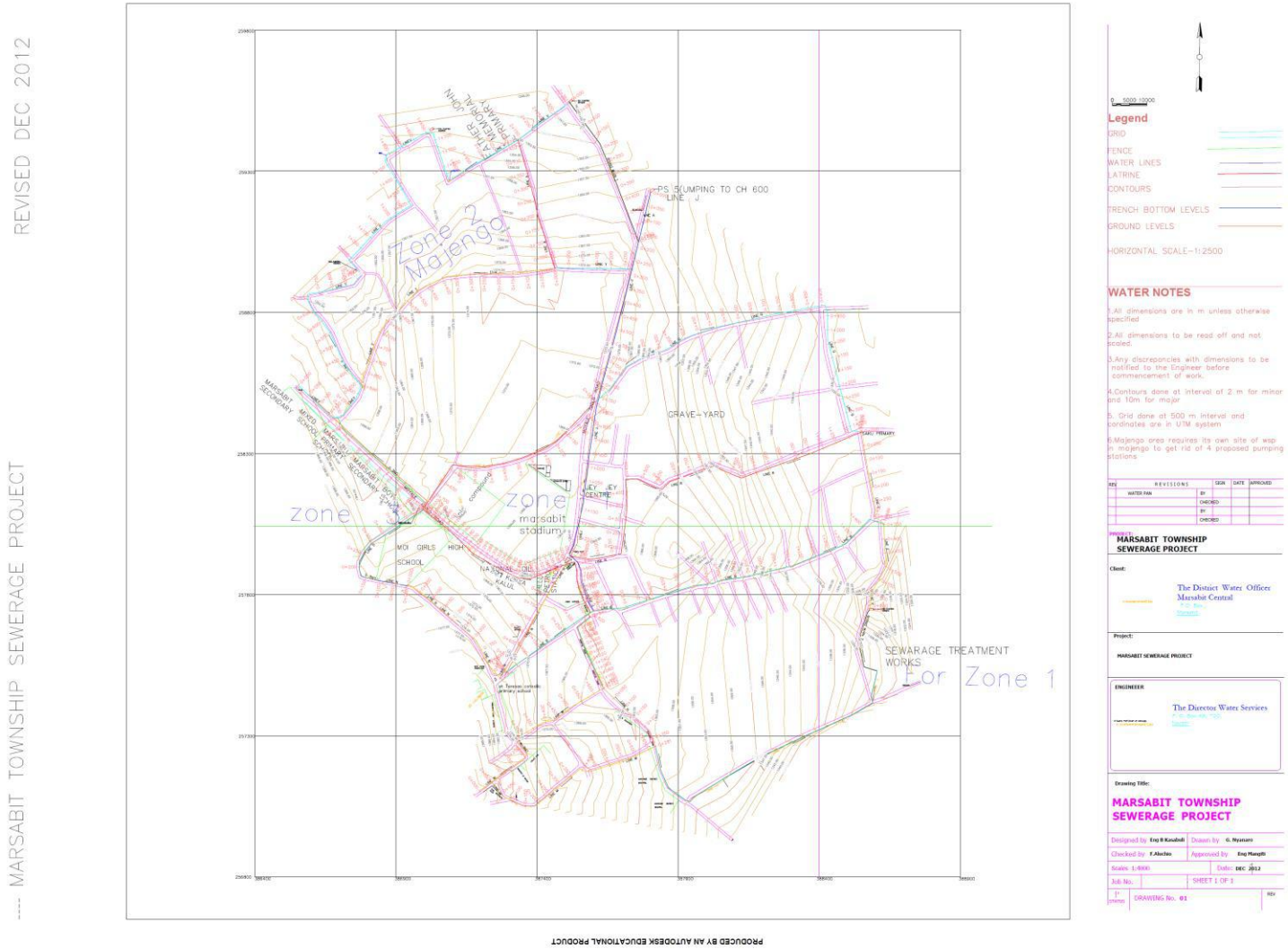


Figure 15: Layout of the proposed Sewerage Work

5.2.1.4 Capital Required

Kshs 1,052,796, 733 is required to Construct Marsabit Sewerage Works with capacity to treat 3,600m^3/day. The works includes laying of 16.91km of Precast Concrete Sewers of diameter varying from 225mm to 450mm, 5Nos. Pumping Stations, 5Nos. Rising Main of diameter 250mm and total length about 4km and two trains of Waste Stabilization Ponds consisting of 5Nos Ponds i.e. 1Anaerobic, 1Facultative and 3Nos. Maturations each train on 20 Hectares (All the two trains) of land at Public Works. Already 5Hectares exist and should be acquired and the remaining 15Hectares sourced from nearby areas.
It should be noted that the works can be constructed in two phases as follows:-

1. Phase 1 - with total cost of Kshs 550million and

2. Phase 2 - With a similar figure as Phase 1 above.

Table 22: Estimated Cost of Marsabit Sewerage Works

MARSABIT SEWERAGE WORKS		
BOQ SUMMARY		
BOQ NO.	**DESCRIPTION**	**AMOUNT (KSHS)**
1	PRELIMINARY AND GENERAL ITEMS	39,560,000
2	SEWERS	282,037,849
3	Pumping Station 1	35,311,871
4	Pumping Station 2	28,180,271
5	Pumping Station 3	35,601,871
6	Pumping Station 4	34,869,871
7	Pumping Station 5	33,141,871
8	Treatment Plant	345,522,767
9	DAYWORKS	8,011,015
	SUB-TOTAL	**842,237,387**
	ADD 10% FOR CONTINGUENCIES	84,223,739
	ADD 15% FOR PRICE EXCALATION	126,335,608
	GRAND TOTAL	**1,052,796,733**

5.2.2 Possible Alternatives

In consideration for the cost of running the pumping stations, development of alternatives was anchored in removing part or all the pumping stations.

A total of five (5) pumping stations with discharge of 8Litres per second against varying pumping head of 7 to 45m. 8L/Second is the minimum discharge for centrifugal sewage pumps available in the market.

Source: World Health Organization Report No. 9.page 61

Table 23 has the details.

Table 23: Proposed Pumping Stations

Code of Pumping Station	Location	Discharge (L/Sec.)	Pumping Head (M)	Pumping Area	Required Pumping Equipments	Zone Number
PS1	Majengo	8	40	From Line V to PS 5, about 550m away	4.48KW Pump Coupled to 5.83KW Motor	2
PS2	Lagga Jaldesa	8	20	From Jaldesa Lagga to WSP about 257m away	2.24KW Pump Coupled to 3.36KW Motor	1
PS3	Got Made Lagga, near Marsabit Primary School	8	15	From Got Made Lagga to Manhole V41 on line V, about 800m away	1.68KW Pump Coupled to 2.18KW Motor	2
PS4	Got Made Lagga, in Majengo Area	8	7	From Got Made Lagga to Manhole V41 on line V, about 220m away	0.78KW Pump Coupled to 2KW Motor	2
PS5	Along Marsabit - Moyale Road	40	20	From Chainage 0 to CH 600 Line J along Marsabit-Moyale Road	2.24KW Pump Coupled to 2.91KW Motor	Boundary of Zone 1 and 2

The Pumping Stations will require Kshs 156,000 for paying electricity without mentioning other operational difficulties.(Refer table 24)

Table 24:Estimated Monthly Energy Costs in Kshs

Estimation of Monthly Energy Costs in Kshs				
Type of Pumping Equipment	Energy Required Per Month in KWH/Month	Fuel Required in Lts/month	Energy Cost in Kshs(Using Diesel)	Energy Cost in Kshs(Using Electricity)
PS1	3,840	960	120,000	61,440
PS2	1,920	480	60,000	30,720
PS3	1,440	360	45,000	23,040
PS4	672	168	21,000	10,752
PS5	1,920	480	60,000	30,720
Total	**9,792**	**2,448**	**306,000**	**156,672**

5.2.2.1 Removal of PS2 from Jaldesa Laga

This implies the ponds should be arranged at proposed site along Jaldesa Laga.

According to scavenging undertaken during this EIA identified the proposed sewerage site as per PDP, 1969 at Elisha Godana's land located at:-

Region 37N
Longitude 0388809E UTM
Latitude 0257032N UTM
Altitude 1323m

An additional land of about 5 hectares can be acquired from site 2 on Galgalo Boro/Khaliff Kuse located at:-

Region 37N
Longitude 0389629E UTM
Latitude 0257032N UTM
Altitude 1290m

However the best site which will allow removing of PS02 was found on good flat land adjacent to laga Jaldesa with alluvial clay soil at:=

Region 37N
Longitude 0389716E UTM
Latitude 0257228N UTM
Altitude 1263m

Refer to Figure 17.

5.2.2.2 Removal of All the Pumping Stations

This will involve obeying the existing drainage regime in Marsabit Town.

Two WSP sites will be provided.

1. The site adjacent to Jaldesa Laga will serve Mountain Location and an area of 7 Hectares will be required.
2. A New site at Majengo WSP site behind KARI will serve Got Gade drainage basin. The land is located at Got Gade laga at:-

Region	37N
Longitude	03686025E UTM
Latitude	0259834N UTM
Altitude	1303m

Refer to Figure 17.

Plate 19: Consultation at KARI WSP

Plate 20:Gotu Gade Laga

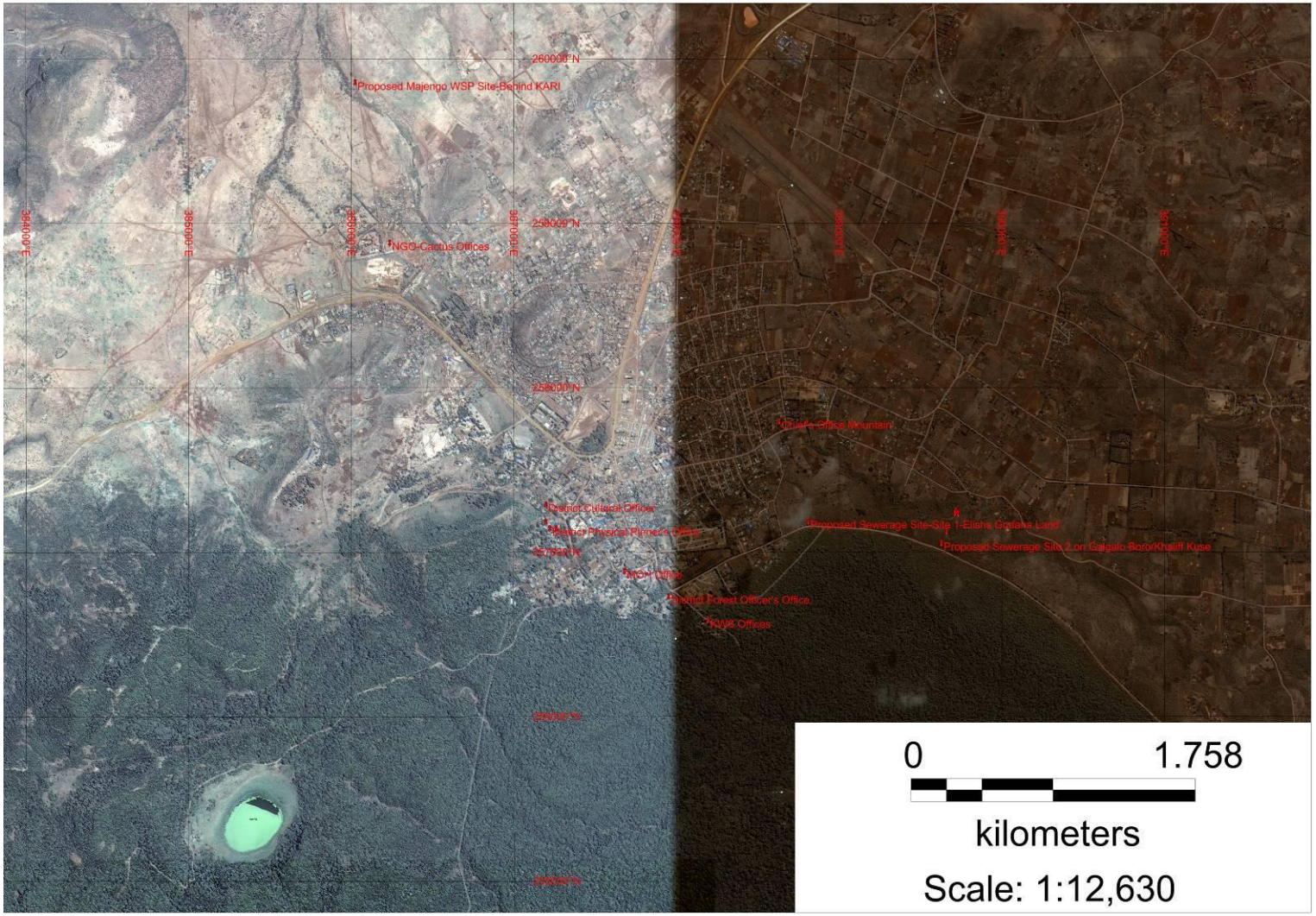


Figure 16: Various Possible Locations of Waste Stabilization Ponds and offices visited

CHAPTER SIX

6.0 PUBLIC CONSULTATION

6.1 Public Participation

Public Participation in the development of an Environmental Impact Assessment Report is necessary and indeed highly desirable to ensure public support for the favoured alternatives and to ensure that no major omissions or mistakes are made in the analysis. Public Participation shall be encouraged as early as possible in the EIA planning process to minimize rejection risks and also facilitate useful contribution. Public Participation has the following benefits:-

a) Establish common needs and ensure that the project continues to satisfy these needs or even enhance the needs
b) Provide background information which forms an important part of base line data; and
c) Create awareness in the community and sensitize it on environmental issues related to the project

Public participation shall be achieved by the following methods:-

- Opinion Surveys and
- Barazas/workshops

6.1.1 Public Opinion Surveys

Opinion Surveys are used to reach a large or diverse community. Public Opinion sampling must be carefully planned and managed to obtain valid results. This method may not be suitable for dealing with complex issues.

6.1.1 Public Barazas and Workshops

Public barazas enable people who might be affected by the project or people who might have any interest to put forward their views and debate issues openly. Workshops are good for individual or interest groups with expert knowledge who have a genuine interest but may not like to express their opinion in public. This also avails more time for participation and tackling of issues in depth and exhaustively.

