

# ENVIRONMENTAL IMPACT ASSESSMENT PROJECT REPORT

FOR

PROPOSED OIL AND GAS SEISMIC PROJECT IN BLOCK 12A: PARTS OF TURKANA EAST,  
EAST POKOT, MARAKWET WEST, BARINGO CENTRAL, MARIGAT, KEIYO SOUTH, BARINGO  
NORTH, MOGOTIO AND SAMBURU DISTRICTS BY  
TULLOW KENYA B.V.



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# PROJECT REPORT

## FOR

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SEPTEMBER 2011

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Signed .....  
Date .....

We the undersigned, confirm that the contents of this report are a true representation of the Environmental Impact Assessment Project Report of the proposed oil and gas seismic survey project in Block 12A: Parts of Turkana East, East Pokot, Marakwet West, Baringo Central, Marigat, Keiyo South, Baringo North, Mogotio and part of Samburu Districts

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Sign.....

Sign.....

Date.....

Date.....

## EXECUTIVE SUMMARY

Tullow Kenya B.V. (TKBV) holds an Exclusive Prospecting Right (EPR) over Block 12A, which covers nine districts (Turkana East, East Pokot, Marakwet West, Baringo Central, Marigat, Keiyo South, Baringo North, Mogotio and part of Samburu Districts) in northwest Kenya. The main objective of the seismic survey is to study in detail the assigned area of 15389.39km<sup>2</sup>, in accordance with the contractual obligations under the Production Sharing Agreement (PSC) signed with the Kenya Government on 17<sup>th</sup> September 2008 in order to delineate potential hydrocarbon prospects. This Environmental Impact Assessment Project Report has been prepared for TKBV, in accordance with the objectives established by the Environmental Management and Coordination Act (EMCA) of 1999, and subsequent related regulations. Seismic surveys are a primary tool utilized during the exploration of hydrocarbons in both onshore (land) and offshore (marine) areas. They provide vital information about the subsurface that assists in the location of exploration wells.

Undertaking this seismic survey is justified by a number of factors. This seismic project, if successful, would play a major role in enabling the country to reduce the cost of energy and over-reliance on hydroelectric power and crude oil imports, as well as benefit from oil and gas exportation to other countries, thus increasing the per capita income and the GDP from foreign exchange. Other possible spin-offs would include: opening up of the northern frontier districts in Kenya to development activities and trade in sectors such as mining, tourism, fishing, agriculture, and animal husbandry which are currently extremely under-exploited; job creation; and increased economic activity in the area.

The detailed field-based environmental impact assessment study, which was preceded by extensive desk top studies, was undertaken from 21<sup>st</sup> February to 6<sup>th</sup> March 2011. The biophysical studies included, amongst others, an assessment of the surface geology and geomorphology, soils, hydrogeology and water resources, climate, hydrology, terrestrial flora and fauna and their habitats. The socio-economic study covered issues such as population and economic activities, education, social amenities (healthcare and schools), cultures and traditions, infrastructure and communications. The legislative and regulatory framework has also been extensively explored in this report. The public consultations were extensive, and included formal and informal meetings with key interested and affected persons and groups (e.g. officials of governmental and non-governmental agencies, community leaders, Community Based Organisations, Women and Youth groups), public *barazas*, and open-air “market” meetings, as well as completion of questionnaires by a sample of local households. The information gathered provides detail for the current environmental and socio-economic baseline situation and is a critical component for development of the Environmental Management Plan. The potential environmental and social impacts, and for which clear, achievable, and effective mitigation measures have been suggested in this report, include:

- Noise and vibrations from Vibroseis machines, and dynamite charges;
- Disturbance to terrestrial and aquatic (riverine) habitats, flora and fauna along survey line transects;
- Dust generation and exhaust emissions by vehicles and equipment;
- Waste generation at camp sites and other work areas;
- Disturbance to livelihood activities during data acquisition along survey lines; and
- Interference with sensitive cultural and natural heritage sites.

Both the field survey and documentation reveal the following existing pressures on the environment and social fabric: soil compaction by grazing animals; active wind erosion and water erosion; more frequently recurring droughts that are related to climate changes; dust generated by moderate to strong winds and enhanced by low vegetation cover; pollution of



rivers, water pans and shallow groundwater in luggas by humans and livestock; high demand for potable groundwater sources; and land degradation due to overgrazing and charcoal burning. The communities lack adequate provision of basic services such as education, health and security. In addition, while the communities are fairly stable, their security is compromised by sporadic but often deadly cattle rustling. Conflicts also occur from time to time in relation to access to natural resources such as water and grazing lands.

Due to the nature, scale and short time duration of the proposed seismic survey, the impacts would by and large be temporary and/or transient, rather than long-term and/or permanent. A number of seismic surveys have already been conducted in the region and other areas of Kenya, and no adverse or long-lasting impacts have been reported from these activities. The measures proposed to mitigate these environmental and social impacts detailed in the Environmental Management Plan within this report are considered adequate and effective in safeguarding the environmental and social fabric of the area, and should be strictly adhered to.

The community members and leaders who attended the various public meetings and participated in the questionnaire survey welcomed the proposed project, but appealed for adherence to environmental safeguards and labour legislation. TKBV (as outlined in its EHS [Environmental, Health and Safety] and CSR [Corporate Social Responsibility] Policies) is committed to environmental protection at the highest level, continual engagement of local stakeholders throughout the duration of the project, and to being sensitive to local culture and customs, and would want to be seen as a valued part of the communities in the project area.

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# CHAPTER 1

## INTRODUCTION

### 1.1 INTRODUCTION

This EIA has been prepared by Earthview Geoconsultants for the project proponent, Tullow Kenya B.V. (TKBV). The EIA project report provides a critical examination of social and environmental issues relevant to the project site. This report is primarily aimed at identifying the environmental, social, cultural and economic aspects and establishing mitigations for minimising the negative impacts and maximising the positive impacts of the proposed seismic survey operations in Block 12A (Figure 1.1). Operations will take place over nine districts (Turkana East, East Pokot, Marakwet West, Baringo Central, Marigat, Keiyo South, Baringo North, Mogotio and part of Samburu to the eastern side of Suguta valley). The study includes a review of available literature, meetings and consultations with local stakeholders and government officials, interviews and public consultation with local residents, site visits to the proposed project site and the surrounding area, and the application of professional knowledge and experience.

### 1.2 DEVELOPER IDENTIFICATION

This EIA is carried out for TKBV (Pin P051340553U), a subsidiary company of Tullow Oil PLC, with respect to the proposed seismic survey in Block 12A.

Offices In Kenya:	Contact:
Ground Floor, Acacia House, Westlands Office Park, Waiyaki Way	Mr. Martin Mbogo General Manager Tullow Oil Kenya B.V. P.O. Box 63298-00619 Nairobi Kenya

Africa Oil Corporation is the development partner. TKBV will engage an internationally experienced seismic acquisition geophysical company that will use suitable state-of-the-art technology to execute the seismic program in Block 12A.

### 1.3 ACTIVITIES OF TULLOW OIL PLC: AN OVERVIEW

Tullow Oil PLC, an FTSE100 company, is one of the largest independent oil and gas exploration companies. The Group has over 80 licences in more than 20 countries, with operations in Africa, Europe, South Asia and South America.



Figure 1.1: Location map of the project area.

#### 1.4 BRIEF REGIONAL DESCRIPTION

The National Oil Corporation of Kenya (NOCK) has identified potential petroleum exploration regions in Kenya and demarcated them into blocks. The project area, classified as Block 12A by NOCK, covers parts of Turkana East, East Pokot, Marakwet West, Baringo Central,

Marigat, Keiyo South, Baringo North, and Mogotio Districts (Figure 1.1). In terms of its geological setting, it covers parts of the Kerio Basin, Baringo Basin and the Suguta Trough. These Tertiary age half-graben basins generally trend north-south.

A large part of the area is semi-arid to arid, while the southernmost part is sub-humid. Mean annual rainfall is less than 300mm yr<sup>-1</sup> that is distributed following a unimodal cycle with the peak in May and July. The mean annual temperature ranges between 28° and 31°C, while mean annual evaporation ranges between 3000 and 4000mm yr<sup>-1</sup>. Precipitation in the Baringo-Bogoria basin ranges from 700mm on Lobo Plain to 1200mm on the adjacent highlands. Most of the rain falls in April and November. Potential evaporation is more than 2500mm and this creates a water deficit below what is needed and semi-arid conditions, over most of the lower parts of Bogoria basin.

The physiography of the area can be divided into five zones: (a) the inner trough which is characterised by Quaternary volcanism and sedimentation, with Lake Baringo in the South; (b) the Eastern margin of the rift composed mainly of Neogene volcanic rocks that flank the margin of the Rift, separated by a series of westerly facing escarpments; (c) the Western margin of the Rift which consists of the Elgeyo and Saimo faults in the south of the project area, both of which give rise to east-facing escarpments that expose metamorphic basement rocks in Kaptubei area overlain by Neogene phonolites and trachytes; (d) the Kerio basin to the West and Baringo basin to the East formed during the Palaeogene age and lie at the base of the rift, thus being known as the Tugen hills sequence; and (e) the Suguta Valley that occupies the present axis of the Gregory Rift south of lake Turkana. The area has three dominant geologic formations: (1) the Precambrian basement system rocks known as the Mozambique belt, that underlie the western region in Elgeyo Escarpment and eastern side in Samburu area; (2) widespread Tertiary (to Quaternary) volcanic rocks; and (3) Quaternary to Recent sediments that overlie much of the older rocks in the project area.

Most of the project area is sparsely vegetated, except in the south. It is characterised by bushland and thicket with the most common tree species being *Acacia spp* and *Cammiphora spp*. There is also *Euphorbia* and *Aloe* as well as grass species like *Dactyloctenium aegyptium* and *Panicum turgidum*. Evergreens in the area are *Boscia*, *Dobera*, *Salvadora*, *Grewia*, *Cadaba*, *Crotalaria* and *Indigofera*. Lake Bogoria supports approximately 210 plant species and the vegetation type can be classified into 7 physiognomic representations: 1. riverine forest, 2. wooded bushland, 3. bushed thicket, 4. bushland, 5. bushed grassland and 6. swamps and 7, grasslands. The land fauna in the area includes bush pigs, waterbucks, buffalo, elephant, crocodile, warthog, yellow baboon, impala, leopard, zebra, mongoose, greater kudu, gazelle, cheetah genet, hyena, giraffe, dik dik, Karakul cat and birds.

The semi-arid northern part of the project area which supports pastoralism is sparsely populated with a very low population density, while the converse is true of the sub-humid southern part that has good nutrient-rich soils that support agriculture. Population estimates from the 2009 census indicate that Turkana South District had 226,379 people; Pokot East District had 133,189 people, and the Baringo and Baringo North Districts had 162,351 and 93,789 people respectively. Transport and communication system is poorly developed towards the north of the project area and well developed in the southern region. Major roads linking District Headquarters in the south are tarmacked, while in the north especially in Turkana East District, the road network is highly eroded and potholes and washouts make it impassable during the rainy season. Airstrips are available in major centres, namely, Lokori, Lomelo, Kapedo, Nginyang and Kabarnet. There are fairly reliable telecommunication services in the south but in the north such services are either not available, poor or unreliable.

## 1.5 PROJECT BACKGROUND, OVERVIEW, JUSTIFICATION AND OBJECTIVES

### 1.5.1 Project Background

A Production Sharing Contract (PSC) for the Exclusive Prospecting Right (EPR) for Block 12A was signed with the Government of Kenya in 17<sup>th</sup> September 2008.

TKBV's main aim and objective over the exploration licence period will be to explore in detail the assigned area of 15389.39 km<sup>2</sup> (Block 12A), in accordance with its contractual obligations under the PSC, in order to: (a) delineate potential hydrocarbon prospects, (b) carry out exploratory drilling within the identified potential prospect areas, and (c) carry out well appraisal and production of oil and/or gas if the prospects prove to be economically viable. TKBV is committed to ensuring that the activities that will be carried out to achieve the stated objectives will be done in a manner that is not detrimental to the natural environment or the local communities in the area. It should be noted that this EIA project report only covers the geophysical programme and any further development in the block will have to undergo further EIA process to identify the impacts that will be associated with that particular project.