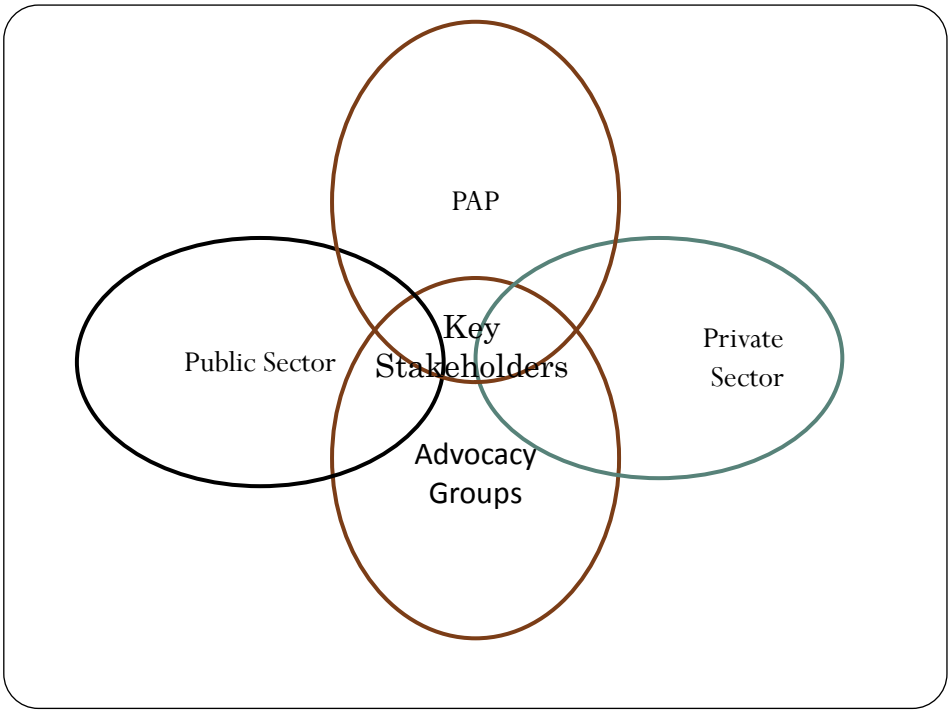
It is important to involve local communities throughout the initial stages of planning, design and implementation of the project.

6.2 Stakeholders Analysis

6.2.1 STAKEHOLDERS: WHO AND WHY THEY NEED TO BE IDENTIFIED?

- Identifying key stakeholders is essential in understanding project outcomes
- Include the various groups who have an interest or a stake in the project

- Include those who are likely to be affected by the projects as well as those who may have an influence over the project



6.2.2 STAKEHOLDER ANALYSIS: WHAT AND WHY?

- Reveals the nature and magnitude of social actors' interests in and influenced by the project
- Stakeholders can be winners or losers, or indifferent
- Important to analyze what are the key players' *assets* and *capabilities*
- By analyzing assets and capabilities, people's liabilities and deficiencies also come out – helps to create a more equitable project.

6.2.3 Four main outputs of Stakeholder Analysis

- Potential winners and losers (those who will be affected positively or negatively by the project) are identified
- Participants' commitment to the goals of the project – their ownership of the project—is assessed
- The likelihood of the stakeholders' assisting or obstructing the project's development objectives is evaluated
- Monitoring stakeholder involvement during implementation stages

6.2.4 How to identify stakeholders?

- To determine who will be directly or indirectly affected, positively or negatively by a project
- To ensure an exhaustive list of stakeholders

- Often context-specific
- Participatory methods are considered as better practices
    - the extent to which stakeholders can influence development by contributing to project design, influencing public choices and holding public institutions accountable for goods and services.
    - the extent to which poor or excluded people are likely to benefit from access to opportunity

6.2 Stakeholders Analysis of Bakuli 4 Dam Project and Introduction of Sewerage System

6.2.1 Analysis

Inorder to identify the stakeholders to consult, stakeholder Analysis was undertaken.

A total of 10 Departments were identified as key for EIA Consultation.

(Refer table 25).

Key informant interviews were carried out with those people who were perceived to be in a position of providing useful information on the water and sanitation situation in Marsabit Town. The following key informants were interviewed (Refer table 25) and figure 17 for their locations.

Table 25: Stakeholders Analysis

Stakeholder	How will he be affected by the Project	Influence of Stakeholder
Kenya Wildlife Services (KWS)	Major Part of the Project is located in Marsabit Game Reserve	Major
Kenya Forest Service (KFS)	Major Part of the Project is Located in Marsabit Gazetted Forest	Major
Water Resources Management Authority	Is incharge of Water Resource. He will benefit from the abstraction through payment of abstraction levies	Major
Lands,Physical Planner,Registrar,Adjudicator	The Reference document is PDP 1969, Where Mountain WSP is located	Major
District Environmental Officer	He will have to isssue Environmental License	Major
Culture	If the project is located in a cultural site	Minor
Provincial Administration	Help in Acquisition of WSP lands, Provide security and Help in ensitization of the Population	Major

Stakeholder	How will he be affected by the Project	Influence of Stakeholder
Kenya Airport Authority	Mountain WSP is located in the flight path	Major
Ministry of Health	Water Borne Treatment	Major
County Government	He is the client and will help in acquisition of land	Major
NGO,s-Caritus	He has Experience in Undertaking Water Projects on behalf of Catholic Diocese of Marsabit	None
FH(K)	He has some element of Water and Environment	Minor
PACIDA	None	None
Concern	None	None
Goal Ireland	None	None

6.2.2 Arising Issues

Each stakeholder was consulted individually.

Table 26 has the arising issues, Appendix 4 has the stakeholders consulted while Appendix 5 has the Consultation Minutes.

Table 26: Arising Issues from Stakeholders Consultation

Stakeholder	Arising Issue
Kenya Wildlife Services (KWS)	Existing Flora:Baboon, Elephant,Buffalo,Zebra found on the low land, Leopards
	Fauna: Olea, croaton being dominant, Cedar and small species
	Access Pass
Kenya Forest Service (KFS)	Compensation for Trees to be cleared in the dam area and pipe wayleaves
MCA of Mountain WSP-Mr. Chikuliza	Land issue has become very sensitive
	Have Plans of putting a dam upstream to be used for Irrigation. Hence issue of sewage is not a good idea
Water Resources Management Authority	Is incharge of Water Resource. He will benefit from the abstraction through payment of abstraction levies
District Adjudication Officer	Land Ownership. People have title deeds in Mountain Location and in Karantina (Barrier) they are now collecting title deeds. In Town, Title deed not yet processed

Stakeholder	Arising Issue
District Environmental Officer	Marsabit Ecosystem is a sensitive area
	Borehole dug was in Logo Logo and gave them a lot of issues
	Dwindling forest cover from 18,000Ha in 1963 to 11,000Ha in 2015
	Two lodges being constructed in Bongole where there are a lot of birds stopped due to lack of Environmental License.
	Encoachment in the Forest. Governor's Residence is in the Forest
	Sewerage is a new phenomenon for the community
	Proper Community Consultation
	Ownership-Land is emotative
	Soil is extremely loose in Marsabit Town
	Loose of Diversity
	flood-when it rains, you get a lot of runoff. The runoff from wajir comes from here
	project impacts;dust pollution, acceptance,improved sanitation, curent there is no water, sewerage should wait until a problem crops up, mountain wsp is the flight path. This has forced relocation of slaughter house
	Proposed Mountain WSP is near the National Park and could be invaded by Baboons or attract other species of wildlife
	soil contamination issues
	Emgangered Species:- Leopard-Number Reducing
	Medical Plants:- Pronas African-Has potential for treatment of prostrate cancer and is found in Kulal and extinct in Marsabit Forest
	Cedar-Lost only in Kulal
Kenya Power and Lightining	Price of Transformer is Kshs 3million
Culture	If the project is located in a cultural site
Provincial Administration	Price of 100x100ft plot in Majengo is Kshs 600,000 to Kshs 800,000
	Within Jirme, Not Less than Kshs 600,000
	to Consider at least 3 options for Mountain WSP
	Consider Buying back the land for Mountain WSP which would be an issue
	Title deeds were given for Mountain WSP in 1993
	The owner , Mr. Elisha knows about it and should be consulted

Stakeholder	Arising Issue
	Forest closed for grazing in year 2012. This increased spring discharge and flora. Moi spring has regenerated due to closing Forest for firewood and grazing. About 300 people used to take firewood from the Forest
	Elephant drowned in Bakuli 3 Dam
	Land belongs to Elishs Godana
	Wind blows from East to West
	Part of the land already sold
	Tored the site with Elishs and Godanaof Elisha
	Land is about 8 hectares
	100 by 50 feet costs Kshs 1 million
	When the Project will take off
Tour of Mountain WSP	
Kenya Airport Authority	Mountain WSP is located in the flight path
	Level of latrine coverage is very low at 35%
	Within Town we have serious water shortage forcing them to buy water from low land e.g. Logo logo.
	Water Scarcity in Marsabit Town
	Disease Prevalence
Ministry of Health	Marsabit Referal Hospital get water at most once per month. They are forced to buy from booster
County Government	He is the client and will help in acquisition of land
NGO,s-Caritus	He has Experience in Undertaking Water Projects on behalf of Catholic Diocese of Marsabit
FH(K)	He has some element of Water and Environment
PACIDA	None
Concern	None
Goal Ireland	None

CHAPTER SEVEN

7.0 ENVIRONMENTAL IMPACT ASSESSMENT AND MITIGATION MEASURES

7.1 General

The Environmental Impact Assessment (EIA) is used as tool to guide environmentally sustainable solutions. Bakuli 4 Dam Project and Introduction of Sewerage System in Marsabit Town is expected to generate environmental impacts and hence the need to subject the project to an EIA.

This chapter analyses the potential impacts of the proposed Bakuli Dams, raw water, treatment works and sewerage treatment works. The potential impacts will be derived from the baseline information and the project activities.

7.2 Project Activities

The proposed Bakuli 4 Dam Project and Introduction of a Sewerage System in Marsabit Town will involve the following:

- Clearing bush
- Excavation
- Construction of Bakuli 4 and Enhanced Bakuli 3 Dam
- Construction of sewage treatment works and a Laboratory
- Installation of pipe works
- Construction of storage tanks
- Movement vehicles
- Staff
- Land acquisition and compensation
- Pedestrian and animals crossing
- Protection works along the reservoir
- Clearing of site of any unused materials

7.3 Identification of Environmental Impacts

The study team involved key stake holders to assist in identifying the potential impacts. The screening process involved visiting the proposed project sites and stakeholders consultation.

7.3.1 Requirement

The following are the available methods for Environmental Scooping:-

01. The Adhoc Method
02. The Checklist Method
03. The Matrix Method
04. Network Method and
05. Cost Benefit Analysis

7.3.1.1 The Adhoc Method

This is a quick and effective method that compares basic characteristic of several possible alternatives for a given project.

7.3.1.2 The Checklist Method

These are comprehensive lists of environmental effects and impact indicators designed to stimulate the analyst to think broadly about possible consequences of the contemplated actions.

Checklists range from simple listings of environmental factors to descriptive approaches which, include information on measurements, predictions, and interpretation of changes. Scaling and weighting is used to rank impacts in order of importance and magnitude.

Impacts have spatial and temporal attributes which can occur near or far and whose effect may vary with time. Other impacts are irreversible while others are cumulative. The long term irreversible impacts are given higher weighting than short term reversible ones. Scaling and weighting takes into account the impact characteristics.

7.3.1.3 The Matrix Method

These are tables with the Y-axis showing the potentially affected environmental features or characteristic of the physical-chemical, biological, and human environment. The X-axis shows the project components that would have impact on the environment.

7.3.1.4 Network Method

This is an approach for investigating and presenting higher order impacts. Its key objective is to display in an easily understood format the intermediary links between a project and its ultimate impacts.

The network permits the analyst to visualize the connection between action and impact as best suited in a single project assessment. Network and matrices are most suited for the identification of impacts but are cumbersome in evaluating different alternatives. In addition, networks are difficult to apply requiring high skilled manpower and computers.

7.3.1.5 Cost Benefit Analysis

The procedures for conducting economic evaluation for the best alternatives require the conversion of quantified impacts to monetary terms. Impact evaluation presents varying degrees of deficit. Some impacts, such as construction, maintenance and operation costs are already expressed in monetary terms. Environmental impacts both positive and negative must be converted into money equivalent. All the possible alternatives including the cost of of the different mitigating measures must be considered before a decision is made on the economic viability of the project.

7.3.2 Bakuli 4 Dam Project

A Checklist was used for scooping due to its easy usage (Refer Appendix 6)

12 items were found to have major negative impacts while 19 were found to major positive impacts.

The items which were found to have major Negative impacts are:-

- Flood Regime
- Eutrophication
- Gas Emissions
- Local erosion
- Hinterland effect
- River Morphology
- Channel Engine
- Sedimentation
- Project lands
- Disease control and
- Disease Hazards
- Surface Water Quality

The items with major positive impact are:-

- Low Flow Regime
- Operation of the dam
- Water Table level
- Ground Water Quality
- Soil Properties
- Water Logging
- Water Bodies
- Surrounding Area
- Wetlands and Plains
- Wildlife
- Vegetation
- Climate
- Income
- Employment
- Settlement
- Recreational sites
- Infrastructure
- Water and Sanitation and
- Disease Ecology

7.3.2.1 Negative Impact

7.3.2.1.1 Flood Regime

The flood regime is going to be decreased and altered downstream of Enhanced Bakuli 3 Dams. Flood will only be released downstream of Enhanced Bakuli 3 Dam when the dams is full. This implies there will be no flood release downstream in a half a year.

This wills sterve riverine vegetation downstream water hence either making them die or the area being colonized by other drought resistant vegetations.

7.3.2.1.2 Eutrophication

Most of the sediments will be leaves falling from the trees in the forest and being carried into the dam by the runoff. This might reach a point where it will lead to eutrophication unless corrective measures are taken like applying soil conservation measures.

7.3.2.1.3 Gas Emissions

During construction, machines will be involved.

However, considering the steepness of the area, mostly human will be adopted and machines will only play a periphery role apart from supplying material to the site.

7.3.2.1.4 Local erosion

During construction, there will be excavation. This will increase local soil erosion unless erosion control measures, making good after excavation and re-planting excavated vegetation after finishing the work.

Further, it is proposed the work should be carried during dry season to minimize the effect of soil erosion.

7.3.2.1.5 Effect of River Impoundment

The changes following the creation of an impoundment will stem from the physical changes induced by the reservoir, owing both to its presence and to its operation.

The construction of an impoundment generally will involve raising the water level upstream, and this will change the morphology of the reaches approaching the reservoir as well their erosion and sedimentation process. It also involves lowering the water level downstream and blocking the passage of floating debris.

7.3.2.1.5.1 Shoreline Erosion

Erosion of the new shoreline and unstable slope will sometimes be observed phenomena on the fine grained banks of a reservoir flooding. The creation of a large body of water will increase the influence of the wind and wave action on the banks.

Certain steps will be taken to limit the erosion of reservoir banks, control of shore use, shore zoning, soil conservation measures in certain sensitive shoreline sectors, use of vegetation resistant to the prevailing filling anddraw-down regime and appropriate management of levels and flow are some of the mitigation measures that will be taken.

7.3.2.1.5.2 Sedimentation

The dams will allow suspended matter to settle out from river water and acts as a trap for sediments transported during rainy periods or heavy storms. Intensified activities in the reservoir catchment, land clearing and deforestation will provide additional inflow of sediments, which is deposited in the reservoir.

Fine sediments might form a mud lake just in front of the dam capable of blocking the bottom outlets as it hardens. Ultimately, the accumulation of sediments will reduce the reservoir's storage capacity.

7.3.2.1.6 Project lands

7.3.2.1.6.1 Bakuli Dams

The construction of enhanced Bakuli 3 dams will lead to inadutation of 3.5 Hectares of Forest Land.

The area will have to be cleared.

For Bakuli 3, the following trees will be cleared:-

Red Tink	1,045Numbers
Diopsy	19 trees
Wild Olive	43 Trees
Croaton	770 trees
Cordia Africana	3 Tree

This will require to be paid to Kenya Forest Service.