### 1.5.2 Overview of the Project

The project is an exploratory activity for determination of potential oil and gas resources in the assigned area (Block 12A) in Northern Kenya, and is commonly referred to, in the Oil and Gas Industry parlance, as a "seismic survey". A seismic survey is conducted by creating an acoustic energy wave (commonly referred to as a 'seismic wave') using an energy source placed on or close to the surface of the ground or in water along a predetermined line (seismic survey line, or transect). This wave travels into and through the earth strata, where it is reflected and refracted by various subsurface formations, and returns to the surface where receivers called geophones (or hydrophones, in water) are used to detect the waves and convey them to a recorder for analysis. By analyzing the time it takes for the seismic waves to reflect off subsurface formations and return to the surface, formations can be mapped and potential oil or gas deposits identified. The seismic waves can be induced using three types of energy sources: (i) dynamite charges that are set off in shallow (5 to 20m deep) holes (known as 'shot holes'); (ii) 'Vibroiseis' trucks that are equipped with heavy plates that vibrate on the ground, and (iii) compressed air systems that release rapid bursts of air (commonly known as airguns) in water bodies.

As per the PSC requirements, approximately 500 km of 2D seismic data will be acquired over a projected time period of eight to twelve weeks, beginning in November 2011. The workforce that will be required to carry out the survey will be between 100 and 150 in number. Line clearance along the pre-determined and pre-surveyed transects on land will be done by use of mulchers and light hand-cutting tools, and where access roads are required, by bulldozers. Support vehicles such as for personnel movement, carrying of data recording equipment, etc., will be available.

The workforce will reside in a base camp that will be constructed by the seismic contractor who has experience in setting up such camps. Issues such as camp security, provision of basic services (e.g. accommodation, water, sanitation, lighting, and health care), waste management, materials storage areas, etc., shall be incorporated in the camp design. The camp will be sited at least 10km away from existing settlements, and its location shall be determined in consultation with the local community leaders. The health and safety of the crew and the general public at large will be ensured by the seismic contractor complying both with the relevant national legislation, and its own in-house environmental health and safety (EHS) policies which embrace the international best practices for such activities. An emergency response plan will be put in place in case of any accidents. A close working

relationship will be fostered with all stakeholders and the local communities, and as far as is practicable, unskilled and semi-skilled workers shall be recruited locally.

### **1.5.3 Project Justification**

Following the discovery of hydrocarbons in the Muglad and Melut basins of the South Sudan rifts and, more recently, by Tullow Oil and Heritage Oil in Uganda within the western branch of the East African Rift, several oil companies have intensified exploration efforts in the related Mesozoic and Early Tertiary rift basins of Kenya with a view to meeting the global, regional and local demand for energy.

Energy is an important factor in socio-economic development (GVEP Kenya, 2006). The international community is today confronted with the daunting task of reducing poverty and achieving sustained economic growth and development for the benefit of all. The provision of adequate, quality, and affordable energy services can play a decisive role in poverty reduction (GVEP Kenya, 2006). To improve on the security of energy supply in Kenya, industries have had to invest in stand-by generators, which run on expensively imported diesel, thus pushing the cost of production even higher. The industry sector has thus been faced with costly energy supply, which has contributed to high industrial production costs. Thus, the availability of fossil fuels locally would significantly reduce the energy cost as well as production cost of industries.

This project, if successful would play a major role in enabling the country to reduce the cost of energy and over-reliance on hydroelectric power and crude oil imports, as well as benefit from oil and gas exportation to other countries, thus increasing the per capita income and the GDP from foreign exchange. Other possible spin-offs would include: opening up of the northern frontier districts in Kenya to development activities and trade in sectors such as mining, tourism, fishing, agriculture, and animal husbandry which are currently extremely under-exploited; job creation; and increased economic activity in the area. The project is in line with the objectives of the national Energy Policy (improving access to affordable energy services, enhancing security of supply, promoting development of indigenous energy resources; promoting energy efficiency and conservation; and promoting appropriate and sustainable environmental, health and safety practices), the Economic Recovery for Wealth and Employment Creation Strategy (expanding and improving infrastructures, developing arid and semi-arid lands, and safeguarding environment and natural resources), and Kenya Vision 2030 (enhanced equity and wealth creation for the poor...in semi-arid and arid districts, must generate more energy at a lower cost and increase efficiency in energy consumption).

## **1.6 PURPOSE OF THE EIA**

In Kenya, the primary authority that regulates the environment with respect to relation to oil and gas exploration activities is the National Environment Management Authority (NEMA). Other key national stakeholders and regulators in the oil and gas industry are: the Ministry of Environment and Mineral Resources, the Ministry of Energy, and the National Oil Corporation of Kenya (NOCK). The country is also a signatory to a number of international treaties and conventions related to environmental protection and conservation.

### **1.6.1 The Mandate of NEMA**

The National Environment Management Authority (NEMA) is the institution that has been established under the Environment Management and Coordination Act (EMCA) of 1999 in order to deal with matters pertaining to the environment, with the object and purpose of exercising general supervision and co-ordination over all matters relating to the environment

and to the principal instrument of government in the implementation of all policies relating to the environment. Some of its mandates that are relevant to EIAs are to:

- Co-ordinate the various environmental management activities being undertaken by the lead agencies and promote the integration of environmental considerations into development policies, plans, programmes and projects with a view to ensuring the proper management and rational utilisation of environmental resources on a sustainable yield basis for the improvement of the quality of human life in Kenya;
- Carry out surveys which will assist in the proper management and conservation of the environment;
- Undertake and co-ordinate research, investigation and surveys in the field of environment and collect, collate and disseminate information about the findings of such research investigation or survey;
- Identify projects and programmes or types of projects and programmes, plans and policies for which environmental audit or environmental monitoring must be conducted under the Act;
- Monitor and assess activities, including activities being carried out by relevant lead agencies, in order to ensure that the environment is not degraded by such activities, environmental management objectives are adhered to and adequate early warning on impending environmental emergencies is given;
- Undertake, in co-operation with relevant lead agencies, programmes intended to enhance environmental education and public awareness about the need for sound environmental management as well as for enlisting public support and encouraging the effort made by other entities in that regard;
- Publish and disseminate manuals, codes or guidelines relating to environmental management and preventing or abatement of environmental degradation;
- Render advice and technical support, where possible, to entities engaged in natural resources management and environmental protection so as to enable them carry out their responsibility satisfactorily.

### **1.6.2 Requirements and Scope of Work for the EIA**

A project report is defined, in the preliminary section of the EMCA (1999) and the interpretation section of the Environmental (Impact and Audit) Regulations (2003), as a summarized statement of the likely environmental effects of a proposed development referred to in section 58 of the Environmental Management and Co-ordination Act, 1999. Section 58 requires that a proponent intending to carry out any undertaking listed in the Second Schedule to the Act must submit a project report to the National Environmental Management Authority ('the Authority') in the prescribed form accompanied by the prescribed fee. The seismic survey project falls under Schedule 2, at 6(j) "exploration for the production of petroleum in any form" of EMCA 1999.

The Regulation No.7 of the Environmental (Impact and Audit) Regulations, 2003 lays down the specific issues that the project report must address, which in summary are: the nature, location, activities, and design of the project; the materials that are to be used; the potential environmental, economic and socio-cultural impacts and mitigation measures; plans for the prevention and management of accidents and for ensuring the health and safety of workers and neighbouring communities; and the project budget. These issues are to further address, as outlined in the Second Schedule of the Environmental (Impact and Audit) Regulations (2003): ecological considerations; sustainable use; ecosystem maintenance; social considerations; landscape and land uses; and water. Within this framework, the collection of relevant baseline data, and consultations with stakeholders and the public are important, and ought also to be included in the report.

### 1.6.3 The EIA Review and Approval Process

Where the Authority finds that the project report conforms to the requirements of regulation 7 (1), it must within seven days of receiving the report, submit a copy to each of the relevant lead agencies, the relevant District Environment Committee, and where it involves more than one district, to the relevant Provincial Environment Committee. Each of these lead agencies and Committees must then submit their written comments to the Authority within twenty-one days from the date on which they received the project report from the Authority or within any other period that the Authority may prescribe (regulation 9). Once the Authority comes to a decision, it must communicate that decision, together with the reasons for it, to the proponent within forty-five days from the date on which the project report was submitted to it (regulation 10(1)). Where the Authority is satisfied that the project will have no significant impact on the environment, or that the project report discloses sufficient mitigation measures, it may issue a licence (regulation 10(2)). If, however, it finds that the project will have a significant impact on the environment, and the project report discloses no sufficient mitigation measures, the Authority will require that the proponent undertake an environmental impact assessment study in accordance with the Regulations.

### 1.7 THE EIA TEAM

Earthview Geoconsultants (K) Ltd. was appointed by TKBV on 7<sup>th</sup> February 2011 to undertake the EIA for the seismic survey in Block 12A. Earthview is a well-established consultancy firm based in Nairobi with good capacity in, e.g., environmental and social impact assessments and audits, geological and hydro-geological studies, geographic information systems, natural resource surveys, and project planning, implementation and management. Earthview is officially registered with the National Environment Management Authority as an Environmental Consultancy Firm. The firm comprises of individuals with many years' experience and knowledge in these and other areas. The firm is conversant with national legislation and regulations that relate to the sectors in which it carries out its activities, including NEMA requirements for environmental and social impact assessments and audits, as well as applicable international best practices and standards.

**Table 1.1: List of consultants.**

<b>Name</b>	<b>Role</b>	<b>Qualifications</b>	<b>Experience (years)</b>
Prof. Norbert Opiyo-Aketch	Overall coordination/Geological issues	PhD	30
Dr. Daniel Olago	Coordination/Biophysical and Socio-economic issues	D.Phil.	20
Mr. Joseph Nganga	Soil and Waste Management	BSc	20
Mr. Adams Gakuo	Aquatic Ecology	MSc	4
Mr. Francis Aketch	Terrestrial and Wildlife Ecology	MSc	4
Mr. John Obunga	Geology, Hydrogeology, Water Resources	BSc	5
Mr. James Ndunda	Socio-economist	BSc	5
Ms. Evelyn Sindani	Health and Socio-cultural issues	BSc	3
Mr. Peter Kibe	GIS Expert	MSc	20
Mr. Nicholas Aketch	Logistics/Administration	BSc	8
Ms. Emily Atieno	Policy/Legislation/Regulations	LLB	25

### 1.8 OBJECTIVES OF THE EIA PROJECT REPORT

In carrying out the project, and considering the national legislative and regulatory requirements for EIAs, TKBV shall seek to:



- a) Assess and analyse the environmental and social aspects, both positive and negative that will be associated with the proposed project.
- b) Identify, evaluate and propose suggested mitigation measures for potential environmental aspects of the proposed project on the various biophysical and socio-economic structures of the area.
- c) Propose and outline environmental management plans and monitoring mechanisms that will be implemented during the project execution phase and demobilisation
- d) Ensure that concerns and aspirations of the local community are addressed in all stages of the project cycle.
- e) Ensure that the project activities do not in any way interfere with the environmental sustainability of the area. This is ensured by giving due consideration to:
  - Land resources and National heritage sites in and around the project area.
  - Local communities and land tenure systems.
  - Sensitive historical, archaeological and cultural sites.
- f) Put in place mitigation and monitoring measures that will ensure that any potential negative impacts arising from activities of the project are eliminated or reduced at the earliest opportunity to obviate any harmful effect to the environment.
- g) Boost the economy by providing jobs and trading opportunities to the local community in the region.