Using a rate of Kshs 149,849/Hectare, it implies Kshs 524,471.50 will have to be paid to Kenya Forest Service.

7.3.2.1.6.2 Pipeline

Pipeline will generally follow public right of way.

The pipes will follow in the road reserve and the raw water rising main will be laid parallel to the existing rising main.

7.3.2.1.6.3 Karantina Tank

About 0.1acres will be acquired at the proposed hill at the tank site located upstream of executive office at a cost of Kshs 2million since it is located on an individual land

7.3.2.1.7 Disease Hazards

Presence of two large bodies will provide breeding grounds for mosquitoes. This will increase cases of malaria incidences.

7.3.2.1.8 Surface Water Quality

A reservoir induces effects on water quality at each stage of its development. Both the water behind the dam and the water in the river downstream the impoundment will be affected..

The flooding of the impoundment triggers possible leaching of the flooded soil and decomposition of organic matter, with subsequent effects on the physical and chemical properties of the water. In addition, the method of operation of major reservoirs entails a change in thermal stratification and distribution of dissolved oxygen which also acts on the chemical properties of the water.

The presence and operation of the reservoir may accelerate the ageing of the water body and its eutrophication to the extent of affecting its different uses.

7.3.2.2 Positive Impact

7.3.2.2.1 Low Flow Regime

Bakuli Spring is the current source of water of Marsabit town Gauging data for the springs are available from 1970 to 1979. The Reference Number is 5E6

According to the analysis undertaken, the 96% dry flow is estimated at 66.2m^3/Day and it is on the decline due to climate change. (Refer table 27).

Table 27**:** Dry Flow of Bakuli Spring from 1971 to 1979

Table: The Dry Flow of Bakuli Spring from 1971 to 1979

Year	Minimum Daily Flow (m3/day)	m	Descending Order	Rank	(n/(m+1))* 100
1971	267	6	49	6	85.71429
1972	267	6	91	5	71.42857
1973	130	6	91	5	71.42857
1974	91	6	91	5	71.42857
1975	103	6	103	4	57.14286
1976	49	6	130	3	42.85714
1977	91	6	242	2	28.57143
1978	91	6	267	1	14.28571
1979	242	6	267	1	14.28571

With construction of enhanced Bakuli3 dam, the low flow regime will increase from 66.2m^3/day to about 1,375m^3/day i.e. over 20 fold.

7.3.2.2.2 Operation of the dam

The offtake is a 10" GI pipe which will be opened when there is pumping.

There is a scouring 10"GI pipe which should be opened at least twice per year to release sediments downstream.

7.3.2.2.2.1 Physical Properties

The major changes related to damming will be the transformation of a river regime into a lacustrine regime. The normal river regime is characterized by significant velocity, mixing and turbulence of water, suspended loads and bed load and high reparation rate. A lacustrine regime is characterized by slow velocity, low mixing and turbulence, sedimentation, less aeration, thermal stratification, longer residence time, wind and wave action and shore erosion.

Turbidity

The opration of filling up of the reservoir by flooding soil may bring into suspension a number of particles which can temporary alter the clarity and color of the water and in extreme conditions contribute to raising its temperature.

Thermal Stratification

Reservoirs with long water residence time and water depth of more than 10m will have frequent thermal stratification. In general, tratification is caused by density differences set up by the differences in temperature, salinity, sediment load, turbidity and other water quality parameters. Thermal stratification is the result of warming up at the water surface by radiation and the vertical mixing which can be induced by wind and wave forces at the water surface.

It appers that reservoirs in tropical regions retain there thermal stratification longer than in temperate climates. In hot tropical environments, the thermal stratification is more intense and induces a much more stable thermal barrier than in cooler environments.

7.3.2.2.3 Water Table level

Damming will cause rising of water table in the vicinity.

This will cause blossoming flora in the environs of the dam.

7.3..2.2.4 Ground Water Quality

Stored Water in the dam will lead to leaching fresh water to the ground water table. This will improve the quality of water due to this dilution.

7.3..2.2.5 Soil Properties

The stored water will also store silt and humus which is washed into the dam over time.

With time elapse, the soil property will improve and could be used as manure during desilting.

7.3.2.2.6 Water Bodies

7.3.2.2.6.1 Effect of flooding on Fauna

Enhanced Bakuli 3 Dams will directly affects the fauna upstream of the dams in many different ways:-

- Some animals will die although there may be ways of moving them
- Some animals will migrate into new areas
- A few animals accodate in the new environment, particularly amphibians and riparian fauna
- Birds will move into the new water habitat.

An important secondary effect which can arise is that animals displaced from the reservoir area may disturb the equilibrium of the new habitat they moved in.

The creation of a new body of water can have positive effect on bird life as the reservoir establishes conditions conducive to a large increase in the variety and numbers of water fowl, waders and their predators. The loss of primarily terrestrial habitat is often compensated for, by the large increase in water and riparian habitat and protection of endangered species of water fowl.

The effect of flooding on fauna is generally more pronounced in wet tropical regions and less severe in arid and semi-arid environment.

7.3.2.2.6.2 Effect on Climate

While the climatic features which influence large water bodies are quite well known, such as the effect of wind, precipitation and air temperatures, the influence of a water body on the climate is hard to determine and is the subject of some controversy. The climate changes caused by the reservoir are so minimal that it is hard to distinguish the specific impact associated with the presence of the new water body from the region's complex weather system and its normal fluctuations.

Generally speaking, the main climatic changes that can be induced by a major body of water such as an impoundment are the effect on temperature, wind regime, evaporation and humidity, precipitation and occurrence of fog.

The larger the water body, the greater its heat capacity is. The water body has the effect of reducing variations in local temperatures. Reservoirs can also affect atmospheric stability.

The creation of a large reservoir creates a large flat surface and offers less resistance to the flow of moving air with increased wind velocity.

It is generally accepted that, in the same climatic regime, the amount of water evaporated annually by a water body is proportional to its area and is inversely proportional to its depth. It also appears that the seasonal variations are higher for shallower lakes, whereas deeper lakes have later minimum and m eva.

It has demonstrated experimentally that large reservoirs produce a new microclimate. The influence of the new water body on local precipitation is however the subject of much controversy. Increased precipitation has been observed in the areas surrounding large rewervoirs in the tropical regions. These observations are based on short term records and it would be rather risky to draw the conclusion that the increased precipitation is due to the reservoir formation.

Fog generally occurs more frequently after a reservoir is built. In warm climates, a large shallow impoundment area can increase fog generally on the coolest days.

In coclusion, the climatic effects of reservoirs are likely to be quite local. Predictions should be made for all new reservoirs of significant size

7.3.2.2.6.3 Local Economy

1. Casuals will be sourced from Marsabit Town
2. Materials which could be obtained locally will be sourced from Marsabit Town
3. Fuel and lubricants will be sourced from Marsabit Town

All the abovr will make the local economy of Marsabit Town to grown

7.3.2.2.6.4 Water Born Diseases

Some of the worst human diseases are of parasitic nature and are transmitted to man by vectors, such as mosquitoes and snails that breed in rivers, lakes and wetlands. New reservoirs will expand these breeding grounds thus increasing the density of vectors in the area and submitting the local population to higher risks of infestation. Malaria incidence will rise significantly among pump attendnants with creation of enhanced Bakuli dam.

7.3.3 Introduction of Sewerage Works in Marsabit Town

A Checklist was used for scooping due to its easy usage (Refer Appendix 7). The scoring was undertaken according to the anticipated Impacts as follows:-

A	-	Significant Impact Anticipated
B	-	Slight Impact Anticipated
C	-	Unknown (Subject to further Verification)
D	-	Almost no impact anticipated and not subject for IEE and EIA

9 items were found to have significant impacts of which 6 are negative impacts while 3 have major positive impacts.

The items which were found to have major Negative impacts are:-

- Relocation
- Topography and Geology
- Soil Erosion
- Ground Water
- River and Lake
- Fauna and Flora

The items with major positive impact are:-

- Economic Activity
- Health and Hygiene
- Waste Disposal

7.3.3.1 Negative Impacts

7.3.3.1.1 Relocation

7.3.3.1.1.1 Laga Jaldesa Drainage Basin

This Waste Stabilization Ponds is to serve Mountain location. It is located in individual land who has title deed in his name. The land belongs to Mr. Elishs Godana and is located at:-

Region	37N
Longitude	0388809E UTM
Latitude	0257165N UTM
Altitude	1323m

The wind blows from East to West.

According to reconnaisence study undertaken during the preparation of EIA revealed that it is possible to remove Pumping Station 2 (PS2) which was to be located at the start of the Waste Stabilization Ponds.

As concerns acquiring land from Elishs Godana, during consultation in the presence of:-

1. Mr. Kombo who is the D.O. of the area
2. The Chief of the Area
3. Mr. Jacob and Abraham who are the sons of Elisha

Suggested thus:-

01. Part of the land is sold and is already occupied
02. The remaining land is 8 acres
03. According to current market rate of land in Marsabit Town, 100ft by 50ft currently costs Kshs 1million implying that 1 acre will cost Kshs 10million

To acquire the whole of 8 acres, about Kshs 80million will have to be paid as compensation cost.

It was noted that the area drains towards Sagante Lodge and note BADASA Dam, the ultimate source of water to Marsabit Town.

Site 2 was identified as an option and extension. This site is located about 200m infrond of the boundary of Mr. Galgalo Boro and Mr. Khaliff. Like Elisha's, the land is bare and is used as a farm land. The land can be identified by GPS at:-

Region	37N
Longitude	0389629E UTM
Latitude	0257032N UTM
Altitude	1290m

Figure 17 above has this location.

However, the best site of eliminating PS2 is adjacent to laga Jaldesa at:-

Region	37N
Longitude	0389716E UTM
Latitude	0257228N UTM
Altitude	1263m

With the best site located at:-

Region	37N
Longitude	0389731E UTM
Latitude	0257213N UTM
Altitude	1266m

The place belongs to Khaliff and it is near Jaldesa and the soil is good alluvial soil which has good water retention.

Conclusion

A total of 15 hectares are required if you consider only one site and 7.5 Hectares if you consider two different sites.

01. **8Acres (3.2 Hectares) will be acquired from mr. Elisha Godana at a total cost of Kshs 80million (The remaining land of Elisha at this site)**
02. **A similar value should be acquired adjacent to Jaldesa laga flood plains from mr. Khaliff at an estimated cost of Kshs 80million.** This implies two trains of WSP would be constructed at this site as per figure 18 below:-

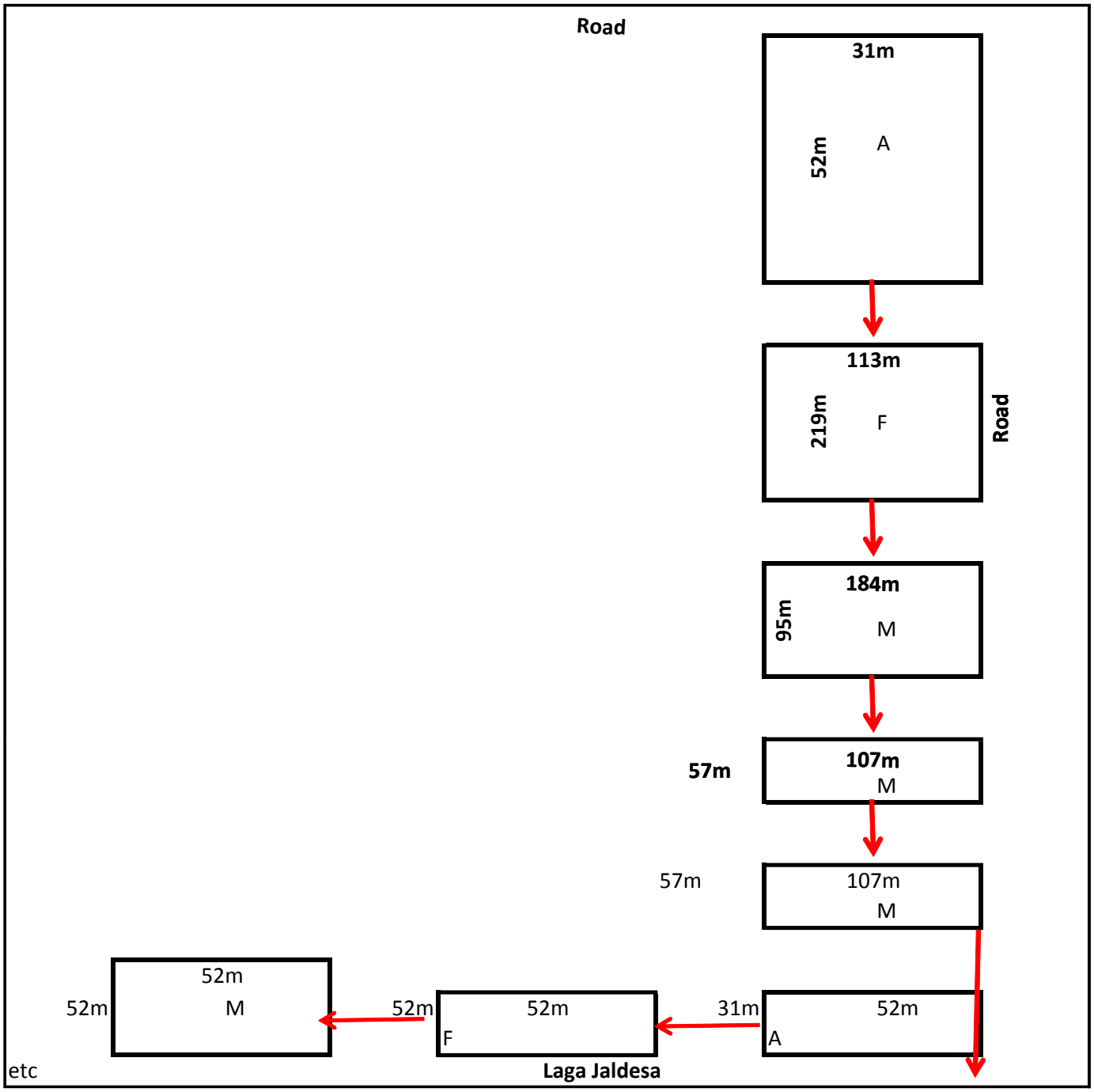


Figure 17: Layout of WSP at Mountain Location near Jaldesa Laga

Plate 21:Mr. Elisha Land

Plate 22: Consultation team walking to Site

Plate 23: Security Team accompanying team

Plate 24: Croaton Trees in Khaliff Land

Plate 25: Lead Expert with the D.O.

Plate 26: Team consulting at site

Plate 27: Elishas Son in centre

Plate 28: Another of Elishas Son in cap at left

Plate 29:Elishas Son putting a point across

Plate 30:Elisha's Son Vehicle

7.3.3.1.1.2 Laga Gotu Gade Drainage Basin

This will host the 2nd WSP at KARI land.About 3.5Hectares will be required to serve Gotu Gade and Sir Henry (Karantina) drainage basins. Minimal compensation of about 5million will be required for compensation since the land belong to KARI, a public institution. The land was previously used for rearing cattle but now days it is idle. There is flat land, optune for construction of WSP adjacent to Gotu Gade laga.

The land is located downstream of KARI at:-

Region	37N
Longitude	0386025E UTM

Latitude	0259834N UTM
Altitude	1303m

Figure 17 above has this location.

One train will be located at this site and will be able to treat 1,500m^3/day of waste Water. The area is covered by sandy silt.

The wind is blowing from East to West.

The land is located in a valley and the rock is located about 2m below ground.

The area is filled with basalt, volcanic rock.

The area can treat sewerage from Sir Henry Drainage Basin which also hosts the newly upcoming Karantina Estate.

The place is just upstream of abandoned and porous Got Gade Dam at:-

Region	37N
Longitude	0385824E UTM
Latitude	0260609N UTM
Altitude	1257m4

Considering the behavior of **locals** during this **EIA, Land** seems to have become an **emotive issue** which is the reverse of two years ago.

In view of the above, it is highly recommended that participatory sensitization be undertaken before and during implementation of this project.

Plate 31:KARI WSP Site

Plate 32:EIA discussing a point

Plate 33:Laga Gotu Gade

Plate 34:loss Basalt at the site

Plate 35: Massive loss Basalt Rock adjacent to site

Plate 36: Encounter with local?

7.3.3.1.2 Topography and Geology

The WSP will have to be dug underground and will be sloping.

Greening the place will make the place attractive and can become a relersing place.

7.3.3.1.3 Soil Erosion

During construction, there will be alot of excavation which will have to be made good by removing all areas where water can pound by levelling and refilling borrowed areas.

All unstable sections will have to be supported by Rip rap. The cleared area will have to be replanted with grass and drought resistant trees like croton, neem trees etc.

7.3.3.1.4 Ground Water

Effluent limits represent the maximum amount of pollutants allowed to discharge from wastewater to its final destination (waterway, reservoir for reuse, etc.). These limits vary from country to another due to geographical, climatic and socio-economical reasons. They vary as well with the character of the wastewater final destination. For example, the effluent quality of wastewater discharged to the ocean would be less stringent than the effluent quality of wastewater used for agriculture.

Effluent limits characterize the required and accepted quality of the discharged wastewater. Hence, prior to design, these limits must be known (from local municipal effluent standards publications) since they will be used as the water quality design objectives. An example is the European Union quality requirements for WSP effluents being discharged into surface and coastal waters:

Filtered BOD = 25 mg/l (non-algal BOD)

Filtered COD = 125 mg/l (non-algal COD)

Suspended solids = 150 mg/l

Together with, for discharge into designated "sensitive areas subject to eutrophication":

Total nitrogen = 15 mg/l

Total phosphorus = 2 mg/l

(Although, if the population served is > 100,000, these last two requirements are reduced to 10 and 1 mg/l, respectively) (Council of the European Communities, 1991a).

Another example is from India. The general standards for the discharge of treated wastewaters into inland surface waters are given in the Environment Protection Rules (CPCB, 1996). The more important of these for WSP design are as follow:

BOD 30 mg/l (non-filtered)

Suspended solids 100 mg/l

Total N 100 mg N/l

Total ammonia 50 mg N/l

Free ammonia 5 mg N/l

Sulphide 2 mg/l

pH 5.5 – 9.0

According to the Environmental Management and Co-ordination (Water Quality) Regulations 2006 in third schedule, requires the following standards be met when discharging into the environment:-

BOD_5	-	30mg/L
Total Dissolved Solids		1,200mg/L and
Total Coliform	-	Nil

According to the detailed design report undertaken by Director Water Services, Ministry of Water and Irrigation dated December, 2012,the effluent which satisfies NEMA Discharge Standard(Table 28) will be discharged in Lagga Jaldera.

Table 28 Quality of Success Effluent

ITEM	% BOD Removal	BOD(mg/L)	FC(Feacal per 100Ml)
Raw Wastewater		**350***	**$1.0x10^8$**
Anaerobic Pond Effluent	**47.6**	**167***	**371,962,923**
Facultative Pond Effluent	**42.4**	**35**	20,655,243
1st Maturation Pond Effluent	**25**	**26.25**	**1,881**
2nd Maturation Pond Effluent	**25**	**19.68**	**415**
3rd Maturation Pond Effluent	**25**	**15**	**91.4**

This implies the quality of ground water will be maintained.

However, if no proper maintenance and operation is not maintained, it will lead to pollution of ground water.

7.3.3.1.5 River and Lake

According to the Environmental Management and Co-ordination (Water Quality) Regulations 2006 in first schedule, requires the following standards be for water source to be a domestic source:-

Table 29: QUALITY STANDARDS FOR SOURCES OF DOMESTIC WATER

Parameter	Guide Value (max allowable)
pH	6.5 – 8.5
Suspended solids	30 (mg/L)
Nitrate-NO_3	10 (mg/L)
Ammonia –NH_3	0.5 (mg/L)
Nitrite –NO_2	3 (mg/L)
Total Dissolved Solids	1200 (mg/L)
Scientific name *(E.coli)*	Nil/100 ml
Fluoride	1.5 (mg/L)
Phenols	Nil (mg/L)
Arsenic	0.01 (mg/L)
Cadmium	0.01 (mg/L)
Lead	0.05 (mg/L)
Selenium	0.01 (mg/L)
Copper	0.05 (mg/L)
Zinc	1.5 (mg/L)
Alkyl benzyl sulphonates	0.5 (mg/L)
Permanganate value (PV)	1.0 (mg/L)

If propore Operation and Maintenance is undertaken.

However, in the absence, it might lead to pollution of Laga Jaldesa and Laga Gotu Gade.

As precaution, village behind laga Gotu Gade dam will have to be provided with alternative water supply.

Further, this water can be used for Irrigation to grow vegetables and other necessity hence providing an additional income to the residence of Marsabit.

7.3.3.1.5 Fauna and Flora

7.3.3.1.5.1 Flora

Flora is the plant life occurring in a particular region or time, generally the naturally occurring or indigenous—native plant life. The corresponding term for animal life is fauna. **Flora**, fauna and other forms of life such as fungi are collectively referred to as biota.

The mountain WSP is bare and infact is being used as farm land. That of KARI is a rangeland and used to be a grazing area.

However, with construction of WSP, downstream will become a wetland and will be now turned into a wetland and be habituated by wetland vegetation which includes papyrus etc.

7.3.3.1.5.2 Fauna

Fauna is all of the animal life of any particular region or time. The corresponding term for plants is *flora*. Flora, fauna and other forms of life such as fungi are collectively referred to as biota. Zoologists and paleontologists use *fauna* to refer to a typical collection of animals found in a specific time or place, e.g. the "Sonoran Desert fauna" or the "Burgess Shale fauna". Paleontologists sometimes refer to a sequence of faunal stages, which is a series of rocks all containing similar fossils.

Fauna comes from the Latin names Fauna, a Roman goddess of earth and fertility, the Roman god Faunus, and the related forest spirits called Fauns. All three words are cognates of the name of the Greek god Pan, and *panis* is the Greek equivalent of fauna. *Fauna* is also the word for a book that catalogues the animals in such a manner. The term was first used by Linnaeus in the title of his 1745[1] work *Fauna Suecica*.

Mountain WSP borders Marsabit Game Reserve. With construction of WSP, this will provide a water source which will attract baboons, birds like duck, fowls etc and other wildlifes. This will widen the human-wildlife conflict unless mitigation measures like fencing and other baboon scaring methods are adopted.

7.3.3.1.6 Traffic/Public Facilities

There is an Airport located over 2km hence no issue of Birds accident with the aeroplanes.

A **bird strike**—sometimes called **birdstrike**, **bird ingestion** (for an engine), **bird hit**, or **BASH** (for **B**ird **A**ircraft **S**trike **H**azard)—is acollision between an airborne animal (usually a bird or bat) and a human-made vehicle, especially aircraft. The term is also used for bird deaths resulting from collisions with human-made structures such as power lines, towers and wind turbines.

Bird strikes are a significant threat to flight safety, and have caused a number of accidents with human casualties. The number of major accidents involving civil aircraft is quite low and

it has been estimated that there is only about 1 accident resulting in human death in one billion (10^9) flying hours.[1] The majority of bird strikes (65%) cause little damage to the aircraft; however the collision is usually fatal to the bird(s) involved.

Most accidents occur when there is a collision involving a bird (or birds) and the windscreen or a bird (or birds) is sucked into the engines of mechanical air craft. These cause annual damages that have been estimated at $400 million within the United States of America alone and up to $1.2 billion to commercial aircraft worldwide. In addition to property damage, collisions between man-made structures and conveyances and birds is a contributing factor, among many others, to the worldwide decline of many avian species.

Bird strikes happen most often during takeoff or landing, or during low altitude flight. However, bird strikes have also been reported at high altitudes, some as high as 6,000 m (20,000 ft) to 9,000 m (30,000 ft) above the ground. Bar-headed geese have been seen flying as high as 10,175 m (33,383 ft) above sea level. An aircraft over the Ivory Coast collided with a Rüppell's vulture at the altitude of 11,300 m (37,100 ft), the current record avian height.[1] The majority of bird collisions occur near or on airports (90%, according to the ICAO) during takeoff, landing and associated phases. According to the FAA wildlife hazard management manual for 2005, less than 8% of strikes occur above 900 m (3,000 ft) and 61% occur at less than 30 m (100 ft).

The point of impact is usually any forward-facing edge of the vehicle such as a wing leading edge, nose cone, jet engine cowling or engine inlet.

Jet engine ingestion is extremely serious due to the rotation speed of the engine fan and engine design. As the bird strikes a fan blade, that blade can be displaced into another blade and so forth, causing a cascading failure. Jet engines are particularly vulnerable during the takeoff phase when the engine is turning at a very high speed and the plane is at a low altitude where birds are more commonly found.

The force of the impact on an aircraft depends on the weight of the animal and the speed difference and direction at the impact. The energy of the impact increases with the square of the speed difference. Hence a low-speed impact of a small bird on a car windshield causes relatively little damage. High speed impacts, as with jet aircraft, can cause considerable damage and even catastrophic failure to the vehicle. The energy of a 5 kg (11 lb) bird moving at a relative velocity of 275 km/h (171 mph) approximately equals the energy of a 100 kg (220 lb) weight dropped from a height of 15 metres (49 ft).[9] However, according to the FAA only 15% of strikes (ICAO 11%) actually result in damage to the aircraft.

Bird strikes can damage vehicle components, or injure passengers. Flocks of birds are especially dangerous, and can lead to multiple strikes, and damage. Depending on the damage, aircraft at low altitudes or during take off and landing often cannot recover in time, and thus crash, as in the case of US Airways Flight 1549.

Remains of the bird, termed *snarge*[are sent to identification centers where forensic techniques may be used to identify the species involved. These samples need to be taken carefully by trained personnel to ensure proper analysis[and reduce the risks ofzoonoses.

The Israeli Air Force has a larger than usual birdstrike risk as Israel is on a major spring and autumn long-distance bird migrationroute.

Sacramento International Airport has had more bird strikes (1,300 collisions between birds and jets between 1990 and 2007, causing an estimated $1.6 million in damage) than any other California airport. Sacramento International Airport has the most bird strikes of any airport in the west and sixth among airports in the US, according to the FAA, as it is located along the Pacific Flyway, a major bird migration path.

According to the Design and Performance of Waste Stabilization Ponds by Hamzeh Ramadan and Victor M. Ponce version 0812 ecommends siting Ponds should not be located within 2 km of airports, as any birds attracted to the ponds may constitute a risk to air navigation.

7.3.3.2 Positive Impacts

7.3.3.2.1 Economic Activity

7.3.3.2.1.1 Residence of Marsabit Town

Marsabit is a cosmolitan town consisting of Gabra, Borana, Rendile, Burji and other small communities.
Borana are the majority followed by Rendile and Borana.
Burji are farmers and business men.

7.3.3.2.1.2 Current Water Supply Arrears and Responses

The current revenue arrears is estimated at Kshs 2million. 20% of this is owed by institutions and the remaining 80% by individuals.

The individual consumers are reluctant to settle there bills.
During rainy season, the revenue is too low due to the emerging existing alternative sources.

7.3.3.2.1.3 Drought Mitigation

During drought, the water is normally fetched from Logologo which is located about 50km away.

7.3.3.2.1.4 Employment

About 80% of the population of Marsabit town derives their livelihood from livestock and livestock based industries. A bout 10% of the total population practice subsistence agriculture and reside mainly around Mount Marsabit. About 7% are involved in commerce trade and the rest are salaried employees.

7.3.3.2.1.5 Education

Most people are illiterate.

7.3.3.2.1.6 Average Household Size

The average household size is estimated at four.

7.3.3.2.1.7 Poverty Index

About 82% of the populations are estimated to live below the poverty line and depend on relief food.

Source: - District Development Plan 2002 to 2008

7.3.3.2.1.8 Income Situation

The majority of the people estimated at 80% earn about Kshs 3,000 per month
Table 30 below has the details:-

Table 30: Income Situation in Marsabit Town

Percentage of Population	Estimated Income in Kshs per month
80	3,000
10	1,500
7	20,000
3	8,000

7.3.3.2.1.9 Ability to pay for water services

Assuming the acceptable International Norm of 3% of household income to be used to pay for water services, the population can only manage to pay an average of Kshs 90 per month for water services against the minimum being charged of about kshs200.

7.3.3.2.2 Health and Hygiene

1. The Hygiene situation in Marsabit can be defined as wanting due to lack of water.
2. 30% of the top 10 prevalent diseases in Marsabit are Water Borne.

7.3.3.2.3 Waste Disposal

7.3.3.2.3.1 Liquid Waste

Marsabit Town depends on Pit latrines for its sanitation needs since 88.24% of the Household depend on Pit Latrines.

Population Density

Based on review of current practice and experience in other developing countries, conventional sewerage is usually cost effective in urban zones where the population density greater than 120 persons per hectare. Arising from above, *onsite* sanitation *should not* be used in Kenya where the population density is at least 120 persons per hectare but adopt sewerage.

Arising from above, 2.6km^2 of the existing area of Marsabit Town of 18.6km^2 representing 14% qualify for introduction of a sewerage system by year 2037.

The areas that qualify for introduction of a sewerage system are:-

1. Nyayo Road Sub location - Area 0.4km^2
2. Mountain Location - Area 2.2km^2

Total Area - Area 2.6km^2

The following areas with total area of 16km^2 do not qualify for introduction of Sewerage System:-

1. Majengo Sub Location - Area 2.0km^2
2. Dakabaricha Location - Area 14.0km^2

Total 98.2 - Area 16.0km^2

Table 31 below has the details.