## 1.9 TERMS OF REFERENCE (TOR)

The following are the Terms of Reference (TOR) for the EIA:

- To hold meetings with the project proponent to establish the procedures, define requirements, responsibilities and a time frame for the proposed project.
- To identify (and consult with) all potential stakeholders associated with the proposed seismic survey;
- To carry out a systematic baseline environmental and social impact assessment of the proposed survey area;
- To carry out a systematic assessment of all identified environmental aspects of the proposed seismic survey project within the project area, following the National Environment Management Authority legislative and regulatory requirements and best international practice for an activity of this nature.
- To provide a description of the proposed activities throughout the entire implementation process of the proposed project with special focus on potential impacts to the surrounding environment and the socio-economic fabric of the local communities.
- To produce an Environmental Impact Assessment Project Report that contains the details of potential negative impacts, together with recommendations for their mitigation and/or prevention, as well as positive impacts and recommendations for enhancing and/or encouraging them.
- To develop an Environmental Management and Monitoring Plan.

## 1.10 STRUCTURE OF THE REPORT

The structure of the report is based on that proposed in the NEMA EIA Guidelines (2002), and is indicated in Table 1.1 below.

**Table 1.2: Structure of the EIA Project Report**

Chapter	Title	Contents
1	Introduction	Introduction to the project area; identification and activities of the project proponent in other regions; project background; objectives and justification; purpose of the EIA and objectives of the report; the

		EIA team; TORs for the report.
2	Project Description	The technology and processes to be used in the implementation of the project; workforce requirements; the materials to be used in the construction and implementation of the project; the products, by-products and waste generated by the project.
3	Methodology	Methods used in carrying out the assessment; identification of gaps in knowledge and uncertainties that were encountered in compiling the information.
4	Legal and Regulatory Framework	A concise description of the national environmental, legislative and regulatory framework, international best practices, and Tullow Oil plc policies.
5	Baseline Environmental Parameters of the Project Area	Description of the potentially affected environment within the framework of the proposed EIA; assessment of existing (pre-project impacts) and potential (project and residual impacts) what?
6	Analysis of Project Alternatives	Alternative technologies and processes available, and reasons for preferring the chosen technology and processes.
7	Environmental Impact Assessment	Environmental effects of the project including the social, economic and cultural effects and the direct, indirect, cumulative irreversible, short-term and long-term effects anticipated.
8	Environmental Management Plan	Environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment; including the cost, time frame and responsibility to implement the measures; provision of an action plan for the prevention and management of foreseeable accidents and hazardous activities in the course of carrying out the project activities; measures to prevent health hazards and to ensure security in the working environment for the employees and for the management of emergencies.
9	Conclusions and Recommendations	Summary of the conclusions and key recommendations from the EIA.
References	References	List of references and websites referred to in the text.
Appendices	1. Provisional 2011 seismic program	Provisional seismic survey lines: may be revised in context of data needs and EIA recommendations.
	2. Minutes of meetings	Minutes of meetings held with communities, community leaders and other stakeholders in the project area.
	3. Copies of laboratory results	Laboratory results for samples collected in the field (water quality, soil chemistry, phytoplankton, zooplankton, lake sediments).
	4. Certificates	Certificates of the consultants and the company doing the EIA project report.
	5. Pin Number and VAT certificates	Pin number and VAT certificates of the proponent.
	6. Emergency Response and Management Plan	Plans for responding to and managing various potential environmental and work-related incidents that may arise.

## **CHAPTER 2:**

### **PROJECT DESCRIPTION**

#### **2.1 INTRODUCTION**

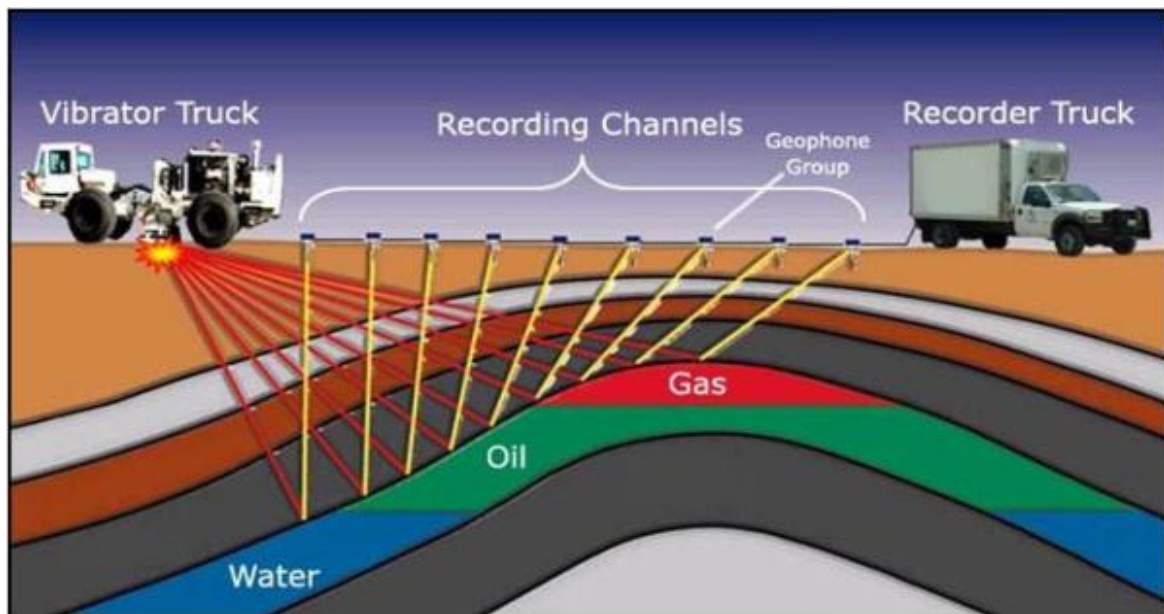
TKBV is proposing to undertake seismic surveys in order to delineate potential hydrocarbon prospects in Block 12A (which covers an area of 15389.39 km<sup>2</sup>) in the northern Kenya Rift (see Figure 1.1). The project area has poor physical infrastructure and lacks tarmacked roads. There is a low density network of generally poorly maintained Murram or earth roads, many of which are impassable during rains because they are criss-crossed by luggas or traverse through river/lugga floodplains. The communications infrastructure is still poor, although telecommunications coverage and reliability has increased in recent years due to nation-wide expansion programmes that have been launched by the major mobile service companies in Kenya.

#### **2.2 PROJECT LOCATION**

The project area lies in parts of Central Pokot, Turkana South, Loima and Turkana Central Districts (Figure 1.1). It is bounded by latitudes ca.0.2°N and 2°N, longitudes ca.36.5°E and 36.6°E and covers an area of 15389.39 km<sup>2</sup>. The area is located in two counties - Turkana County and Pokot County.

#### **2.3 OVERVIEW OF SEISMIC SURVEYS AND DESIGN**

Seismic surveys are the primary tool utilized during the exploration of hydrocarbons in both onshore (land) and offshore (marine or lake) areas. A seismic survey is conducted by creating an energy wave commonly referred to as a 'seismic wave' on the surface of the ground or in water along a predetermined line, using an energy source. This wave travels into and through the earth strata, where it is reflected and refracted by various subsurface formations, and returns to the surface where receivers called geophones are used to detect the waves and convey them to a recorder for analysis. Seismic waves can be induced by the following methods: small explosive charges, primarily dynamite, set off in shallow holes known as 'shot holes'; by large 'Vibroseis' trucks equipped with heavy plates that vibrate on the ground or by use of airguns in water bodies. By analyzing the time it takes for the seismic waves to reflect off subsurface formations and return to the surface, formations can be mapped and potential oil or gas deposits identified (Figure 2.1).



**Figure 2.1: Onshore Seismology Using a Vibrator Truck as a Seismic Energy Source.**  
 (Source: Adapted from <http://www.cougarlandservices.net/landowner>)

### 2.3.1 Onshore Seismic Surveys

Onshore 2D seismic surveys are conducted along ground transects where sequential “receiver cables” of 6 to 12 kilometres in length are laid out on the ground. A group of evenly spaced geophones that are sensitive to small sound waves and vibration are placed on the ground and connected to the cable. A truck-mounted recording system connected at one end of the receiver cable records the sound waves picked up by the geophones. At carefully calculated points along the receiver line, an impulse is sent into the earth. This “shot” may be initiated by a specially-built vibrator truck shaking the surface (Vibroseis) or by a small detonation at the bottom of a five to twenty metre deep, narrow-diameter hole drilled into the ground. On completion of recording, a section at one end of the cable is unplugged and moved, together with its geophones/hydrophones, to the front of the cable where the process is repeated. In this way, the recording moves along the pre-determined seismic line.

### 2.3.2 Seismic Survey Data

#### (a) 2D Surveys

Computer analyses of the recorded seismic waves provide a profile of the underlying rock strata and offer the basis for identifying potential hydrocarbon traps. The analysis creates a two-dimensional picture (Figure 2.2) that shows the subsurface geology of the earth’s strata along the line of the cable.

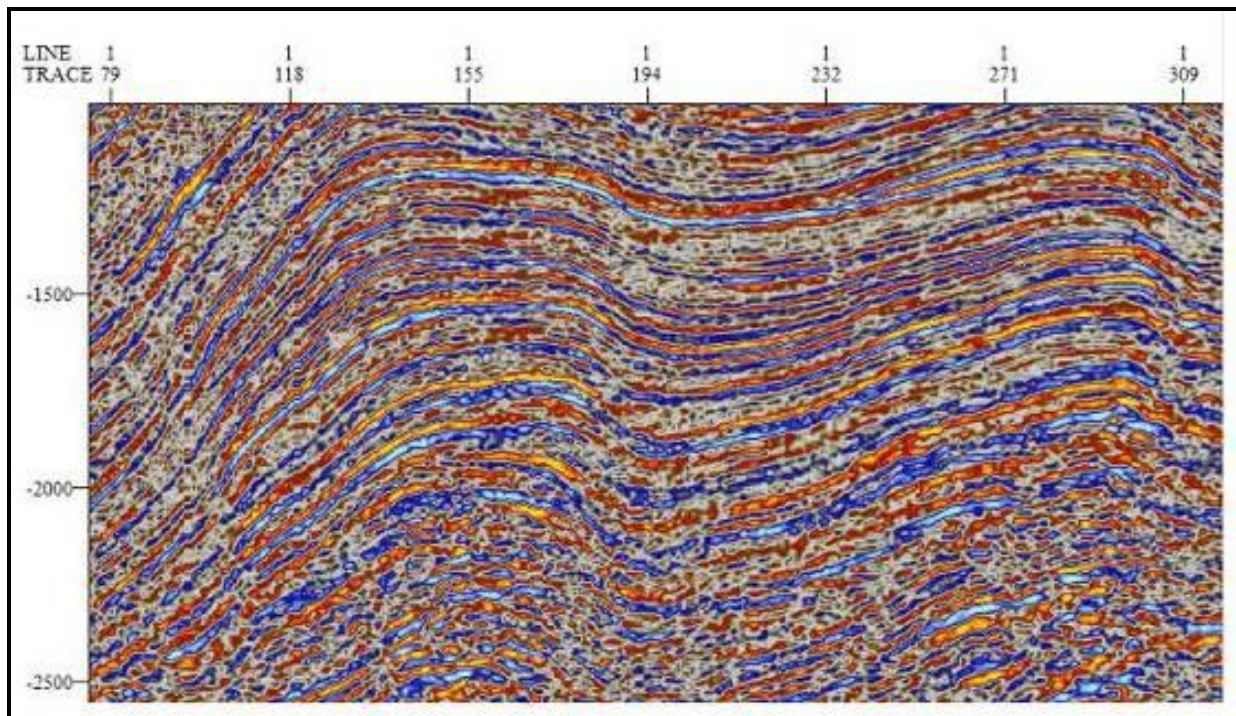


Figure 2.2: 2D Seismic section (after McFarland, 2009)

## 2.4 THE PROPOSED SEISMIC SURVEY

### 2.4.1 Seismic Survey Objectives

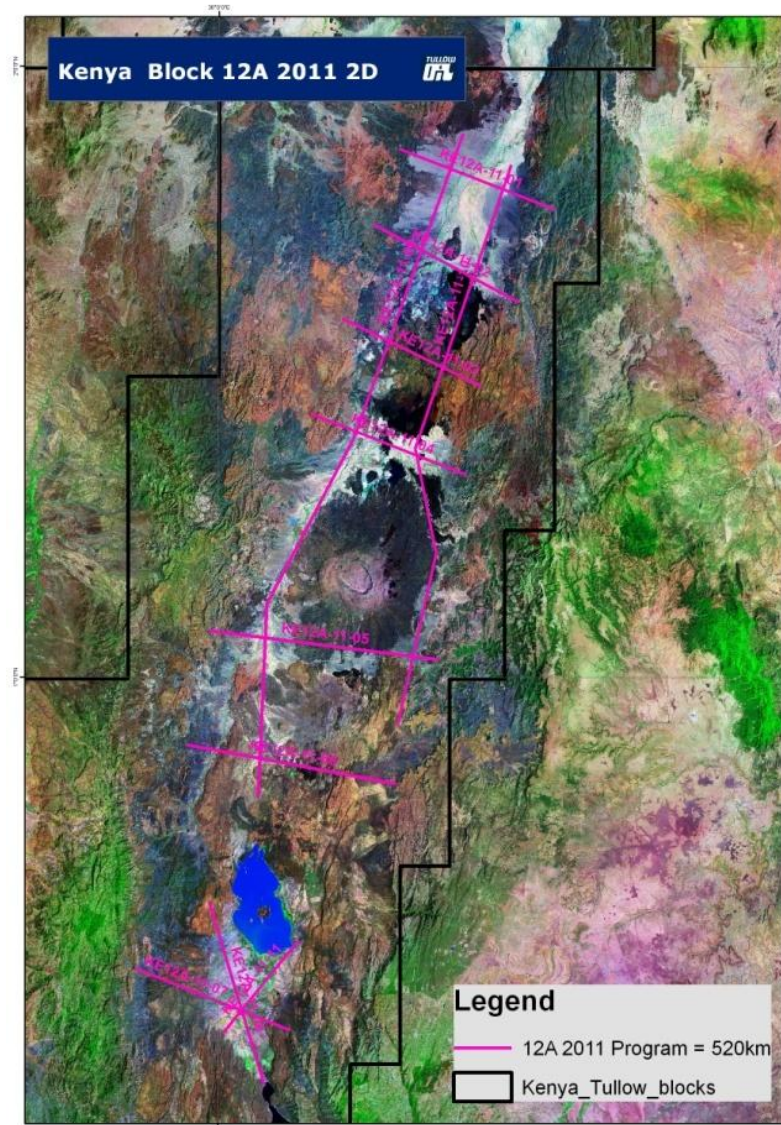
The objectives of the seismic surveys to be conducted are to infill existing seismic data from earlier exploration initiatives and to delineate the mapped prospects. It is expected that the new seismic will be considerably better quality than the existing seismic, and lower environmental impact due to improved acquisition methods and equipment. Infilling the older data will add confidence and detail to the interpretation and location of the prospects and define the prospects in sufficient detail to, at a later and different stage, test one or more by drilling.

### 2.4.2 Seismic Survey Scale and Extent

The seismic survey operation will involve the collection of approximately 500 line kilometres of seismic data on within Block 12A area (see Figure 1.1). It should be noted that while there are pre-determined seismic line transects based on analysis of existing data as well as available information, the actual locations of the seismic transects may be varied prior to and/or during the seismic data acquisition exercise.

The seismic survey operation will be constrained along the seismic survey lines and to the base and fly camps, as well as to the access roads to these areas (Figure 2.3 and Table 2.1).





**Figure 2.3: Proposed Seismic Lines (exact locations may change)**

**Table 2.1 Co-ordinates of the proposed seismic lines indicated in Figure 2.2 above.**

Name	X	N	
KE12A-11-01	866596	206583	FIRM
KE12A-11-01	894917	195674	FIRM
KE12A-11-02	861897	192880	FIRM
KE12A-11-02	888440	178796	FIRM
KE12A-11-03	856322	175760	FIRM
KE12A-11-03	881582	163581	FIRM
KE12A-11-04	850734	158501	FIRM
KE12A-11-04	878915	147465	FIRM
KE12A-11-05	832192	119169	FIRM
KE12A-11-05	873962	113975	FIRM
KE12A-11-06	828255	98493	FIRM
KE12A-11-06	866342	91381	FIRM
KE12A-11-07	818869	58018	FIRM
KE12A-11-07	847051	46728	FIRM

KE12A-11-08	832319	70071	FIRM
KE12A-11-08	842352	36962	FIRM
KE12A-11-09a	841209	88841	FIRM
KE12A-11-09a	842862.9	126992.9	FIRM
KE12A-11-09b	841359.3	121327.9	FIRM
KE12A-11-09b	859869	156843.8	FIRM
KE12A-11-09c	857472.4	151353.1	FIRM
KE12A-11-09c	878153	209377	FIRM
KE12A-11-10a	866485	102037	FIRM
KE12A-11-10a	874107	136181	FIRM
KE12A-11-10b	874041.8	130317.9	FIRM
KE12A-11-10b	869054.8	155219.6	FIRM
KE12A-11-10c	868693.8	149444	FIRM
KE12A-11-10c	886916	203789	FIRM
KE12A-11-11	848575	63086	Contingent
KE12A-11-11	834859	46207	Contingent
Datum:WGS84			
Projection: UTM 36			

### 2.4.3 Seismic Survey Logistics

The seismic surveys are expected to take about three months to complete and will involve approximately one hundred and fifty personnel plus security personnel (see Chapter 8 for more details on the activity time frame). A base camp will support the crew, and “fly camps” will accommodate smaller-sized groups of personnel in outlying areas, and will be set up as and when required (see section 2.4.5 below). A fully equipped and staffed ambulance will be on standby in case of accidents or emergencies, and will be supported by a fully equipped and staffed clinic that will be located in the base camp. There are a number of airstrips in the area that can handle small fixed-wing aircraft. They are found in the following major centers: Lokichar, Lorugum, Kaputir, Katilu and Kalemyang and can receive 12-seater Caravans. They are served only by charter flight companies. A Medevac plan will be developed for transporting injured parties out of the field if such a case happens to occur.

Where possible, unskilled and semi-skilled workers will be hired locally from towns and villages representative of the area and after consultation with the local authorities and communities. The aim will be to ensure a fair distribution of employment opportunities.

#### 2.4.3.1 Seismic survey operations

Approximately 40 vehicles (4x4s, light trucks and pickups) will be required for movement of personnel and equipment. A number of Vibroseis trucks will be used for acoustic energy generation, and there will also be recording trucks to receive the data relayed from the geophones. Bulldozers and mulchers will be used for improving or opening up new access roads (the latter only if absolutely necessary), and for cutting the transect lines, respectively. Small drill rigs will be used for drilling the shot-holes, and larger truck-mounted drill rigs will be used to drill upholes. Other vehicles will include specialised explosive transport trucks.

#### 2.4.4 Data Acquisition Methods and Equipment

The seismic survey will be conducted using Vibroseis and dynamite charges as sources of seismic energy (Plates 2.1 and 2.2). The seismic acquisition methodology has been designed to minimise disruption to local flora and fauna as well as the local communities. Low Impact seismic technologies (see Chapter 6) will include the use of Vibroseis and/or deep-drilled dynamite charges as acoustic energy sources; line-cutting with mulchers to minimise line width and accelerate re-growth of vegetation; and use of bulldozers and graders to open up new or improve existing access roads. Hand carried augers may be used in sensitive areas such as wetlands.



**Plate 2.1: Vibroseis vehicles operating in Kenya.**



**Plate 2.2: Dynamite charge (with plastic anchors) proposed as an alternative seismic source for the survey.**

The seismic data acquisition plan is as follows:

- Survey teams will first map out the seismic transects on the ground using coordinates of planned seismic lines. They will take care to avoid existing infrastructure and minimize any damage to cultivated land, natural water points and pastureland.
- Transects line placements and programme size will be adjusted accordingly to bypass habitations or areas of particular sensitivity. A detailed evaluation of each line will be carried out as work progresses and line placements will be adjusted to achieve maximum effect at minimum disruption.



- Vibroseis and/or dynamite charges will be the source of acoustic energy. One “receiver cable” will be laid out at a time on the ground. Groups of small geophones will be placed on the ground and connected to the cable (Plate 2.3). These geophone nodes will be placed at intervals of 25 to 50 metres, depending on the survey parameters, which will be determined at survey start up.



**Plate 2.3: Geophones, batteries, cables and digitizing units before deployment on a seismic line.**

The proposed seismic survey will involve the use of 4x4 wheel drive vehicles and recording trucks, a grader, and a bulldozer to provide vehicular access roads (cut-lines).

**Uphole Survey:** In addition, there will be seismic ‘Upholes’ drilled and surveyed at the intersections of the land seismic lines. These upholes will involve using a water-well drilling rig to drill to about 100m below ground level, allowing seismic velocity data to be collected for the shallow weathered layers of bedrock. It is likely that about 15 to 20 upholes will need to be drilled and surveyed. These boreholes are typically backfilled and plugged on completion of the survey.

**LVL Survey:** Shallow seismic refraction (Low Velocity Layer, LVL) surveys will be carried out along the land seismic lines at approximately 5km intervals. These low impact surveys are required to collect data on the shallow weathered layers, allowing the calculation of ‘statics’ required for accurate seismic processing. These shallow seismic surveys typically use a small vehicle-mounted accelerated weight-drop seismic source.

## **2.4.5 Occupational Health and Safety**

Safety and environmental responsibility are among the most important aspects of modern seismic surveying in oil and gas exploration and production activities. The health and safety of all personnel and the impact of operations on third parties and on the environment are of paramount importance. Too often, safety is perceived by field personnel as a burden on production, so it is the responsibility of crew managers to ensure that safety standards are maintained and safe working practices adhered to. No work can be done efficiently if it is not performed safely. Some of the safety issues include but are not limited to the following factors:

- Risk of personal injury at work, especially during excavation and construction.
- Noise generation;
- Solid and liquid waste management;
- Oil and chemical spills;
- Transportation;
- Fire protection;
- Material handling;
- Wastewater and effluent discharges,
- Risk of personal injury at work, and;
- Excavation and construction hazards.
- 

Occupational health and safety issues can be best addressed when company internal management systems that address worker and public safety are buttressed by, and compliant with, Oil and Gas Industry guidelines on international good practices in this area, such as those set by the International Association of Oil and Gas Producers (OGP), the International Association of Geophysical Contractors (IAGC), and the World Bank – International Finance Corporation (WB-IFB).

Thus, it is a requirement that the Tullow Oil Environmental, Health and Safety Management System (EHS-MS) and Corporate Social Responsibility (CSR) Policies and Regulations, be integrated into the project lifecycle. The crew must also ensure that they adhere, at all times, to all international health and safety standards applicable in the Oil and Gas industry, in addition to TKBV's internal management systems. The EHS-MS and CSR policy should be communicated to the personnel regularly to ensure strict adherence.

#### **2.4.6 Waste Management**

The types of waste that will be generated at the camp sites and/or work sites during the survey operation can be grouped into two categories, non-hazardous and hazardous, as per the NEMA Waste Management Regulations of 2006. The non-hazardous wastes would include: domestic wastes and effluents, plastics, metal cans, and paper. The hazardous wastes would include: medical and pharmaceutical wastes, waste oils, small quantities of chemicals (e.g. paint, thinners etc) and used batteries.

The domestic waste disposal facilities will be located outside the perimeter fence of the camp compound. Typically, these would consist of solid waste pits and unlined grey water pits that would receive effluent from the bathrooms and kitchens. There would also be black water pits serving as settling and overflow discharge pits, set in a cascading sequence which should then be treated and left to evaporate. The conveyance of waste water and black water effluents from the bathrooms, kitchens and toilets will be via PVC-drain pipes. The facilities will be fenced to ensure the safety of villagers and livestock.