Table 31: Projected Population Density of Marsabit Town from year 2009 to 2037

			2009 census		Current 2012		Initial 2017		Future 2027		Vision 2030		Ultimate 2037	
Location	**Sub location**	**Area in Km²**	2009 Population	**Population Density in km²**	**Population**	**Population Density in km²**	**Population**	**Population Density in km²**	**Population**	**Population Density in km²**	**Population**	**Population Density in km²**	**Population**	**Population Density in km²**
	Nyayo Road	0.4	2,328	5820	2,502	6,255	3,587	8,966	3,587	8,966	3,854	9,636	4,560	**11,399**
	Majengo	339.2	5,645	17	6,067	18	8,697	26	8,697	26	9,346	28	11,057	33
Nagayo		**339.6**	7,973	23	8,568	25	12,283	36	12,283	36	13,201	39	15,616	46
	Mataarba	6.4	1,187	185	1,276	199	1,829	286	1,829	286	1,965	307	2,325	363
	Dakabaricha	7.6	3,053	402	3,281	432	4,703	619	4,703	619	5,055	665	5,980	787
Dakabaricha		**14.0**	4,240	303	4,557	325	6,532	467	6,532	467	7,020	501	8,305	593
	Township	1.3	2,447	1,882	2,630	2,023	3,770	2,900	3,770	2,900	4,051	3,116	4,793	3,687
	Wabera	0.9	4,204	4,671	4,518	5,020	6,477	7,196	6,477	7,196	6,960	7,734	8,234	**9,149**
Mountain		**2.2**	6,651	3,023	7,148	3,249	10,247	4,658	10,247	4,658	11,012	5,005	13,027	**5,921**
Marsabit Town		**16.2**	18,864	1,164	20,273	1,251	29,062	1,794	29,062	1,794	31,232	1,928	36,948	2,281

Service Level of Water Supply

Most low cost, on site waste disposal systems, such as pit latrines and pour flush latrines, only handle the disposal of excreta. Sullage is usually left to infiltrate into the ground at the surface or via some form of on-site sullage soak away. As water consumption increases, the need for such soaks ways increases. In areas of adverse soil conditions and high densities of population, the space for soak ways may not be readily available.

Further, because low income communities do not see the need for investing in soak ways for the disposal of sullage, it is not uncommon to see large quantities of sullage flowing in the streets. Such uncontrolled disposal of sullage can give rise to diseases such as filariasis, as well as erode the usually unsurfaced alleyways found in these settlements. Shallow sewers, because they dispose of both excreta and sullage, can be adopted in settlements where average levels of water consumption are high. A minimum average water consumption of at least 25litres per person per day is required, however, to be available for shallow sewers to operate without blockages.

There are two chief issues to be addressed when considering the service level of water supply namely:-

"How near is a water supply facility located "and

"How much is the per capita consumption?"

The appropriate sanitation system is governed by a combination of these two factors.

Table 32 indicates the relationship between per capita consumption and appropriate Sanitation/Sewerage Facilities. With service levels I and II, the supply is hand carried, the minimum volume of water necessary for sustaining a living being carried from wells, tankers, rivers, springs or communal faucets. Therefore, less water using sanitation systems like VIP latrines, etc are desirable. Since the water use of a PF toilet is 6 liters (assuming that one person uses a toilet three times daily with 2 liters per use), it is difficult to use PF toilets effectively with this service level, particularly for large families, except when the housing is located near the water source.

Table 32: Relationship between per capita consumption and applicable Sanitation/Sewerage Facilities

	Per Capita Consumption (L)			Applicable Facility	
Service level for water supply(sources)	World Bank	Duncan Mara	Lyonnaise Des Eaux	Excreta	Sullage
(1) Well etc			50		
(2) Communal Faucet	20-25	20-30	10-50	VIP Latrine	Pit Latrine Surface Drain
(3) Yard Tap	50	40-80		PF Latrine+ Pit Latrine PF latrine+Pit Latrine+Sewerage PF latrine + Settling box +Sewerage PF latrine + Septic tank +Soakway PF latrine +Septic tank +Sewerage	 Pit latrine + Sewerage Settling box +Sewerage
(4) Indoor Tap	50-100		40-250	CF Latrine+Septic Tank +Soakway CF latrine+ Sewerage	Settling box +Sewerage Sewerage

Considering that introduction of Water borne Sanitation is envisaged after Completion of Badesa/Songa Dam Project and the per capita water is estimated at 150litres per person per day, this implies that the critical factor remains population density. This implies the use of Marsabit Google will help establish the settlements and not only administrative boundaries.

7.3.3.2.3.2 Solid Waste

Marsabit Town generates about 13tonnes of solid wastes per day of which only 6.8tonnes representing 50% is collected and dumped at Henry Dumpsite in Kari.

CHAPTER EIGHT

8.0 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

8.1 General

An EMP is a site-specific **plan** developed to ensure that all necessary measures are identified and implemented in order to protect the **environment** and comply with **environmental** legislation. A site-specific EMP must be prepared for all Landcom civil works projects.

The Environmental Management Plan (EMP) is a combination of all mitigative and monitoring actions, with set timelines that show the specific responsibility assigned and follow actions as defined. The Environmental Management Plan in water and sanitation ensures that the monitoring frequency, mitigation measures are implemented and verifiable indicators are clearly outlined.

Environmental management plans describe how an action might impact on the natural environment in which it occurs and set out clear commitments from the person taking the action on how those impacts will be avoided, minimised and managed so that they are environmentally acceptable.

A site specific EMP provides the answers to the following important questions.

What are the likely environmental issues for your site?

What likely harm these issues can cause to the surrounding environment?

How will you manage these issues to minimize harm to the environment?4

As every project always has certain negative effect, even if acceptable, they must be managed or controlled to ensure that:

- ✓ The magnitude of the effects are (and will continue to be) inside the limits of acceptance, and
- ✓ The conditions that made the project acceptable are not violated.

The measures that could be taken can be classified as:

01. Mitigation measures (When the objective is to attenuate or to limit the impact)
02. Compensation Measures (When the objective is to repair or make up for effective or potential losses or damage), and
03. Monitoring measures (When the objective is to check up on parameters)

These measures should also counteract:

- ❖ Any possible incorrectness or incompleteness in the EIA
- ❖ Rare environmental events or episodes (Earth quakes, dro etc)
- ❖ Rare accidents (e.g. generalized fires), or failures (e.g. multiple equipment faults) and
- ❖ Human errors (e.g. erroneous opening of valve),

The Environmental Management Plan consists of the following:-

1. Mitigation Plan

2. Monitoring and Evaluation Plan
3. Emergency Preparedness Plan
4. Training Plan and
5. Environmental Management Costs

8.2 Mitigation Plan

8.2.1 Requirement

Mitigation means minimization of the effects i.e. to suppress, subdue or reduce those consequences which might be intolerable in certain phases of the project. The whole project must be analyzed with the aim of mitigating the more important effects, once these have been identified..

Mitigation measures can be classified into three types:

- Measures inherent to the project, such as the choice of technologies, modifications in the construction or production processes, or waste production/deposit control
- Measures that tend to remedy the potential damages (e.g. oxygenation of waters, repopulating of species, etc) and
- Measures that try to prevent or diminish the effects (E.g. with barriers against noise, dust, etc.)

Compensation measures must be directed mainly towards the community exposed to the effects with the goal of counter balancing or indemnifying any “bad” effects. These measures may be part of the conditions laid down by the population for the project to be accepted.

These compensations can be:-

- Economic (i.e. indemnities for damage, harm, injuries, etc. to economic or social assets, and in general for effects on health)
- Social (such as reforestation, approaches to highways, etc)
- Sanitary (Any compensation for probable health provides that might occur in accidents or critical conditions)

The human concerns that must be considered in order to define these measures are:Economic and occupational status, social pattern and life styles, social and physical amenities, psychological features (e.g. mobility, personal security, molestation), safety and hazards, cultural and aesthetic aspects etc.

8.2.2 Recommended Mitigation Plan for Bakuli 4 Dam Project and Introduction of Sewerage System in Marsabit Town

Table 33 below has the recommended Mitigation Plan of Bakuli 4 Dam Project and Introduction of Sewerage System in Marsabit Town which has been deduced from checklist in Appendix 6.

Table 33: Mitigation Plan of Bakuli 4 Dam Project and Introduction of Sewerage System in Marsabit Town

Environmental Item	Mitigation Measures
Flood Regime	Allow for Environmental Flow
	Open Scouring Pipe at least before the long rains and short rains
	Undertake Soil Conservation measures like Rip Rap and use of Gabion Boxes
	Construct Check Dams upstream and downstream
	Avoid the unstable Section
Eutrophication	Clear the site of vegetation and trees before damming water
	Employ Intergrated Water Resource Management
	Maintain the current forest cover in Marsabit Forest Reserve
	Avoid overgrazing of the Forest by avoiding overstacking of wildlife
	Avoid grazing of livestock in the Forest
Noise	Limit use of Noisy Equipment
	Undertake works only day time to avoid disturbances in Marsabit Forest
	Limit the Number of trips to the Forest
	Establish a living quarter near the dam area
	Maintain quiteness in the forest
Public Safety and Health	Wear Proctetive Gear
	Undertake Sensitization
	Maintain First Aid Equipments
Sedimentation	Improve Forest and Grass Cover
	Follow designated Roads and Footpath
	Adapt Good Soil erosion control measures
	Avoid Overgrazing
	Clear where it is a must
Project Lands	Follow Public Right of Way
	Pay Compenssation at current market rates
	Undertake Sensitization
	Use existing designated Public Land where it is possible
Valleys and Slopes	Undertake Soil Conservation to maintain current scenario
Wildlife	Undertake Fencing of the dams to avoid drowning of wildlife
	Allow access corridors to the water where the terrain is gentle and the water not deep
	Avoid illumination of the dam area to scare wildlife
Disease hazards	Provide Mosquito Nets

Environmental Item	Mitigation Measures
	Provide Malaria Preventing drugs to Operation gang before deployment
	Avail Malaria Treatment to Water Operation Gangs
Pollution	Do not exceed WSP designed loading rate
	Employ Qualified Manpower
	Undertake monitoring and evaluation
	Ensure discharge of effluent is as per NEMA Water Quality regulation 2006
	Ensure the Per capita water is at least 50LPD
	Ensure Industrial Treatment bmeets recommended values of NEMA quality discharge 2006
	Provide Alternative Water Source to downstream Residence
	Provide Sewerage Works
	Provide Drainage network along the roads
	Use Impermeable Soil or membrane in WSPs
	Undertake Proper Geotechnical Investigation for WSPs
	Provide Appropriate liquid waste disposal system
Landscapping	Undertake proper landscapping work
	Plant flowers and trees to make the place a relaxation park
	Employ qualified landcsapping expert
Fauna(Wildlife)	Undertake Electrical Fencing of the park
	Fence the WSP site
Disease Vector	Put mosquito feeding fish in the last pond
	Maintain a minimum of 200m between nearest residence and WSP
	Cut grass at WSP site
	Provide Mosquito Nets to population in the environs of WSP

8.3 Monitoring and Auditing

8.3.1 Requirement

Environmental monitoring establishes benchmarks to judge the nature and magnitude of potential environmental and social impacts.

Monitoring means the periodic or continuous of environmental variables with the objective of:-

Following the status and evolution of pre-established environmental components and systems (Also to check that the assumptions made in the study are fulfilled, and
Identifying the modifications and actions that must be carried out to maintain or recover specific environmental conditions.

Environmental monitoring will ensure that:

i. The procedures recommended in the approved EIA report are adhered to by the various agencies;
ii. Environmental, social mitigation and enhancement schemes are well understood and communicated to all involved parties, including the general public;
iii. Proposed environmental and social remedial measures are implemented during the project execution stage;
iv. Evaluation is made of the effectiveness of environmental and social remedial measures.

A detailed EMP will evaluate the extent and severity of environmental impacts as compared to the predicted impacts, the performance of the environmental protection measures and compliance with related rules and regulations, the trends of impacts and the overall effectiveness of the project EMP.

8.3.2 Bakuli 4 Dam Project

The EMP should be carried out by qualified staff with equipment and technical capacity to monitor the aquatic, air, and physical environment (noise), soil and receiving water conditions, solid waste disposal, industrial pre-treatment, water source pollution control and traffic conditions. When any complaints are received from the public, monitoring staff will immediately conduct additional inspections and tests carried out in accredited laboratories.

Table 35 presents the potential indicators that will be used to monitor the implementation of the project. The indicators are selected according to the project context and major anticipated impacts.

Table 34: Environmental Impacts Monitoring Plan

Environmental Component	Indicators: Measures taken or to be taken	Monitoring frequency	Monitoring Point
Atmosphere	A) Construction Phase (i) Monitoring Item: Dust	Once/week for 1 day	Main construction sites and materials transportation roads near sensitive points and areas.
	(B) Monitoring Standard: Atmospheric Monitoring Standard Issued by NEMA.		
Noise	(A) Construction Phase (i) Monitoring Item: Noise	Once/week	Construction sites within 50m of settlements.
	(B) Monitoring Standard: Existing Noise Standard issued by NEMA.		
Water Quality	(A) Construction Phase (i) Monitoring Item: SS, Oil & E. Coli	3 times/year for two times/day	2 points

	(B) Operation Phase (i) Monitoring Item: SS & Rainfall,	*Daily*	
	(C) Monitoring Standard: Water Quality Standards issued by NEMA.		

8.3.3 Introduction of Sewerage in Marsabit Town

Table 36 has the Monitoring Plan for Sewerage.

Table 35: Environmental Impacts Monitoring Plan-Sewerage

Environmental Component	Indicators: Measures taken or to be taken	Monitoring frequency	Monitoring Point
Atmosphere	A) Construction Phase (i) Monitoring Item: Dust	Once/week for 1 day	Main construction sites and materials transportation roads near sensitive points and areas.
	(B) Monitoring Standard: Atmospheric Monitoring Standard Issued by NEMA.		
Noise	(A) Construction Phase (i) Monitoring Item: Noise	Once/week	Construction sites within 50m of settlements.
	(B) Monitoring Standard: Existing Noise Standard issued by NEMA.		
Discharge	(A) Construction Phase (i) Monitoring Item: SS, hard metal, BOD5,Peak Value & E. Coli	3 times/year for two times/day *Once/year*	2 points
	(B) Operation Phase (i) Monitoring Item: SS, Oil,BOD5, Flow, Peak Value		
	(C) Monitoring Standard: discharge Standards issued by NEMA.		

8.4 Environmental Management Costs

Implementation of Bakuli 4 EMP and Introduction of Sewerage in Marsabit Town EMP is estimated to cost Kshs 202million.

CHAPTER NINE

9.0 CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

The proposed Bakuli 4 Dam Project will ensure availability of clean drinking water to the town's residents. This will improve on their health and sanitation. The introduction of sewerage works will take care of all the sewage from the town. The whole Marsabit Forest should be fenced by Electrical fencing.

9.2 Recommendations

It is recommended that:

- Implementation of Bakuli 4 Dam Project is overdue..
- The Onsite sanitation being practiced in CBD has reached its limit and Sewerage Works should be introduced soonest..
- Marsabit Town should prepare PDP to guide the development of the town as a priority.
- The proposed EMP for the identified impacts will be implemented by the proponent.
- The environmental mitigation measures will be incorporated into the Bakuli 4 Dam Project and Marsabit Sewerage Works project documents and contract agreements. The proponent should consider allocating a small percentage (10%) of the implementing budget for environmental monitoring.
- Labour should be sourced from the local community and should be gender sensitive.

APPENDICES

Appendix 1- List of References

1. State of Environment (SOE) Report, Marsabi County, 2013 Published by: National Environment Management Authority dated 2015

2. The Marsabit Mountain Forest and its Resources:the importance of reconciling conservation and livelihood values of the Forest Ecosystem, PHD Thesis dated 2004

3. Wet Season Biodiversity Baseline Survey of Marsabit Forest Ecosystem by Halima Saado Abdillahi, Joseph Edebe, Samuel Andanje and Godwin Leslie Muhati

4. Food Security District Profiles for 23 Districts in Kenya by FAO, Kenya dated Nairobi, March 2007

5. Directory of Wetlands of International Importance prepared by World Conservation Monitoring Centre dated May, 1990

6. Lecture Notes on five day Training Course on Application of NGORE ESMF and Implementation of Environmental Management Plans from 15th to 19th December, 2014 held at Naura Springs, Arusha Tanzania.

7. Several Acts and Laws of Kenya

8. Class Notes on EIA held in year 2007 at Kenya Institute of Administration

9. Detailed Design Report of Marsabit Town Sewerage Works by Director Water Services dated December 2012

10. Sanitation Master Plan of Marsabit Town by Director Water Services dated September, 2012

11. Pre-Feasibility,Feasibility and Preliminary Design Report of Bakuli 4 Dam Project by Technical Manager, Northern Water Services Board dated July,2015

12. Detailed Design of Bakuli 4 Dam Project dated 11/09/2015 by Technical Manager, Northern Water Services Board

13. Guidelines for Environmental Assessment of Dam Projects by M. Trojanow, dated June, 1993

14. Environmental Impact Assessment for Sewerage Project by Okada Hiroshi dated 2004

15. International Conventions Kenya is a signatory to.

Appendix 2- List of Plant Species existing in Marsabit Game Reserve in the wet Season

1. *Abrus schimperi*
2. *Abutilon mauritianum*
3. *Acacia ataxacantha*
4. *Acacia brevispica*
5. *Acacia nilotica*
6. *Acacia sp.*

7. *Acalypha racemosa*
8. *Acalypha volkensii*
9. *Acanthaceae sp*
10. *Acanthospermum hispidum*
11. *Achyranthes aspera*
12. *Achyrothalamus marginatus*
13. *Actiniopteris radiata*
14. *Actiniopteris semiflabellata*
15. *Adenia gummifera*
16. *Adenia schweinfurthii*
17. *Adenia sp.*
18. *Aerangis sp.*
19. *Aerangis sp. Somalensis*
20. *Aerva lanata*
21. *Ageratum conyzoides*
22. *Alaphia sp.*
23. *Albizia gummifera*
24. *Alisycarpus glumaceum*
25. *Allophyllus rubifolius*
26. *Alternanthera sessilis*
27. *Amaranthus graecizans*
28. *Amaranthus lividus*
29. *Amaranthus sp*
30. *Aneilema aequinoctiale*
31. *Apodytes dimidiata*
32. *Aristida sp*
33. *Asparagus africanus*
34. *Asparagus asparagoides*
35. *Asparagus sp*
36. *Aspilia pluriseta*
37. *Asplenium rutifolium*
38. *Astereceae sp.*
39. *Asterolinon adoense*
40. *Astripomoea malvacea var. flocossa*
41. *Asystacia gangetica*
42. *Barleria sp*
43. *Barleria volkensii*
44. *Basella alba*
45. *Bauhinia tormentosa*
46. *Bidens bicarinata*
47. *Bidens pilosa*
48. *Bidens sp.*
49. *Bleinvillea acmella*

50. *Blepharis maderaspatensis*
51. *Bothlochloa insculpta*
52. *Brachiaria deflexa*
53. *Brachiaria semiundulata*
54. *Brucea antydisenterica*
55. *Capparis sepiaria*
56. *Capparis tomentosa*
57. *Cardamine trichocarpa*
58. *Cassia septemtrionalis*
59. *Cassipourea malossanna*
60. *Cayratia gracilis*
61. *Celosia sp.*
62. *Cenchrus ciliaris*
63. *Chamaecrista mimosoides*
64. *Chaschanum hildebrandtii*
65. *Chenopodium schraderianum*
66. *Chionanthus batiscombei*
67. *Chloris roxburghiana*
68. *Chlorophytum galabatense*
69. *Chorchorus trilocularis*
70. *Christella dentata*
71. *Chrysopogon plumulosus*
72. *Cissampelos pareira*
73. *Cissus sp.*
74. *Clausena anisata*
75. *Clematis brachiata*
76. *Cleome monophylla*
77. *Clerodendrum myricoides*
78. *Clitoria ternatea*
79. *Coccinia trilobata*
80. *Commelina diffusa*
81. *Commelina imbervis*
82. *Commelina latifolia*
83. *Commellina africana*
84. *Commellina benghalensis*
85. *Commellina foliacea*
86. *Commellina spp.*
87. *Commiphora africana*
88. *Commiphora habessinica*
89. *Commiphora sp*
90. *Compositae sp.*
91. *Conyza conizoides*
92. *Cordia monoica*

93. *Courtoisina assimilis*
94. *Crateva adansoniae*
95. *Crossandra massaica*
96. *Crotolaria sp.*
97. *Croton dichogamus*
98. *Croton megalocarpus*
99. *Croton scheffleri*
100. *Cucumis prophetarum*
101. *Cycnium volkensii*
102. *Cynodon nlefuensis*
103. *Cynoglossum coerulum*
104. *Cyperus alternifolius*
105. *Cyperus amauropus*
106. *Cyperus blysmoides*
107. *Cyperus cyperoides*
108. *Cyperus maranguensis*
109. *Cyperus niveus*
110. *Cyperus oblongoincrassatus*
111. *Cyperus sp.*
112. *Cyperus squarrosus*
113. *Cyperus usitatus?*
114. *Cyphostemma kilimandischaricum*
115. *Cyphostemma sp.*
116. *Dactyloctenium sp.*
117. *Desmodium repandum*
118. *Dichrostachys sp.*
119. *Digitaria sp*
120. *Digitaria velutina*
121. *Diospyros abyssinica*
122. *Diplocyclos palmatus*
123. *Dorstenia brownii*
124. *Doryopteris kirkii*
125. *Dovyalis abyssinica*
126. *Drimopsis sp.*
127. *Drimopsis ssomalense*
128. *Dryepetes gerardii*
129. *Drymaria cordata*
130. *Dychoriste sp.*
131. *Echnochloa colana*
132. *Echnochloa sp*
133. *Ekebergia capensis*
134. *Emilia somalensis*
135. *Endostemon tereticaulis*

136. *Eragrostis capituliflora*
137. *Eragrostis cilianensis*
138. *Eragrostis sp.*
139. *Eranthemum Sp*
140. *Eriochloa sp.*
141. *Eriosema nutans*
142. *Erythrococca fischeri*
143. *Erythroxylum marginatum*
144. *Ficus sp.*
145. *Fimbristylis dichotoma*
146. *Flueggea virosa*
147. *Galinsoga sp.*
148. *Gardenia volkensii*
149. *Gerrardanthus lobatus*
150. *Girrardinia diversifolia*
151. *Glycine wightii*
152. *Grewia cacothamnus*
153. *Grewia tembensis*
154. *Hancas deflexa*
155. *Harrisonia abyssinica*
156. *Helichrysum glumaceum*
157. *Helinus integrifolius*
158. *Heliotopium steudneri ssp. Bullarum*
159. *Hernsenia dierbiellodes*
160. *Hibiscus calyphyllus*
161. *Hibiscus fuscus*
162. *Hibiscus micranthus*
163. *Hibiscus vitifolius*
164. *Hoslundia oppositifolia*
165. *Hybanthis sp*
166. *Hydrocotyle manii*
167. *Hypoestes forskaolii*
168. *Indigofera arrecta*
169. *Indigofera binderi*
170. *Indigofera sp*
171. *Indigofera spicata*
172. *Indigofera trita var. subulata*
173. *Indigofera vohemarensis*
174. *Indigofera volkensii*
175. *Iphigenia pauciflora*
176. *Ipomoea mombassana*
177. *Ipomoea obscura*
178. *Ipomoea sp.*

179. *Jasminum fluminense*
180. *Justicia anagalloides*
181. *Justicia diclipteroides*
182. *Justicia flava*
183. *Justicia inaequifolia*
184. *Justicia inaequilatera*
185. *Justicia nyassana*
186. *Justicia sp.*
187. *Justicia striata*
188. *Kohautia caespitosa*
189. *Kyllinga alba-purpurea*
190. *Kyllinga nervosa*
191. *Kyllinga pumila*
192. *Lagenaria siceraria*
193. *Lantana sp.*
194. *Launea intybacea*
195. *Ledebouria kirkii*
196. *Leerssia hexandra*
197. *Leptothrium senegalensis*
198. *Leucas glabrata*
199. *Leucas grandis*
200. *Leucas martincensis*
201. *Leucas mollis*
202. *Leucas sp*
203. *Lippia kituensis*
204. *Lippia somalensis*
205. *Loxogramme abyssinica*
206. *Ludwigia stolonifera*
207. *Maerua sp.*
208. *Marsidenia schimperi*
209. *Maytenus heterophylla*
210. *Maytenus putalicoides*
211. *Meineckia phyllantoidea*
212. *Melhania velutina*
213. *Microglossa densiflora*
214. *Microglossa pyrifolia*
215. *Misopates orontium*
216. *Mormodica boivinii*
217. *Nanorrhinum ramosissimum*
218. *Nastatum Sp.*
219. *Neonotonia wightii*
220. *Ochna holstii*
221. *Ochna insculpta*

222. *Ocimum americanum*
223. *Ocimum filamentosum*
224. *Ocimum gratissmum*
225. *Ocimum kilimanjaricum*
226. *Ocimum sp*
227. *Ocimum suave*
228. *Oldenlandia fastigiata*
229. *Olea africana*
230. *Olea capensis*
231. *Oplismenus compositus*
232. *Oplismenus hirtellus*
233. *Oplismenus undulatifolius*
234. *Oreocyce africana*
235. *Orthosiphon pallidus*
236. *Orthosiphon thymflorus*
237. *Osyris lanceolata*
238. *Oxalis perniculata*
239. *Oxyanthus speciosus*
240. *Oxygonum sinuatum*
241. *Ozoroa insignis*
242. *Panicum maximum*
243. *Panicum monticola*
244. *Panicum sp.*
245. *Pavetta elliottii var. elliottii*
246. *Pavetta gardeniifolia*
247. *Pavonia burchelii*
248. *Pavonia patens*
249. *Pavonia sp.*
250. *Pellaea Viridis*
251. *Pennisetum massaicum*
252. *Pennisetum mezianum*
253. *Pentanisia ouranogyne*
254. *Pentanisia sp.*
255. *Phaulopsis imbricata*
256. *Phyllanthus maderaspatensis*
257. *Phyllanthus sepialis*
258. *Phyllanthus fischeri*
259. *Phyllanthus rotundifolius*
260. *Physalis peruviana*
261. *Plumbago zeylanicum*
262. *Poaceae sp.*
263. *Polygala sadebeckiana*
264. *Portulaca sp.*

265.Pseuderanthemum hildebrandtii

266.Psilotrichum elliotii

267.Psydrax schimperiana

268.Pycreus sanguinolentus

269.Rhamnus staddo

270.Rhipsalis baccifera

271.Rhynchosia sublobata

272.Rinorea convallarioides

273.Rorippa sp.

274.Rottboellia cochinchinensis

275.Rubus apetalus

276.Ruellia patula

277.Rytigynia neglecta

278.Sanicula alata

279.Scadoxus multiflorus

280.Schoenoxiphium lehmanii

281.Sckhuria pinnata

282.Scolopia spp

283.Scolopia zeyheri

284.Sehima nervosa

285.Senna septemtrionalis

286.Setaria plicatilis

287.Setaria pumila

288.Setaria sp.

289.Setaria verticillata

290.Sida acuta

291.Sida ovata

292.Sida rhombifolia

293.Sida tenuicarpa

294.Solanum acculeastrum

295. solanum anguivi

296.Solanum bicarinata

297.Solanum campylacanthum

298.solanum esculantum

299.Solanum incanum

300.solanum nigrum

301.Solanum seaforthianum

302.Solanum sp

303.Solanum terminale

304.Sorghum bicolor

305.Sporobolus pellucidudus

306.Strombosia scheflera

307.Strychnos henningsii

308.Strychnos mitis

309.Tapura fischeri

310.Tarenna graveolense

311.Tephrosia uniflora

312.Themeda triandra

313.Todalia asiatica

314.Tragela natalensis

315.Trema orientalis

316.Tribulus terestris

317.Trichilia emetica

318.Tridactyle fuscistipes

319.Triumfetta flavascens

320.Triumfetta macrophyla

321.Triumphetta rhomboidea

322.Tylophora sp.

323.Tylophora tenuipedunculata

324.Tylosema fosoglense

325.Urocholoa brachyura

326.Vangueria madagascariensis

327.Vepris hanangensis

328.Vepris simplicifolia

329.Verbuscum inerruptum

330.Vernonia auriculifera

331.Vernonia galamensis

332.Vernonia schimperi

333.Vigna membrenacea

334.Vigna sp.

335.Vigna vexillata

336.Withania Somnifera

337.Zehneria glabra

338.Zornia glochidiata

Source:- Wet Season Biodiversity Baseline Survey of Marsabit Forest Ecosystem by Halima Saado Abdillahi, Joseph Edebe, Samuel Andanje and Godwin Leslie Muhati

Appendix 3- A checklist of Birds of Marsabit Forest Ecosystem November to December 2014

AM Afrotropical Migrant

OM Migrant from the Oriental region

PM Migrant from Palaearctic region

MM Migrant from Malagasy region

in lower case migrants of that category may occur alongside resident, non-migratory individuals.

Forest dependency categories follow (Bennun, Dranzoa and Pomeroy,1996):

i) Forest specialist species (**FF species**): These are true forest birds, characteristic of the interior of undisturbed forest. They may persist in secondary forest and forest patches if their particular ecological requirements are met. They are rarely seen in non-forest habitats and breed exclusively in the forest.

ii) Forest generalist species (**F species**): May occur in undisturbed forest but are also regularly found in forest strips, edges and gaps, where they are likely to be commoner than in the interior forest. They breed within the forest.

iii) Forest visitors (**f species**): these are often recorded in the forest but are not dependent on it. They are almost more common in non-forest habitats where they breed.

Scientific and common names in this list follow Checklist of Birds of Kenya (Bird Committee 2009).