All waste material from field operations should be brought back to the base camp for proper disposal. Disposal options include: incineration, compaction and removal from site, and burial (especially for biodegradable material), or a combination of these activities. Where practical, wastes should be managed on site by burial in pits or landfills, or other biological treatment. Waste disposal areas will be fenced where necessary. During construction of the campsite, qualified personnel should survey the land to determine the best site for construction of waste pits and/or landfills. At particularly sensitive locations, or with hazardous materials, these disposal methods are not permitted, requiring the wastes to be transported to off-site locations for disposal at a commercial disposal facility or municipal landfill. In such cases, the closest such facility would be in Lodwar town. Metallic materials may be separated and sold as scrap metal to dealers in the town centres. All solid wastes

generated during the survey will be weighed and quantities recorded so that all waste streams can be tracked.

Hazardous (medical and pharmaceutical, waste oils and other hazardous fluids) and non-hazardous wastes will be segregated, and disposed of in the waste disposal facility as provided for by the relevant Local Authority (Turkana County Council in the Northern part of the project area, and Pokot County Council in the Southern part of the project area) (Table 2.1). The used oil may also be sold in urban centers as it is utilized as a wood preservative (against termite infestation) on telephone and electricity posts and construction timber. Biomedical waste will not be stored above 0°C for more than seven days without the written approval of the relevant lead agency, provided that untreated pathological waste shall be disposed of within 48 hours.

#### **2.4.7 Sourcing of Equipment and Supplies**

All the technical equipment and machinery that are required for the seismic survey will be imported as they are not available locally. Other support vehicles such as pick-ups and trucks may be purchased or hired locally. It is a Tullow corporate requirement that all vehicles working for or on behalf of Tullow are compliant with OGP Land Transportation Safety Recommended Practice and Tullow's Driving Policy.

The seismic contractor will source for general goods, consumables and food items, in the first instance, locally within the project area to support the service industries there. Where these are not available locally, they will be sourced from other parts of the country. The seismic contractor will have its own water supply (borehole) for the camps.

#### **2.4.8 Emergency Response Plans**

A number of different types of accidents or hazards can occur in this kind of operation, including: personal injury; fire; collisions between vehicles, collisions between vehicles and humans or animals; oil pollution from storage bladders/tanks or pipe leaks or rupture, during its transportation by trucks, and indiscriminate disposal of used lubricating oil, amongst others. Mitigation of these risks is outlined in Chapter 8 of this report (Environmental Management Plan), and an Emergency Response Plan is included in the Appendix of this report. However, it is noted that comprehensive seismic contractor response plans to specific hazards will need to be developed, which will be in line with both the national regulations and regulations that govern the oil and gas industry activities in Kenya, and will be in compliance with Tullow Oil's robust policies on environmental, health and safety (EHS) and Corporate Social Responsibility (CSR) that are in tandem with current good practices in the oil and gas industry (see section 4.6). TKBV will need to customise and domesticate these plans to fit into the Kenyan context.

### **2.5 CAMPSITE(S) DECOMMISSIONING**

The decommissioning plan will involve the following sequence of activities:

- Workers lay-off and compensation;
- Equipment demobilization (such as containers, vehicles, accommodation facilities);
- Dismantling of camp facilities;
- Cleaning the camps and disposal of solid, liquid and hazardous waste;
- Restoration of waste pits, cesspools and the whole camp site;
- Line restoration, shot hole repairs, removal of debris, recovery and controlled destruction of waste explosive materials; and
- Audit and sign off.

The decommissioning will cover the base camp and any fly camps or any other facility that shall be erected. The decommissioning will lay emphasis on:

- Examining the conformity to the EMP's developed during the EIA for the seismic survey project;
- Preparation of a decommissioning strategy and EMP before decommissioning begins;
- Awareness creation;
- Ecological, socio-cultural and economic survey of camp sites and impacts;
- Conforming to national legislation and regulatory requirements and international best practices.

The decommission will be carried out as soon as is practicable after the end of the seismic survey, hence the specifics of it, which will depend largely on what was actually constructed on the ground, will need to be formulated well in advance. TKBV will seek approval from the relevant stakeholders before implementation of the decommissioning plan.

## CHAPTER 3:

### ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY

#### 3.1 APPROACH TAKEN FOR THE EIA

The approach that was taken for the EIA assessment included, with respect to the proposed seismic survey, the following:

1. Scaling and work evaluation (determination of geographical and other boundaries; preliminary assessment);
2. Detailed assessment based on: project design and technologies vis-à-vis environment, social, cultural and economic considerations of the project area; evaluation of pre-existing environmental, social, cultural and economic conditions, pressures and impacts; identification and evaluation of potential environmental, social, cultural and economic impacts that may arise from the proposed project; public consultations to explain what the project is all about and to receive their views, perceptions, concerns and local expert knowledge and advice with respect to the proposed project;
3. Determination/evaluation of the significance of the potential project impacts and recommendation of mitigation measures; development of an Environmental Management Plan and Monitoring Programme; and decommissioning of the project.
4. Preparation of the EIA Project Report.

#### 3.2 WORK EVALUATION FOR THE EIA

The work evaluation for the EIA was based on the NEMA requirements (section 1.6.2) and customised for the project to be undertaken (outlined in Chapter 2), as per the objectives and terms of reference outlined sections 1.9 and 1.10.

#### 3.3 TOPICS ADDRESSED AND ISSUES CONSIDERED

**Table 3.1: Topics addressed in the EIA and issues considered**

Topic or Context	Issues Considered	Rationale	Spatial Scope	Limitations of Methodology and Consequences for the Study Outcomes
Project Design, Technologies, Scale and Extent	<ul style="list-style-type: none"> <li>• Project components</li> <li>• Equipment and machinery used</li> <li>• Personnel required</li> <li>• Facilities required</li> <li>• Management of fluid and solid wastes</li> <li>• Occupational and public health and safety</li> <li>• Supplies</li> <li>• Decommissioning</li> </ul>	<ul style="list-style-type: none"> <li>• Project components equipment/ machinery used, and facilities will have a number of environmental impacts related to construction, operations and decommissioning</li> <li>• Identification and prioritisation of factors requiring mitigation</li> <li>• Personnel and public safety during operations needs to be ensured</li> </ul>	<ul style="list-style-type: none"> <li>• Pre-determined seismic survey lines</li> <li>• Access roads</li> <li>• Selected camp sites, storage, repair and waste disposal and facilities</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>
Legislative and Regulatory Framework	<ul style="list-style-type: none"> <li>• Legislation and regulations applicable to project design, execution, affected parties, and environment protection</li> </ul>	<ul style="list-style-type: none"> <li>• Need to ensure that all applicable laws are followed during project execution</li> <li>• Need to be conversant with the authorizations required for the regulatory approval of the project</li> </ul>	<ul style="list-style-type: none"> <li>• National legislation and regulations and authorities responsible</li> <li>• International best practices in Oil and Gas</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>

		<ul style="list-style-type: none"> <li>Some legislation, regulations and guidelines have embedded mitigations relevant to the proposed seismic survey</li> </ul>	industry <ul style="list-style-type: none"> <li>Company EHS, CSR and Code of Conduct</li> </ul>	
Geographical Aspects and Boundaries	<ul style="list-style-type: none"> <li>Description of the setting of the project area</li> <li>Identification of key features</li> </ul>	<ul style="list-style-type: none"> <li>Determination of the context within which the work is to be done</li> <li>Assessment of the scale and extent of the work</li> </ul>	<ul style="list-style-type: none"> <li>Entire project area</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>
Administrative set-up	<ul style="list-style-type: none"> <li>Key administrative units and their roles in the project area</li> </ul>	<ul style="list-style-type: none"> <li>Establishment of jurisdictions</li> <li>Identification of key administrative contacts</li> <li>Role in emergency situations (e.g. security threats) and response</li> </ul>	<ul style="list-style-type: none"> <li>Entire project area</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>
Communication and Transport	<ul style="list-style-type: none"> <li>Road infrastructure</li> <li>Air transport network</li> <li>Land, radio and mobile communications network</li> </ul>	<ul style="list-style-type: none"> <li>These will determine the ease with which the project will be carried out</li> <li>Identification of areas difficult to access</li> <li>Inform on types of equipment/ machinery that will be required for the project</li> <li>Assist in development of contingency/ emergency plans</li> </ul>	<ul style="list-style-type: none"> <li>Entire project area</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>
Governmental, Non-Governmental and Community Based Organisations	<ul style="list-style-type: none"> <li>Activities and projects carried out in the area</li> </ul>	<ul style="list-style-type: none"> <li>Identification of potential local partners particularly with respect to CSR</li> </ul>	<ul style="list-style-type: none"> <li>Entire project area</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>
Physiography and Geology	<ul style="list-style-type: none"> <li>Physiography and geology</li> <li>Assessment of terrain ruggedness</li> <li>Assessment of susceptibility to landslides, earthquakes, subsidence and floods</li> <li>Active surface processes</li> </ul>	<ul style="list-style-type: none"> <li>Establishment of baseline conditions</li> <li>Identification of potentially difficult areas to work in – terrain and accessibility by vehicles</li> <li>Identification of areas requiring extra safety precautions</li> <li>Identification of hazard-prone areas</li> <li>Assessment of project impacts, primarily cut-lines and access roads, and mitigations</li> </ul>	<ul style="list-style-type: none"> <li>The entire project area</li> </ul>	<ul style="list-style-type: none"> <li>Some areas were not accessible due to lack of roads or security concerns hence data is incomplete but samples representative of the whole area were assessed.</li> </ul>
Soils	<ul style="list-style-type: none"> <li>Soil degradation status</li> <li>Areas subject to wind and water erosion</li> <li>Soil texture and drainage characteristics</li> <li>Soil chemical quality</li> <li>Assessment of rehabilitation potential</li> </ul>	<ul style="list-style-type: none"> <li>Establishment of baseline conditions</li> <li>Ease of accessibility by vehicles</li> <li>Identification of hazard prone areas (e.g. ponding /flooding)</li> <li>Assessment of impacts of opening up access roads and cut-lines and campsite construction</li> <li>Assessment of impacts of domestic effluent</li> </ul>	<ul style="list-style-type: none"> <li>Entire project area</li> </ul>	<ul style="list-style-type: none"> <li>Some areas were not accessible due to lack of roads or security concerns hence data is incomplete</li> </ul>