IUCN Status: LC – Least Concern; EN – Endangered; VU – Vulnerable; NT – Near Threatened

	Common Name	**Scientific Name**	**Threat Status**	**Migratory Status**	**Forest Dependency**
	Struthionidae: Ostrich				
1	Somali Ostrich	*Struthio molybdophanes*	VU		
	Numididae: guineafowl				
2	Helmeted Guineafowl	*Numida meleagris*			
	Phasianidae: quails, francolins, spurfowl and allies				
3	Yellow-necked Spurfowl	*Francolinus leucoscepus*			
	Anatidae: ducks and geese				
4	White-faced Whistling Duck	*Dendrocygna viduata*			
5	Egyptian Goose	*Alopochen aegyptiaca*			
6	Red-billed Teal	*Anas erythrorhyncha*			
7	Southern Pochard	*Netta erythrophthalma*		am	
	Podicipedidae: grebes				
8	Little Grebe	*Tachybaptus ruficollis*			
	Ciconiidae: storks				
9	African Open-billed Stork	*Anastomus lamelligerus*		am	

	Common Name	Scientific Name	Threat Status	Migratory Status	Forest Dependency
10	Black Stork	*Ciconia nigra*		PM	
	Threskiornithidae: ibises and spoonbills				
11	Sacred Ibis	*Threskiornis aethiopicus*			
12	Glossy Ibis	*Plegadis falcinellus*			
	Ardeidae: herons, egrets and bitterns				
13	Striated Heron	*Butorides striata*			
14	Squacco Heron	*Ardeola ralloides*		am, pm	
15	Cattle Egret	*Bubulcus ibis*		am	
16	Grey Heron	*Ardea cinerea*		am, pm	
17	Black-headed Heron	*Ardea melanocephala*			
18	Purple Heron	*Ardea purpurea*		pm	
19	Yellow-billed Egret	*Ardea brachyrhyncha*			
	Scopidae: Hamerkop				
20	Hamerkop	*Scopus umbretta*			
	Falconidae: falcons				
21	Pygmy Falcon	*Polihierax semitorquatus*			
22	Common Kestrel	*Falco tinnunculus*			
23	Greater Kestrel	*Falco rupicoloides*			
24	Amur Falcon	*Falco amurensis*		PM	
25	Peregrine Falcon	*Falco peregrinus*		pm	
	Accipitridae: diurnal birds of prey other than falcons				
26	Black Kite	*Milvus migrans*		am, pm	
27	African Fish Eagle	*Haliaeetus vocifer*			
28	Egyptian Vulture	*Neophron percnopterus*	EN		
29	Hooded Vulture	*Necrosyrtes monachus*	EN		f
30	White-backed Vulture	*Gyps africanus*	EN		
31	Bateleur	*Terathopius ecaudatus*	NT		
32	Western Marsh Harrier	*Circus aeruginosus*		PM	

	Common Name	Scientific Name	Threat Status	Migratory Status	Forest Dependency
33	Pallid Harrier	*Circus macrourus*	NT	PM	
34	African Harrier Hawk	*Polyboroides typus*			f
35	Eastern Chanting Goshawk	*Melierax poliopterus*			
36	Great Sparrowhawk	*Accipiter melanoleucus*			F
37	Common Buzzard	*Buteo buteo*		PM	
38	Mountain Buzzard	*Buteo oreophilus*	NT		FF
39	Long-legged Buzzard	*Buteo rufinus*		PM	
40	Augur Buzzard	*Buteo augur*			
41	Tawny Eagle	*Aquila rapax*			
42	Booted Eagle	*Aquila pennata*		PM	
43	Martial Eagle	*Polemaetus bellicosus*	VU		
	Rallidae: rails and relatives				
44	Common Moorhen	*Gallinula chloropus*			
45	Red-knobbed Coot	*Fulica cristata*		am	
	Recurvirostridae: stilts and avocets				
46	Black-winged Stilt	*Himantopus himantopus*		am	
	Charadriidae: plovers				
47	Black-headed Plover	*Vanellus tectus*			
	Jacanidae: jacanas				
48	African Jacana	*Actophilornis africanus*			
	Scolopacidae: sandpipers and relatives				
49	Marsh Sandpiper	*Tringa stagnatilis*		PM	
50	Green Sandpiper	*Tringa ochropus*		PM	
51	Wood Sandpiper	*Tringa glareola*		PM	
	Laridae: gulls, terns and skimmers				
52	Whiskered Tern	*Chlidonias hybrida*		pm	
	Columbidae: pigeons and doves				
53	Speckled Pigeon	*Columba guinea*			
54	Lemon Dove	*Aplopelia larvata*			
55	African Mourning Dove	*Streptopelia decipiens*			

	Common Name	Scientific Name	Threat Status	Migratory Status	Forest Dependency
56	Red-eyed Dove	*Streptopelia semitorquata*			f
57	Ring-necked Dove	*Streptopelia capicola*			f
58	Laughing Dove	*Streptopelia senegalensis*			
59	Emerald-spotted Wood Dove	*Turtur chalcospilos*			
60	Tambourine Wood Dove	*Turtur tympanistria*			
61	Namaqua Dove	*Oena capensis*			
	Psittacidae: lovebirds and parrots				
62	African Orange-bellied Parrot	*Poicephalus rufiventris*			
	Musophagidae: turacos				
63	White-bellied Go-away-bird	*Criniferoides leucogaster*			
	Cuculidae: cuckoos and coucals				
64	Jacobin Cuckoo	*Clamator jacobinus*		am, pm, om	
65	Red-chested Cuckoo	*Cuculus solitarius*		am	
66	Black Cuckoo	*Cuculus clamosus*		am	FF
67	Common Cuckoo	*Cuculus canorus*		PM	
68	Klaas's Cuckoo	*Chrysococcyx klaas*			f
69	African Emerald Cuckoo	*Chrysococcyx cupreus*			F
70	Diederik Cuckoo	*Chrysococcyx caprius*		am	
71	White-browed Coucal	*Centropus superciliosus*			
	Strigidae: typical owls				
72	African Wood Owl	*Strix woodfordii*			F
	Apodidae: swifts				
73	Mottled Spinetail	*Telecanthura ussheri*			F
	Coliidae: mousebirds				
74	Blue-naped Mousebird	*Urocolius macrourus*			
	Coraciidae: rollers				

	Common Name	Scientific Name	Threat Status	Migratory Status	Forest Dependency
75	Rufous-crowned Roller	*Coracias naevius*			
76	Lilac-breasted Roller	*Coracias caudatus*		am	
	Alcedinidae: kingfishers				
77	Woodland Kingfisher	*Halcyon senegalensis*			
	Meropidae: bee-eaters				
78	Little Bee-eater	*Merops pusillus*			
79	Cinnamon-chested Bee-eater	*Merops oreobates*			F
	Upupidae: Hoopoe				
80	Hoopoe	*Upupa epops*		am, pm	
	Bucerotidae: hornbills				
81	African Grey Hornbill	*Lophocerus nasutus*			
82	Von der Decken's Hornbill	*Tockus deckeni*			
	Capitonidae: barbets and tinkerbirds				
83	Yellow-rumped Tinkerbird	*Pogoniulus bilineatus*			F
84	Red-fronted Tinkerbird	*Pogoniulus pusillus*			
85	Red-fronted Barbet	*Tricholaema diademata*			
86	Black-throated Barbet	*Tricholaema melanocephala*			
87	Red-and-yellow Barbet	*Trachyphonus erythrocephalus*			
	Picidae: wrynecks and woodpeckers				
88	Nubian Woodpecker	*Campethera nubica*			
89	Golden-tailed Woodpecker	*Campethera abingoni*			
90	Cardinal Woodpecker	*Dendropicos fuscescens*			f
	Platysteiridae: batises, wattle-eyes and relatives				
91	Pygmy Batis	*Batis perkeo*			
	Malaconotidae: helmetshrikes, bushshrikes, tchagras and puffbacks				
92	Grey-headed Bushshrike	*Malaconotus blanchoti*			

	Common Name	Scientific Name	Threat Status	Migratory Status	Forest Dependency
93	Sulphur-breasted Bushshrike	*Telephorus sulfureopectus*			f
94	Rosy-patched Bushshrike	*Rhodophoneus cruentus*			
95	Three-streaked Tchagra	*Tchagra jamesi*			
96	Northern Puffback	*Dryoscopus gambensis*			F
97	Slate-coloured Boubou	*Laniarius funebris*			
98	Tropical Boubou	*Laniarius aethopicus*			f
99	Brubru	*Nilaus afer*			
	Campephagidae: cuckooshrikes				
100	Grey Cuckooshrike	*Coracina caesia*			FF
	Laniidae: shrikes				
101	Northern White-crowned Shrike	*Eurocephalus rueppelli*			
102	Red-backed Shrike	*Lanius collurio*		PM	
103	Isabelline Shrike	*Lanius isabellinus*		PM	
104	Taita Fiscal	*Lanius dorsalis*			
105	Somali Fiscal	*Lanius somalicus*			
106	Common Fiscal	*Lanius collaris*			
	Oriolidae: orioles				
107	Black-headed Oriole	*Oriolus larvatus*			f
	Dicruridae: drongos				
108	Common Drongo	*Dicrurus adsimilis*			
	Monarchidae: monarch flycatchers				
109	African Paradise Flycatcher	*Terpsiphone viridis*		am	f
	Corvidae: crows and allies				
110	Pied Crow	*Corvus albus*			
111	Dwarf Raven	*Corvus edithae*			
112	Fan-tailed Raven	*Corvus rhipidurus*			
	Hirundinidae: saw-wings, swallows and martins				
113	Barn Swallow	*Hirundo rustica*		PM	
114	Rock Martin	*Hirundo fuligula*			
	Alaudidae: larks				
115	Flappet Lark	*Mirafra*			

	Common Name	Scientific Name	Threat Status	Migratory Status	Forest Dependency
		rufocinnamomea			
	Cisticolidae: cisticolas and allies				
116	Rattling Cisticola	*Cisticola chiniana*			
117	Pale Prinia	*Prinia somalica*			
118	Grey Apalis	*Apalis cinerea*			
119	Grey-backed Camaroptera	*Camaroptera brachyura*			f
120	Grey Wren Warbler	*Calamonastes simplex*			
	Pycnonotidae: bulbuls				
121	Common Bulbul	*Pycnonotus barbatus*			
122	Cabanis's Greenbul	*Phyllastrephus cabanisi*			FF
	Sylviidae: Old World warblers				
123	Sedge Warbler	*Acrocephalus schoenobaenus*		PM	
124	Marsh Warbler	*Acrocephalus palustris*		PM	
125	Willow Warbler	*Phylloscopus trochilus*		PM	f
126	Yellow-vented Eremomela	*Eremomela flavicrissalis*			
127	Northern Crombec	*Sylvietta brachyura*			
128	Blackcap	*Sylvia atricapilla*		PM	F
129	Barred Warbler	*Sylvia nisoria*		PM	
130	Common Whitethroat	*Sylvia communis*		PM	
	Timaliidae: illadopses, babblers and chatterers				
131	Rufous Chatterer	*Turdoides rubiginosa*			
	Zosteropidae: white-eyes				
132	African Yellow White-eye	*Zosterops senegalensis*			
	Sturnidae: starlings and oxpeckers				
133	Golden-breasted Starling	*Cosmopsarus regius*			
134	Superb Starling	*Lamprotornis superbus*			

	Common Name	Scientific Name	Threat Status	Migratory Status	Forest Dependency
135	Waller's Starling	*Onychognathus walleri*			FF
	Turdidae: thrushes				
136	Abyssinian Ground Thrush	*Zoothera piaggiae*			FF
137	Olive Thrush	*Turdus olivaceus*			F
	Muscicapidae: chats, wheatears and Old World flycatchers				
138	White-browed Robin Chat	*Cossypha heuglini*			f
139	Spotted Palm Thrush	*Cichladusa guttata*			
140	White-browed Scrub Robin	*Erythrophygia leucophrys*			
141	Rufous Bush Chat	*Erythrophygia galactotes*		PM	
142	Northern Wheatear	*Oenanthe oenanthe*		PM	
143	Pied Wheatear	*Oenanthe pleschanka*		PM	
144	Common Rock Thrush	*Monticola saxatilis*		PM	
145	African Dusky Flycatcher	*Muscicapa adusta*			F
	Nectariniidae: sunbirds				
146	Eastern Violet-backed Sunbird	*Anthreptes orientalis*			
147	Collared Sunbird	*Anthreptes collaris*			F
148	Amethyst Sunbird	*Nectarinia amethystina*			f
149	Hunter's Sunbird	*Nectarinia hunteri*			
150	Variable Sunbird	*Nectarinia venustus*			f
	Passeridae: sparrow weavers, Old World sparrows and petronias				
151	House Sparrow	*Passer domesticus*			
152	Grey-headed Sparrow	*Passer griseus*			
153	Yellow-spotted Petronia	*Petronia pyrgita*			

	Common Name	Scientific Name	Threat Status	Migratory Status	Forest Dependency
	Ploceidae: weavers, bishops and widowbirds				
154	Red-billed Buffalo Weaver	*Bubalornis niger*			
155	White-headed Buffalo Weaver	*Dinemellia dinemelli*			
156	Baglafecht Weaver	*Ploceus baglafecht*			f
157	Lesser Masked Weaver	*Ploceus intermedius*			
158	Vitelline Masked Weaver	*Ploceus vitellinus*			
159	Chestnut Weaver	*Ploceus rubiginosus*		am	
160	Brown-capped Weaver	*Ploceus insignis*			FF
161	Red-billed Quelea	*Quelea quelea*		am	
162	White-winged Widowbird	*Euplectes albonotatus*			
	Estrildidae: waxbills				
163	Crimson-rumped Waxbill	*Estrilda rhodopyga*			
164	Green-winged Pytilia	*Pytilia melba*			
	Viduidae: Parasitic Weaver, indigobirds and whydahs				
165	Broad-tailed Paradise Whydah	*Vidua obtusa*			
166	Straw-tailed Whydah	*Vidua fischeri*			
	Motacillidae: wagtails, longclaws and pipits				
167	Yellow Wagtail	*Motacilla flava*			
168	African Pied Wagtail	*Motacilla aguimp*			
169	Tree Pipit	*Anthus trivialis*			f
	Fringillidae: canaries, citrils, seedeaters and relatives				
170	Reichenow's Seedeater	*Serinus reichenowi*			
	Emberizidae: Old World buntings				
171	Somali Bunting	*Emberiza poliopleura*			

Appendix 4- List of Stakeholders Consulted

AUGMENTATION OF MARSABIT TOWN WATER SUPPLY AND INTRODUCTION OF SEWERAGE SYSTEM									
STAKEHOLDERS CONSULTATION IN MARSABIT TOWN HELD FROM 19TH AUGUST 2015 TO 28TH AUGUST 2015									
S/No.	Name	Institutions	Designation	Contact					
				Post Office Box	E-mail	Mobile	Physical Address	Signature
1	JACOB ELISHA GODANA	BUSSINESS		BOX 18 MARSABIT	jacob.elisha@yahoo.co	0725461117	farm	[signature]
2	ABRAHAM ELISHA	BUSSINESS		"	"	0721434114	farm	[signature]
3.	Omar J. Sege	[illegible]		BOX 1		0727558447	farm	[signature]
4.	ALI D. FERNANDES	[illegible]	[illegible]	"	ali.fernandes96.@yahoo.com	0728861701	CHIEFS OFFICE	[signature]
5.	HUSSEIN CHARFI	O.O.P	CHIEF	BOX 1	husseincharfi@yahoo.com		CHIEFS OFFICE	[signature]
6.	HERBERT. A. KOMBO	O.O.P.	ACC	BOX 1	herbertakaliche@yahoo.com	0711912494	COUNTY COMM. OFFICE	[signature]

AUGMENTATION OF MARSABIT TOWN WATER SUPPLY AND INTRODUCTION OF SEWERAGE SYSTEM

STAKEHOLDERS CONSULTATION IN MARSABIT TOWN HELD FROM 19TH AUGUST 2015 TO 28TH AUGUST 2015

S/No.	Name	Institutions	Designation	Contact				
				Post Office Box	E-mail	Mobile	Fixed	Physical Address
	ANDREW KHAEMBA	(Land Adj.) MOLH&UD	CLASO	80-60500 MARSABIT	Khaemba.andrew@yahoo.com	0721606812		Lands office Marsabit
	SAMUEL MOI	Kenya Forest Service	Snr. Forester	Box 27 Marsabit	Fmmarsabit@kenyaforest.org	0720146163		Forest office Marsabit
	HON ADAN CHUKULISA MCA	MCA	MCA	BOX29-Marsabit	chukulisa adan@gmail	0725800455 87		MCA sagante/Jaldesa
	P.K. THUKU	R/GAO	CC	1, MARSABIT	ccmarsabit@gmail.com	0724657860		MARSABIT
	Kipchumba Rutto	MGAO	DCC	P.O Box 1 MSbt	Kipchumba.rutto@yahoo.com	0720997755		MARSABIT Chmbr
	Dr. M.S. Ndakalu	Health	DOMS	5, MBT	mndakalu@gmail	0722860644		Marsabit hospital.
	ABSHIRO MOHAMED HAPICHA	MARSABIT Referral Hospital	Hospital CEO	5 MBT	Abshirohapicha@gmail.com	0723521398		Marsabit Hospital.
	ROTICH BETWEL	MOH-AS CHRO	CHRO	5MBT	Kbetwel@gmail.com	0720129654		Marsabit Hospital
	MAMO B. MAMO	NEMA	CDE	204, MBT	mboru@nema.go.ke	0725746493		County Commissioners office
	Peter Lekeren	KWS	Senior Warden	42, MBt	lekeren@kws.go.ke	0722857733		Kws County Hqs.