		<p>discharges on soils</p> <ul style="list-style-type: none"> <li>• Identification and prioritisation of factors requiring mitigation</li> </ul>		
Climate	<ul style="list-style-type: none"> <li>• Temperature</li> <li>• Winds</li> <li>• Precipitation</li> <li>• Climate change</li> </ul>	<ul style="list-style-type: none"> <li>• Establishment of baseline conditions</li> <li>• Information useful for project elements such as cooling of temperature-sensitive equipment and installations</li> <li>• Wind strength and direction is important for safety of the operations</li> <li>• Wet seasons can significantly impede progress in seismic data acquisition</li> <li>• Sudden, torrential rains can pose a danger to personnel through flash flooding in lugga crossing zones</li> </ul>	<ul style="list-style-type: none"> <li>• Pre-determined seismic survey lines</li> <li>• Access roads</li> <li>• Selected camp sites and pier sites and facilities</li> </ul>	<ul style="list-style-type: none"> <li>• No data available for trend analysis.</li> </ul>
Air Quality	<ul style="list-style-type: none"> <li>• Ambient air quality</li> <li>• Generation of dust, smoke, odorous fumes, and other toxic gaseous emissions</li> <li>• Release of gases which contribute to the greenhouse effect or ozone damage</li> <li>• Identification of project components that can lower air quality</li> </ul>	<ul style="list-style-type: none"> <li>• Establishment of baseline conditions</li> <li>• Assessment of project impacts on air quality</li> <li>• Identification and prioritisation of factors requiring mitigation</li> </ul>	<ul style="list-style-type: none"> <li>• Pre-determined seismic survey lines</li> <li>• Access roads</li> <li>• Selected camp sites and pier sites and facilities</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of air quality data on particulate loading, SO<sub>x</sub> and NO<sub>x</sub> or any other gaseous compounds in the area. Area is, however, rural and undeveloped so air quality can be assumed to be good and varies mainly due to variations in wind speeds (natural particulate loading).</li> </ul>
Surface and Ground Water Resources	<ul style="list-style-type: none"> <li>• Ground and surface water sources</li> <li>• Ground and surface water use</li> <li>• Planned water use</li> <li>• Changes in quantity</li> <li>• Identification of project components that can affect water use</li> </ul>	<ul style="list-style-type: none"> <li>• Establishment of baseline conditions</li> <li>• Potentially high demand for water by project group in a water scarce region</li> <li>• Planned water uses that affect water quantity may be blamed on the project proponent</li> <li>• Identification and prioritisation of factors requiring mitigation</li> </ul>	<ul style="list-style-type: none"> <li>• Selected camp sites and pier sites and facilities</li> </ul>	<ul style="list-style-type: none"> <li>• Inaccessibility of some areas due to lack of roads and security concerns</li> </ul>
Water Quality	<ul style="list-style-type: none"> <li>• Current ground and surface water quantity</li> <li>• Current point and non-point sources of water pollution</li> <li>• Identification of project components that can potentially alter water quality</li> </ul>	<ul style="list-style-type: none"> <li>• Establishment of baseline conditions</li> <li>• Assessment of project impacts (e.g. effluent disposal and accidental spills) on water quality</li> <li>• Domestic and boat effluent discharges</li> <li>• Identification and prioritisation of factors requiring mitigation</li> </ul>	<ul style="list-style-type: none"> <li>• Pre-determined seismic survey lines</li> <li>• Access roads</li> <li>• Selected camp sites and pier sites and facilities</li> </ul>	<ul style="list-style-type: none"> <li>• Representative water samples were taken.</li> </ul>

Terrestrial Environment (Habitats, Flora and Fauna)	<ul style="list-style-type: none"> <li>• Vegetation cover and classes</li> <li>• Habitat conditions</li> <li>• Floral and faunal communities which are uncommon, threatened or endangered</li> <li>• Environmentally sensitive localities</li> <li>• Wildlife corridors</li> <li>• Pastoral areas</li> <li>• Assessment of ecosystem state</li> </ul>	<ul style="list-style-type: none"> <li>• Establishment of baseline conditions</li> <li>• Physical disturbance of terrestrial environment during operations, e.g. line cutting</li> <li>• Determination of pre-project endangered communities</li> <li>• Assessment of areas requiring special precautions</li> <li>• Avoidance of human-human and human-wildlife conflicts</li> <li>• Identification and prioritisation of factors requiring mitigation</li> </ul>	<ul style="list-style-type: none"> <li>• Entire project area</li> </ul>	<ul style="list-style-type: none"> <li>• Old data, but the ecosystem structures are resilient to the effects of land degradation and deforestation, Land cover, for example, has become more patchy, but the species diversity within the various ecotones remain the same.</li> </ul>
Aquatic Environment (Habitats, Flora and Fauna)	<ul style="list-style-type: none"> <li>• Habitats</li> <li>• Floral and faunal communities which are uncommon, threatened or endangered</li> <li>• Fish, reptile or invertebrate breeding and nesting areas</li> <li>• Fishing grounds</li> <li>• Bird nesting and breeding areas</li> <li>• Assessment of ecosystem state</li> </ul>	<ul style="list-style-type: none"> <li>• Establishment of baseline conditions</li> <li>• Physical disturbance of aquatic environment and ecosystems e.g. by vessels and associated equipment</li> <li>• Potential impacts of accidents such as oil and chemical spills, collisions</li> </ul>	<ul style="list-style-type: none"> <li>• Perennial rivers and luggas.</li> </ul>	<ul style="list-style-type: none"> <li>• Changes to aquatic life</li> </ul>
Land Resources and National Parks	<ul style="list-style-type: none"> <li>• Land use and designation</li> <li>• Existing activities in the area</li> <li>• Currently known and exploited mineral resources</li> <li>• Artisanal, commercial and sport fishing activities, tourism</li> <li>• Resource inventory</li> </ul>	<ul style="list-style-type: none"> <li>• The land resources are critical resources supporting livelihoods in the area.</li> <li>• Parks are national and global heritage areas</li> <li>• Consideration of competing resources</li> </ul>	<ul style="list-style-type: none"> <li>• Entire project area</li> </ul>	<ul style="list-style-type: none"> <li>• Limited accessibility to the parks</li> </ul>
Archaeological, Historical and Cultural Sites	<ul style="list-style-type: none"> <li>• Identification of archaeological, historical, cultural sites</li> </ul>	<ul style="list-style-type: none"> <li>• Establishment of currently known sites</li> <li>• Avoidance of such sites during line cutting and seismic data acquisition</li> </ul>	<ul style="list-style-type: none"> <li>• Project area</li> </ul>	<ul style="list-style-type: none"> <li>• Only a few sites were visited and georeferenced, relative to existing number (hundreds) of archaeological sites. GPS coordinates of sites will have to be obtained from NMK and TBI to assist in determining cut-line locations.</li> </ul>
Visual Aesthetics	<ul style="list-style-type: none"> <li>• Aesthetic or high</li> </ul>	<ul style="list-style-type: none"> <li>• Establishment of baseline</li> </ul>	<ul style="list-style-type: none"> <li>• Pre-</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>



	scenic value	conditions <ul style="list-style-type: none"> <li>Assessment of project impacts such as vegetation clearance along cut lines and at campsites</li> </ul>	determined seismic survey lines <ul style="list-style-type: none"> <li>Access roads</li> <li>Selected camp sites and pier sites and facilities</li> </ul>	
Noise and Vibrations	<ul style="list-style-type: none"> <li>Ambient noise and vibration levels in the area</li> <li>Potential sources of noise and vibrations produced by project operations</li> <li>Noise impacts on terrestrial and aquatic fauna</li> </ul>	<ul style="list-style-type: none"> <li>Establishment of baseline conditions</li> <li>Acoustic source impacts on terrestrial and aquatic fauna and mitigation</li> <li>Noise and vibrations impacts on the project workforce and the neighbouring public</li> <li>Impacts on nearby structures and facilities</li> </ul>	<ul style="list-style-type: none"> <li>Pre-determined seismic survey lines</li> <li>Access roads</li> <li>Selected camp sites and pier sites and facilities</li> </ul>	<ul style="list-style-type: none"> <li>Lack of studies on noise and vibration impacts on inland water fauna</li> </ul>
Solid and Liquid Wastes	<ul style="list-style-type: none"> <li>Disposal of sewage or domestic wastes</li> <li>Damage to marine environment through accidental spills of oil, fuel, cargo, waste or sewage</li> </ul>	<ul style="list-style-type: none"> <li>Establishment of baseline conditions</li> <li>Campsites will require to install waste discharge systems</li> <li>Boat crew will have to manage waste on board</li> </ul>	<ul style="list-style-type: none"> <li>Campsites</li> <li>Working areas</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>
Social Characteristics	<ul style="list-style-type: none"> <li>Level of services available</li> <li>Social support information</li> <li>Identification of key community needs</li> </ul>	<ul style="list-style-type: none"> <li>Quality of life baseline.</li> <li>Ability to absorb change</li> </ul>	<ul style="list-style-type: none"> <li>Entire project area</li> </ul>	<ul style="list-style-type: none"> <li>Language barrier in some places</li> <li>Reluctance to adopt new social practises</li> </ul>
Economic Setting	<ul style="list-style-type: none"> <li>Area targeted for growth</li> <li>Labour and employment</li> </ul>	<ul style="list-style-type: none"> <li>Quality of life baseline</li> <li>Development level baseline</li> <li>Willingness to adopt new economic activities</li> </ul>	<ul style="list-style-type: none"> <li>Entire project area</li> </ul>	<ul style="list-style-type: none"> <li>Reluctance to adopt new economic opportunities by the locals</li> </ul>
Health Setting	<ul style="list-style-type: none"> <li>Status of health facilities</li> <li>Access to health services</li> <li>Occupational health and safety hazards</li> <li>Hazards due to the use, storage, disposal or transportation of flammable, explosive, toxic, carcinogenic or mutagenic substances</li> <li>Emission of electromagnetic or other radiation which may adversely affect electronic equipment or human health</li> <li>Traffic hazards</li> </ul>	<ul style="list-style-type: none"> <li>Determination of the available health facilities in the area</li> <li>Availability of officials in the available health facilities</li> <li>Emergency preparedness</li> </ul>	<ul style="list-style-type: none"> <li>Project area and the surrounding environment</li> </ul>	<ul style="list-style-type: none"> <li>Inaccessibility of some areas</li> </ul>
Security and Public Safety	<ul style="list-style-type: none"> <li>Public risks</li> <li>Crime</li> </ul>	<ul style="list-style-type: none"> <li>Need to enhance security in some parts of the project</li> </ul>	<ul style="list-style-type: none"> <li>Project area and the</li> </ul>	<ul style="list-style-type: none"> <li>Some areas are considered as</li> </ul>

	<ul style="list-style-type: none"> <li>Conflicts over resources</li> <li>Fires</li> </ul>	<ul style="list-style-type: none"> <li>area</li> <li>Emergency preparedness</li> </ul>	<ul style="list-style-type: none"> <li>surrounding environment</li> </ul>	<ul style="list-style-type: none"> <li>high risk areas in terms of security</li> </ul>
Public Consultations	<ul style="list-style-type: none"> <li>Awareness creation on the project</li> <li>Environmental pressures in the area</li> <li>Expert and indigenous knowledge of the area</li> </ul>	<ul style="list-style-type: none"> <li>Involvement of all stakeholders</li> <li>Information gathering on environmental issues and concerns in the project area</li> <li>Acceptability of the project</li> </ul>	<ul style="list-style-type: none"> <li>Entire project area</li> </ul>	<ul style="list-style-type: none"> <li>Language barrier</li> </ul>
Corporate Social Responsibility	<ul style="list-style-type: none"> <li>Community prioritisation of areas/projects for possible CSR assistance</li> </ul>	<ul style="list-style-type: none"> <li>These were stated during the public consultations</li> </ul>	<ul style="list-style-type: none"> <li>Project area</li> </ul>	<ul style="list-style-type: none"> <li>Expectations may require management</li> </ul>
Mitigation Measures	<ul style="list-style-type: none"> <li>Mitigation hierarchy</li> </ul>	<ul style="list-style-type: none"> <li>Avoiding or reducing at source</li> <li>Abating on site</li> <li>Abating off-site</li> <li>Repair or remedy</li> <li>Compensate for loss or damage</li> </ul>	<ul style="list-style-type: none"> <li>Pre-determined seismic survey lines</li> <li>Access roads</li> <li>Selected camp sites and pier sites and facilities</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>
Environmental Management Plan	<ul style="list-style-type: none"> <li>Effective mitigations specified for the topics addressed</li> <li>Costs</li> <li>Responsibility</li> <li>Management</li> <li>Relevant legislation and regulations</li> <li>Decommissioning</li> </ul>	<ul style="list-style-type: none"> <li>Least possible interference with the environment</li> <li>Compliance with principles, policies and legislation relating to conservation of environment</li> <li>Decommissioning of campsites</li> </ul>	<ul style="list-style-type: none"> <li>Pre-determined seismic survey lines</li> <li>Access roads</li> <li>Selected camp sites and pier sites and facilities</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>
Environmental Monitoring Plan	<ul style="list-style-type: none"> <li>Parameters to be monitored</li> <li>Personnel required</li> <li>Training needs</li> </ul>	<ul style="list-style-type: none"> <li>Ease of monitoring</li> <li>Effectiveness of monitoring method</li> <li>Cost of monitoring</li> <li>Frequency</li> </ul>	<ul style="list-style-type: none"> <li>Pre-determined seismic survey lines</li> <li>Access roads</li> <li>Selected camp sites and pier sites and facilities</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>

### 3.4 COLLECTION OF BASELINE DATA

#### 3.4.1 Overview of Methods

The general framework of the baseline data collection was as follows:

- Scaling and scoping (determination of geographical and other boundaries; preliminary assessment).
- Review of existing regulatory framework and institutional arrangement.
- Detailed environmental assessment and community sensitization undertaken from 13<sup>th</sup> to 30<sup>th</sup> March 2011 (see route map, Figure 3.1).
- Impact identification and development of suggested mitigation measures.
- Development of an Environmental Management Plan including costs estimates and responsibility assignment.

Prior to the field study, a desktop study was conducted to review the available reports and to design plans and maps in order to compile relevant biophysical and socio-economic

information of the study area. The field study (detailed environmental impact assessment, community sensitization and social impact assessment, and development of mitigation measures and environmental management plan) was carried out from 16<sup>th</sup> March to 30<sup>th</sup> March 2011 as shown in Figure 3.1 route map. Biophysical studies covered environmental aspects such as physiography, climate, hydrology, drainage, soils, geology/hydrogeology, vegetation and wildlife. The socio-economic environmental study covered information on issues such as population, literacy, social amenities (healthcare and schools), land use, land tenure, the social dimensions of well-being and income levels, water supply, sanitation levels and security, along with other pertinent issues. The field study also enabled crosschecking of the data compiled during the desktop study.

### **3.4.2 Physiography and Geology**

A literature review and field verification of the physiography, regional geology and geological setting of the project area was undertaken and the potential of related hazards such as subsidence, landslides, earthquakes, soil erosion, etc were assessed in relation to the proposed seismic survey to be done in the area.

### **3.4.3 Soils**

Primary soil data was obtained using the exploratory soil and agro-climatic zone map and report of Kenya (Sombroek et al. 1982). Reference was also made to the NOCK oil blocks map for boundary delineation. The scale used in this report was 1:50,000. Field analysis included visual observation of soil units and road/riverbed cut descriptions where applicable, as well as soil classification and sampling. The surface description assisted in classification of the soil units. Parameters assessed in surface description included: soil texture, colour, structure, drainage, soil depth, surface stones and rock outcrops. Surface physical characteristics were described to determine wind and soil-water erosion hazards, flooding, ponding and logging potential, as well as accessibility of the units by vehicles. A GPS was used to geo-reference the sampling points (Figure 3.2). Soil samples were collected for fertility and texture determination at the National Agricultural Research Laboratories. Desktop work included soil map compilation and correlation to assign soil boundaries and harmonize the soil legend.

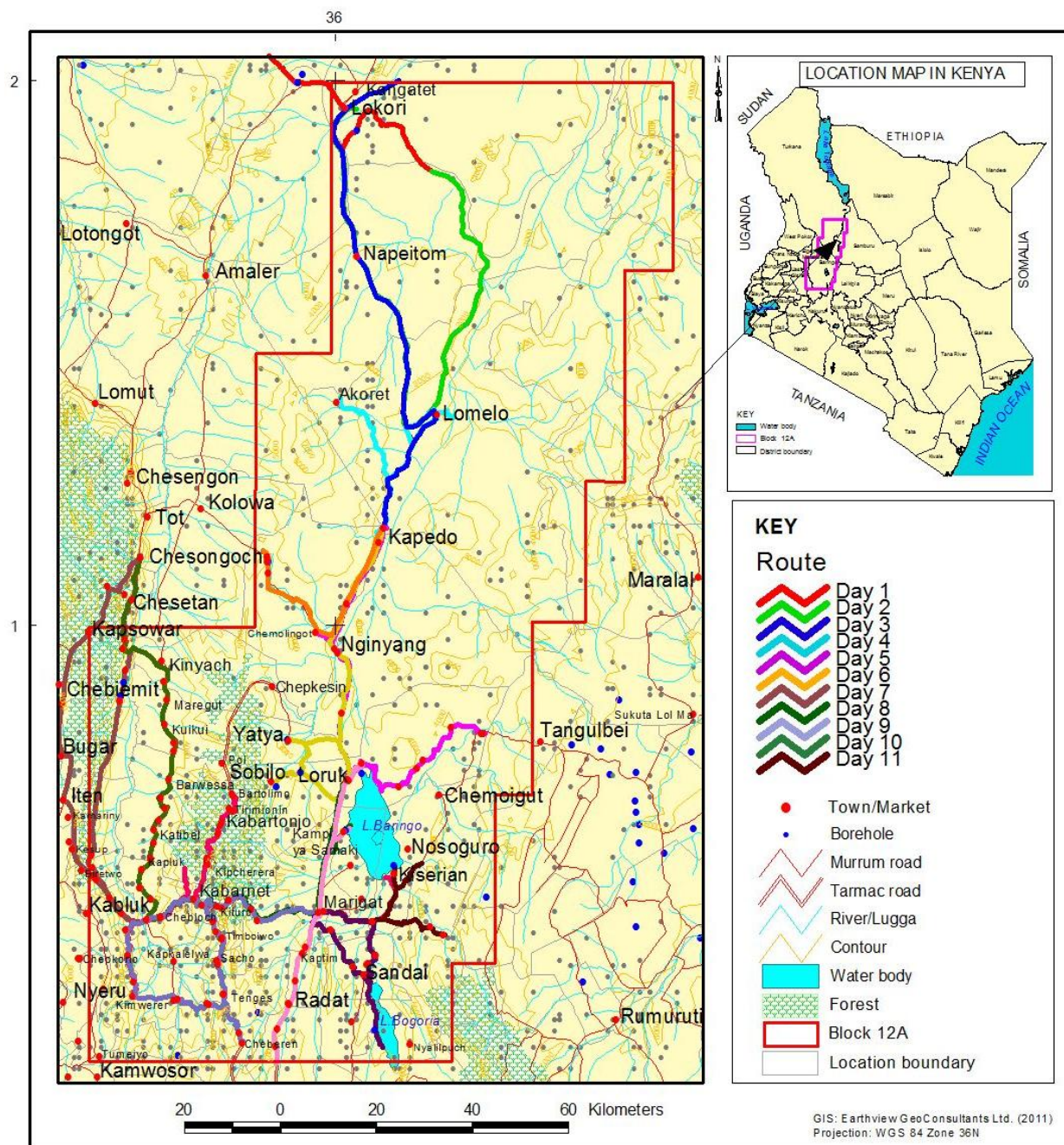


Figure 3.1: Route map of the study area.



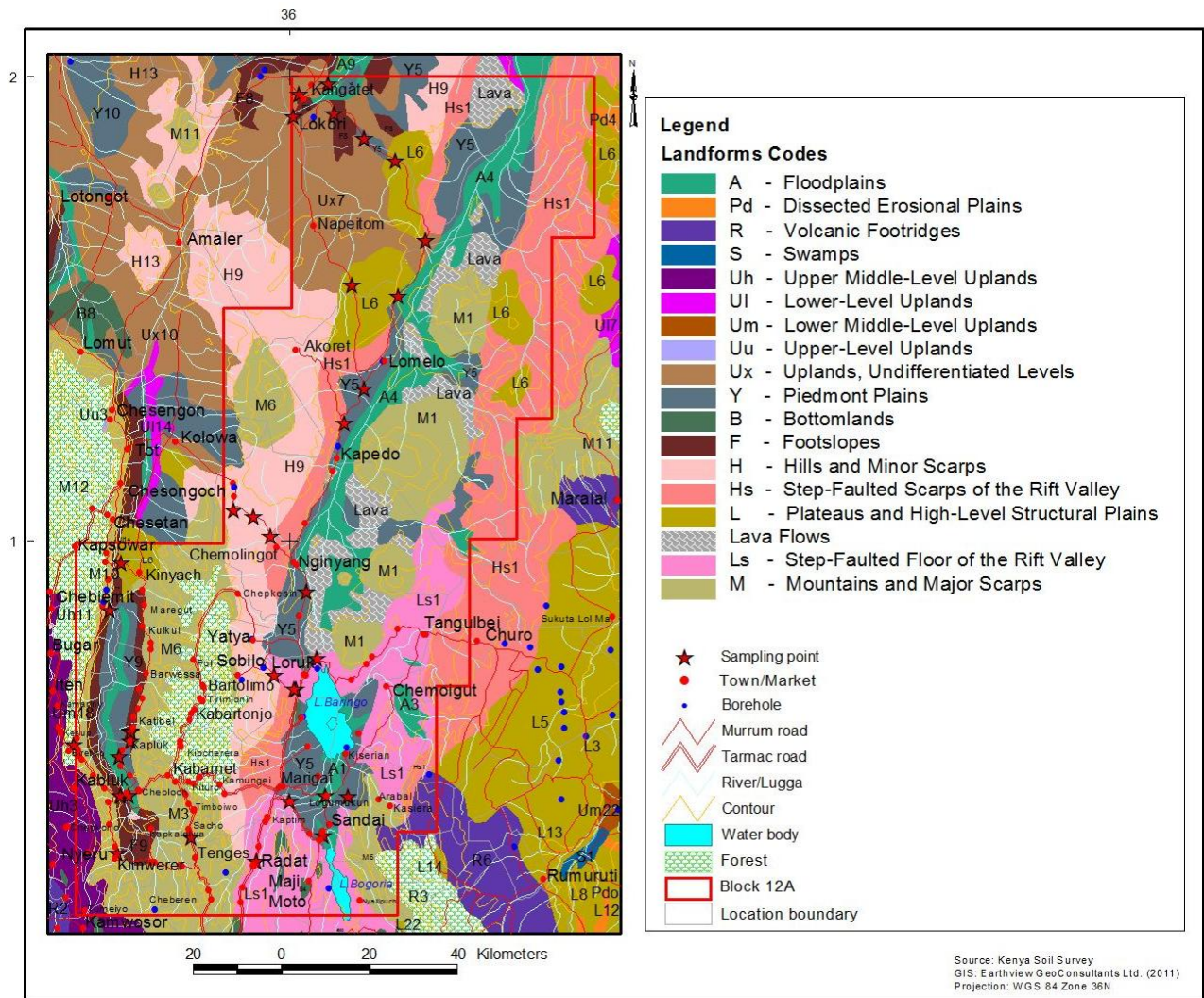


Figure 3.2: Soil sampling points.

### 3.4.4 Winds and Precipitation

Wind and precipitation data was obtained from desktop studies of existing literature from the Kenya Meteorological Department. In addition, wind data was supplemented by visual observations in the field.

### 3.4.5 Air

The project area is generally remote, semi-arid, largely rural, and sparsely populated. Determination of the ambient air quality in this particular setting was assessed qualitatively.

### 3.4.6 Water

In order to assess the water potential and quality, a thorough literature review was conducted covering the existing water sources for physico-chemical analysis. In addition, water samples were collected from boreholes, shallow wells, water pans, springs, streams and rivers for physico-chemical analysis. The locations of all sampling points were determined (Figure 3.3 below) and recorded using a GPS receiver and recorded accordingly.