AUGMENTATION OF MARSABIT TOWN WATER SUPPLY AND INTRODUCTION OF SEWERAGE SYSTEM

STAKEHOLDERS CONSULTATION IN MARSABIT TOWN HELD FROM 19TH AUGUST 2015 TO 28TH AUGUST 2015

S/No.	Name	Institutions	Designation	Contact				
				Post Office Box	E-mail	Mobile	Physical Address	Signature
	Paul Wambi	KWS	SPW		Powambi@kws.go.ke	0723211684		
	Hunyu Murithi	NEMA	E:O		hunyusam@gmail.com	0723105546	Probation office	

Appendix 5- Stakeholders Consultation Minutes

ENVIROMENTAL IMPACT ASSESMENT OF WATER SUPPLY IN MARSABIT TOWN

MINUTE OF STAKERHOLDERS CONSOLTATION FOR CREATING ASEWARAGE SITE IN MARSABIT TOWN

AGENDA

VISITING OF PHISICAL PLANERS OFFICE
KENYA FOREST OFFICE
MEMBER OF COUNTY ASSEMBLY OF SAGANTE
COUNTY COMMISIONER AND HIS ASSISTANT
MINISTRY OF HEALTH OFFICE
NATURAL ENENVIROMENT MANAGEMENT AUTHORITY OFFICER

PHISICAL PLANERS OFFICER
He said in Marsabit land has ownership and people have title deeds since 2002 and especially it work within town while Karantina registered now people are collecting title deeds. He show us a Jirime sheet number 12 and Majengo sheet number 10.Within Jirime plot are not less than 600000 shillings while Majengo 100 by 100 is 800000 shillings

KENYAN FOREST OFFICER
As we request the dead material like trees which are in existing Bakuli 3 and spacing of proposed Bakuli
4 dam which are located in the forest he gave us the process of removing dead materials . Requirements
1 application for easement form water resources management authority 002
2 copy of form water resources management authority 004
3 one topographical map of the area showing route of the pipeline
4 map showing the route of the way leave
5 application letter
6 map showing area being applied for.
He also told us animals that lives in the Marsabit Park e.g. Elephant, Leopard, Buffalo, Lion, Birds and snakes
He promised us to back to his office so that he can give us the statics and cost they can get from
the park per year .

MEMBER OF COUNTY ASSEMBLY OF SAGANTE
The member of county assembly of sagante was called since the required site is in sagante location but he claimed that he supposed to see the site so that he can give the way out and also he complained that the waste water has smell which are not comfortable to his people who lives nearer the site. He promised to see the site with us the following day at 10.00a.m but not attend it.

COUNTY COMMISIONER OF MARSABIT
We request him to go with some people like area chiefs, member of county assembly, land ownership and his assistant if possible to the sewerage site physically where he called for us the chiefs of three locations Mountain, Town and Dakabaricha to inform them the issues and to go with us to the site tomorrow. He told us that the site was belong to the Elisha Godana

He also informed the land owners to meet the following day at their land to see the site physically

MINISTRY OF HEALTH OFFICER OF MARSABIT COUNTY
The officer claimed that if water level goes down the water has bacteria which lead to water borne diseases like typhoid, cholera and skin diseases and malaria but he said malaria is very rare since this place has scarcity of water the mosquitoes are not much it rains once in a year there is no stagnant water. the hospital get water brought by water bowers through the department of water, environment and natural resource. Finally he take us to the medical superintendent office

MEDICAL SUPERINTENDENT OFFICER
He is the chief executive officer of the hospital where he talks about the issues of water borne disease since there is scarcity of water in the hospital area the little water they get has bacteria which causes water borne disease.
He also complained that hospital has no constant supply of water and he promised that he will prepare a comprehensive report on cost of treatment and statistics of the hospital on Monday

NATURAL ENVIROMENT MANAGEMENT AUTHORITY OFFICER
He has report of 2014 of state of environment where he said Marsabit ecosystem is very intensive and borehole is not issues to marsabit water problem since the land in marsabit has ownership we supposed to consult proper group and environmental committee and supposed to look negative impact like
1 Biodiversity
2 Smells
3 Environmental degradation
4 Pollutions
5 Floods
6 Disturbance of soil structure
7 Noise pollution
8 Attraction of animals like Baboons, elephant, and Birds
9 Acceptance of the land owner
And positive issues like
1 employment opportunity for those working there
2 sanitation
Finally we went to the site with the county commissioner central, three chiefs of town, mountain, Dakabaricha, land owners the two sons of Mr. Elisha Godana and one solder. At the site we confirmed that land was exactly belong to mr.Elisha Godana and we informed his sons that the land is flat and alaga pass though it which does not flood to the any water source in Marsabit so far which can describe its good place for the sewerage site and they agreed that they can sale the land , where we proceed to the next plot to see whether its better than the one unfortunately we saw that its better it.

Appendix 6:- Scoping Checklist of Bakuli 4 Dam

Checklist for Positive and Negative Environmental Impacts of Water Resources Development Projects

Project name/Location----Bakuli 4 Dam Project----------

Enumerator's name---------Eng. B.I. Kasabuli----------

Assessment: 1st/2nd/----------1st----------

For each potential Environmental Effect place cross (X)	Positive Impacts			Negative Impacts		
	None	Minor	Major	None	Minor	Major
Hydrology Low flow regime			X			
Flood Regime						X
Operation of Dam			X			
Water Table Level			X			
Surface Water Quality						X
Ground Water Quality			X			
Eutrophication						X
Pollution Noise						X
Agrochemicals	**X**					
Organic Pollution	**X**					
Anaerobic Effects	**X**					
Gas Emissions						**X**
Soils Salinization	**X**					
Soil Properties			**X**			
Water logging			**X**			
Erosion		**X**				
Soil fertility	**X**					
Soil Productivity	**X**					
Sediments Local Erosion						**X**
Hinterland Effect						**X**
River Morphology						**X**
Channel Engine						**X**
Sedimentation						**X**
Estuary Erosion						**X**

For each potential Environmental Effect place cross (X)	Positive Impacts			Negative Impacts		
	None	**Minor**	**Major**	**None**	**Minor**	**Major**
Ecology Projects Lands						**X**
Water Bodies			**X**			
Surrounding Area			**X**			
Valleys and Slopes						**X**
Wetlands and Plains			**X**			
Wildlife			**X**			
Vegetation			**X**			
Climate						**X**
Socio-Economic Population Change			**X**			
Income			**X**			
Employment			**X**			
Arable Agriculture	**X**					
Settlement			**X**			
Recreational sites			**X**			
Historical and archaeologist sites	**X**					
Livestock raising	**X**					
Tourism			**X**			
Infrastructure			**X**			
Fishing	**X**					
Land tenure						**X**
Health Water and Sanitation			**X**			
Relocation effect						**X**
Disease effect						**X**
Disease ecology			**X**			
Disease control						**X**
Disease hazards						**X**
Imbalances Pests and weeds				**X**		
Animal diseases				**X**		
Aquatic weed				**X**		
Structural Damage				**X**		
Animal imbalances				**X**		

Appendix 7:- Scoping Checklist of Introduction of Sewerage Works in Marsabit Town

Item			Description	Impact	Remarks
Social Environment	1	Relocation	Compensation due to land Acqusition	A	No inhabitant in the plant area, sewer in Public Right of way (Road Reserve and Riparian areas)
	2	**Economic Activity**	**Increase in Production, change of economic structure**	**A**	**The Project will lead to rapid population growth of Marsabit Town**
	3	Traffic/Public Facilities	Traffic congestion, accident, effect on public facilities	D	There is an Airport located over 2km hence no issue of Birds accident with the aeroplanes
	4	Division of Communities	Separation of local communities due to blocking of transportation system	D	No structure to separate local community
	5	Archaeological/Cultural Heritage	Decrease or deterioration of archaelogical/cultural sites	D	No such sites
	6	Vested Rights	Right for fishery, water use, logging etc	C	No impact. But, the water contamination may cause the trouble of water use
	7	Health and Hygiene	Degradation of hygienic conditions caused by waste disposal and vector insects	A	Depending on the disposal of wastes and contamination of ground waterdue to
	8	Waste Disposal	Construction waste/debris, contaminated mud, sludge, general wastes, etc	A	the sludge disposal is usual environmental issue for sewerage
	9	Dister/Accident	Increase of danger on ground collapse, land sliding, traffic accident, etc	D	No such danger is considerable from the viewpoint of small scale of structure and topographic
Natural Environment	10	Topography and Geology	Change of significant land forms and geological features caused by earthwork, etc	A	The site is sloping . However, need a care for an impact to underground
	11	Soil Erosion	Soil erosion originated by runoff through earthworks, logging, etc.	A	The rainfall intensity is low. No remarkable scale of earthworks

Item			Description	Impact	Remarks
	12	Ground Water	Water contamination caused by excessive pumping, decreasing seepage capacity, etc.	A	Depending on the disposal of wastes and contamination of ground water due to the effluent.
	13	River & Lake	Change of discharge, velocity, riverbed due to reclamation, new channel construction, etc.	A	Probabable impacts due to the effluent from the plant.
	14	Coast	Scouring or sedimentation of coastal area due to change of drifting sands and waves	D	None applicable
	15	Fauna & Flora	Mountain WSP borders forest and will cause invasion of the Ponds with baboons and creation of an artificial wetland	A	The area borders Gazetted Forest and Game Reserve. Construction of Mountain WSP might worsen human/wildlife conflicts
	16	Climate	Climate change arising by implementation of large scale development of earthworks and structures	D	No change due to small scale. Sewerage project is not a type to give an impact on climate.
	17	Landscape	Change of Landscape due to earth works and new structures	D	It is necessary to consider the harmony with the present landscape and reserve the natural
Pollution	18	Air Pollution	Air Pollution caused by exhaust gas and poisonous gas from vehicles and Waste Stabilization Ponds	D	No burning facility. The location is in a rural town.
	19	Water Pollution	Water contamination caused by inflow of soil, chemical substances,oil etc.	B	The effluent from factories has generally organic one and very limited toxic substance. But the effluent may cause water pollution if not treated well

Item			Description	Impact	Remarks
	20	Soil Contamination	Soil contamination caused by runoff and diffusion of effluent, posonous substances, etc	D	The Waste sludge disposal may contaminate the soil
	21	Noise /Vibration	Noise and vibration caused by running vehicle, pumping, etc	D	No facilities with noise or vibration. The structure is small in scale. The sites are located near forest and unsettled area
	22	Ground Subsidence	Ground surface subsidence caused by change of foundation condition and lowering of ground water	D	No pumping up of the ground water. Foundation work is not deep
	23	Odor	Occurrence of exhaust gas and odor	B	Depending on the site location and the wind direction from the treatment plant and waste disposal site.
	Score:	**A**	**Significant Impact Anticipated**		
		B	**Slight Impact Anticipated**		
		C	**Unknown (Subject to further verification)**		
		D	**Almost No impact anticipated and not for IEE and EIA**		

Appendix 8: Environmental Impact Assessment Team

S/no	Name	Designation/Qualifications
1	Samuel K. Ndungu	Asset Development Officer/ Northern Water Services Board (Garissa)
2	Teresia Njeri	Lecturer, Botany and Zoology, Tourism Department, Kenya Utalii College, Kenya.
3	Daniel S. Lealo	SCWO – North Horr, Marsabit
4	Waqo Guyo Samuel	Trainee, Bsc. Soil, Water and Engineering, Jomo Kenyatta University of Agriculture and Technology
5	Kula Boru Waqo	Trainee, Diploma Water Engineering, Kenya Water Institute
6	Eng. Benard Imbambi Kasabuli	Lead Expert ,Ministry of Water and Irrigation

Appendix 9: Lead Expert Qualification Documents

FORM 5 (r. 14(4))

Application Reference No: 1082
Registration No 534
FOR OFFICIAL USE

THE ENVIRONMENTAL MANAGEMENT AND COORDINATION ACT

CERTIFICATE OF REGISTRATION AS AN ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT EXPERT

JAMES K. KIPKEMEI
ADVOCATE
P.O. Box 61436-00200
NAIROBI

This is to certify Ms. ENG. BERNARD MBAMBI KASABULI
of P.O. BOX 7907 – 00200, NAIROBI (Address)
has been registered as an Environmental Impact Assessment Expert in accordance with the provisions of the Environment Management and Coordination Act and is authorized to practice in the capacity of a Lead Expert/Associate Expert/Firm of Experts (Type) LEAD EXPERT

Dated this 8TH day JUNE of 20 06

Signature.....

(Seal)

Director General
The National Environmental Management Authority

GPK (L)

FORM 7 (r.15(2))

nema
mazingira yetu | uhai wetu | wajibu wetu

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/2431

Application Reference No: NEMA/EIA/EL/3988

M/S **Eng. Benard Imbambi Kasabuli**
(individual or firm) of address

P.O. Box 7907-00200 Nairobi

is licensed to practice in the

capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Lead Expert**
registration number **531**

in accordance with the provision of the Environmental Management and Coordination Act, 1999.

Issued Date: **8/19/2015** Expiry Date: **12/31/2015**

Signature…..

(Seal)
Director General
The National Environment Management Authority

P. T. O.

ISO 9001 : 2008 Certified

EIK Environment
INSTITUTE OF KENYA

1,000,866

Certificate of Membership

This is to certify that

Benard Kasabuli

is a Lead Expert Member of Environment Institute of Kenya.
An institute founded in the year 2014 to extend and disseminate
Environmental knowledge and promote the
practical application for public good.

Chairman

3/9/2015

Date

This certificate remains property of Environment Institute of Kenya. Membership is subject to annual renewal