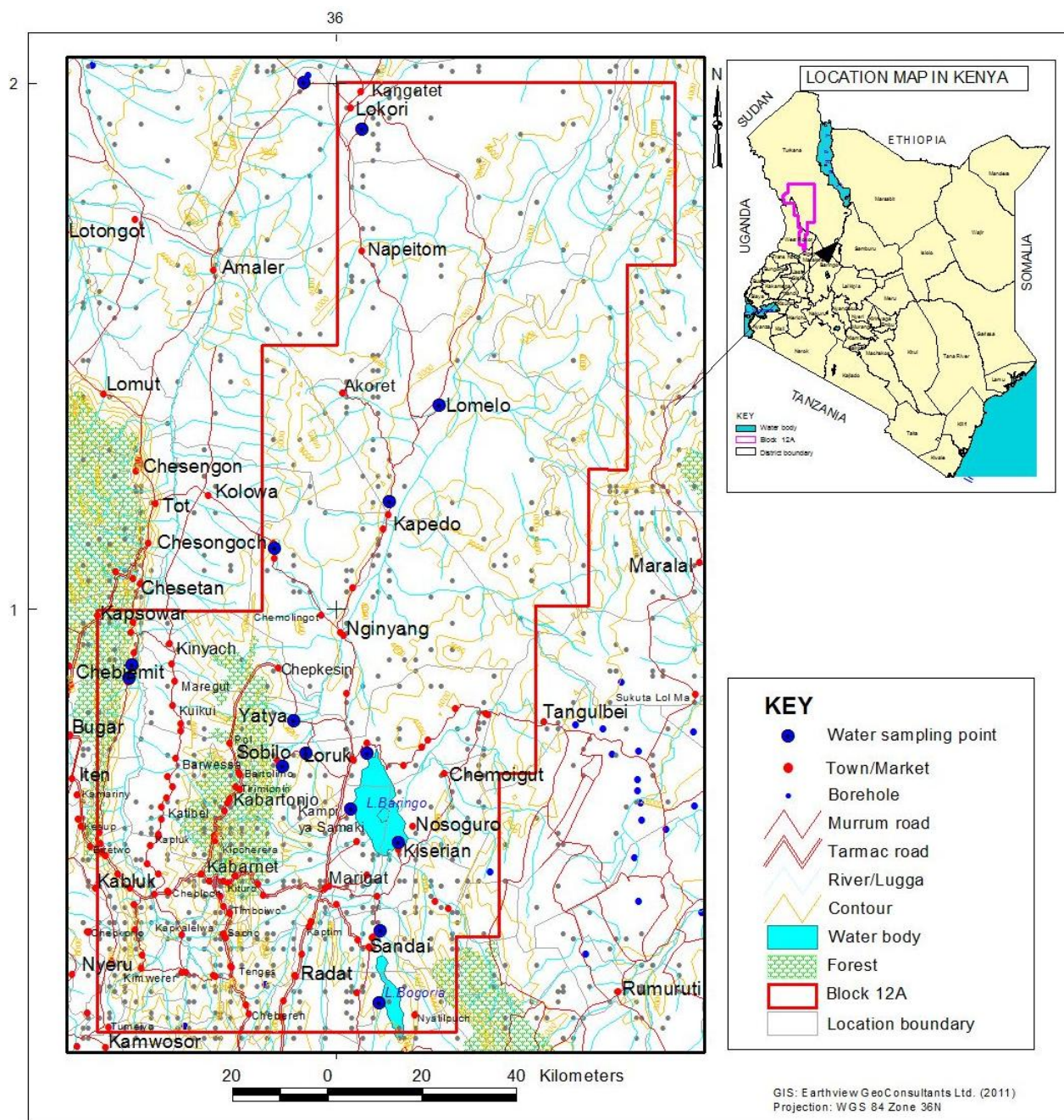


Figure 3.3: Water sampling points.

### 3.4.7 Terrestrial Environment

Collection of baseline information for the terrestrial environment including floral and faunal components in the project area was based on field observations and supported by literature review. Considerations included inventories of habitat types and species (including local names, where provided); vegetation cover, classes, and dominance levels; presence of rare and endangered species; presence of ecological reserves, and any critical ecosystem components. In addition, assessment was done to determine whether the area has experienced any known loss of habitat or biodiversity decline, and whether the proposed seismic survey activity would have any adverse effect on the existing ecosystems, flora, and fauna. Field guide books were handy in helping to confirm identified species. Habitats and animal encounters of interest were recorded, and photographs of species of mammals, birds, reptiles, amphibians, and arthropods present at the time of observation were taken.

### **3.4.8 Aquatic Environment**

Assessment of the riverine environments (along the perennial rivers Kerio, Suguta, Molo and the lake ecosystems of Bogoria and Baringo) included field-based identification of floral and faunal components and sampling, supported by literature review. Lake and river habitat types and species (common, rare, endemic and endangered) were noted.

### **3.4.9 Land Resources and Natural Heritage Sites**

The assessment was achieved through literature review and field observations. The issues considered included land use patterns in the area as well as available natural resources. Also considered was the potential impact of the seismic exploration in the area on land use patterns and their sustainability.

### **3.4.10 Visual Aesthetics**

An assessment of visual aesthetics was based on observations in the field. The following issues were considered:-

- Scenery;
- Geomorphology and landscapes;
- Pristine natural environments
- Potential impacts of seismic surveys and associated operations on the visual aesthetics of the area.

### **3.4.11 Noise and Vibrations**

The potential disturbance caused by noise levels during the seismic operations within the study area were taken into consideration during the fieldwork period. The mitigation of noise and vibrations arising from the use of Vibroseis and dynamite to generate the acoustic (seismic) waves, and associated support vehicles and equipment, was addressed.

### **3.4.12 Solid Wastes, Waste Oils and Effluents**

Possible impacts from solid and oil wastes generated as a result of the proposed seismic operation were assessed taking into account the increased use of vehicles and mitigation measures suggested. An assessment of methods to be employed in solid waste and effluent management in the proposed project was made and implementation suggestions recorded.

### **3.4.13 Public Consultations and Socio-Economics**

Public consultations were carried out during the field study (table 3.2) with the following aims:

- To inform the local people and their leaders about the proposed seismic data acquisition project and its objectives
- To gather the concerns and views of the local people on the proposed project
- To establish if the local people foresee any positive and/or negative impacts associated with the proposed seismic survey project, and suggest possible ways of mitigating negative impacts and enhancing positive impacts arising from it.
- To identify and document the diverse socio-cultural and economic setups in the project area that could be potentially impacted by the project activities.

**Table 3.2: Meetings held in Block 12A.**

	<b>DAYS &amp; DATES</b>	<b>TIME (Start/ End)</b>	<b>AREAS COVERED</b>	<b>DISTRICTS</b>	<b>GPS COORDINATES</b>
<b>1</b>	WEDNESDAY 16/03/2011	9:07 A.M 10:56A.M	Lokori Location Lokori Division	TURKANA EAST	272/N01.95195 E036.02592 593M
<b>2</b>	WEDNESDAY 16/03/2011	1:52 P.M 2:36 P.M	Napeitom Sub location Napeitom Location Lomelo Division	TURKANA EAST	273/N01.68006 E036.05012 677M
<b>3</b>	SATURDAY 19/03/2011	9:07 A.M 10:47A.M	Kapedo Location Lomelo Division	TURKANA EAST	274/N01.18359 E036.10358 699M
<b>4</b>	SATURDAY 19/03/2011	12:06 P.M 1:16 P.M	Lomelo Location Lomelo Division	TURKANA EAST	275/N01.39220 E036.19734 651M
<b>5</b>	SATURDAY 19/03/2011	3:20 P.M 4:00 P.M	Kulal Sub location Akoret Location Nginyang' Division	EAST POKOT	277/N01.41804 E036.01895 935M
<b>6</b>	MONDAY 21/03/2011	11:05A.M 12:12 P.M	Loyamorok Location Mondi Division	EAST POKOT	281/N00.94851 E036.01518 830M
<b>7</b>	MONDAY 21/03/2011	3:06 P.M 4:28 P.M	Kositei Location Nginyang Division	EAST POKOT	282/N00.98873 E035.96932 928M
<b>8</b>	TUESDAY 22/03/2011	11:47P.M 12:44P.M	Loruk-Kongasis Sublocation Loruk Location Mondi Division	EAST POKOT	283/N00.74533 E036.03096 980M
<b>9</b>	TUESDAY 22/03/2011	3:07P.M 4:00P.M	Tangulbei Location Tangulbei Division	EAST POKOT	284/N00.80309 E036.28521 1234M
<b>10</b>	THURSDAY 24/03/2011	5:17P.M 5:55P.M	Chepkem Sublocation Chesuman Location Tunyo Division	MARAKWET WEST	285/N00.97570 E035.61518 1097M
<b>11</b>	FRIDAY 25/03/2011	11:17A.M 11:51A.M	Kabarnet Division	BARINGO CENTRAL	287/N00.50353 E035.74495 1931M
<b>12</b>	FRIDAY 25/03/2011	3:46P.M 5:01P.M	Tenges Location Tenges Division	BARINGO CENTRAL	285/N00.31527 E035.80240 1943M
<b>13</b>	SATURDAY 26/03/2011	12:00P.M 12:42P.M	Koriema Sub location Kimalael Location Marigat Division	MARIGAT	286/N00.45820 E035.86366 1335M
<b>14</b>	SATURDAY 26/03/2011	5:55P.M 6:30P.M	Kiserian Location Mukutan Division	MARIGAT	286/N00.53424 E036.10327 989M
<b>15</b>	SUNDAY 27/03/2011	1:17P.M 1:58P.M	Chop Sublocation Soy Location Soy Division	KEIYO SOUTH	289/N00.32253 E035.63544 1378M
<b>16</b>	MONDAY 28/03/2011	11:40P.M 1:27P.M	Marigat Division	MARIGAT	290/N00.48499 E035.97816 1020M
<b>17</b>	TUESDAY 29/03/2011	12:17P.M 1:56P.M	Akorian Sub location Bartum Location Kabartonjo Division	BARINGO NORTH	292/N00.62242 E036.02550 1320M
<b>18</b>	TUESDAY 29/03/2011	5:43P.M 6:25P.M	Majo moto Sub location Kibos Location Mogotio Division	MOGOTIO	293/N00.26788 E036.04817 1439M
<b>19</b>	WEDNESDAY 30/03/2011	9:25A.M 11:44A.M	Kabartonjo Division	BARINGO NORTH	293/N00.63156 E035.79441 2226M

Other social and economic aspects relating to the project area, including livelihoods and cultures, education and health, among others, were assessed.

The methodologies employed include review of available literature, public meetings and consultation with local residents and their leaders; and administration of formal questionnaires and interviews with interested parties and at household level, was administered.



### 3.4.14 Health and Public Safety

This assessment was done through literature review of the available health data in the area. Primary data was collected through interviews with key informants and observations.

### 3.4.15 Infrastructure

The assessment was done through observation and interview with key officers in charge of development and maintenance of infrastructural facilities in the area.

### 3.4.16 Health and Public Safety

This assessment was done through literature review of the available health data in the area. It also consisted of a site-walk survey using a checklist of environmental health issues such as general level of sanitation, waste disposal practices, water supply and availability of health facilities.

The main issues assessed include:

- Sources of water;
- Types of sewage disposal/facilities;
- Types and quality of housing;
- Refuse disposal;
- The general cleanliness of the environment;
- Availability of health facilities;
- Interaction between environment and health, and;
- Potential health impacts related to the project.

### 3.4.17 Key informant interviews

Some administrative, social, economic, cultural and health issues were captured through interviews with key informants such as district administration officers, opinion leaders, councillors, community elders, chiefs, teachers, health workers and spiritual leaders, among others. Some of the information elicited during such interviews included:

- Cultural practises;
- Religion and belief systems;
- Social amenities and infrastructure;
- Health facilities available within the communities in the project area;
- Common diseases in the community;
- Community health concerns relating to the project;
- Health expectations from the project;
- View on employment of locals for the project, and;
- Security issues.

## 3.5 IMPACT ASSESSMENT CRITERIA AND RATING SCALES

CRITERIA	RATING SCALES
<b>Intensity</b> (expected size or magnitude of impact)	<b>Negligible</b> <b>Low</b> - where the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally affected <b>Medium</b> - where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; and valued, important, sensitive or vulnerable systems or communities are negatively affected

CRITERIA	RATING SCALES
	<b>High</b> - where natural, cultural or social functions and processes are altered to the extent that it will temporarily or permanently cease; and valued, important, sensitive or vulnerable systems or communities are substantially affected
<b>Extent</b> (predicted scale of impact)	<b>Site-specific</b> <b>Local</b> (immediate surrounding areas) <b>Regional</b> <b>National</b>
<b>Duration</b> (predicted lifetime of impact)	<b>Short-term</b> - 0 to 5 years <b>Medium term</b> - 6 to 15 years <b>Long term</b> - 16 to 30 years - where the impact will cease after the operational life of the activity either because of natural processes or by human intervention <b>Permanent</b> - where mitigation either by natural process or human intervention will not occur in such a way or in such a time span that the impact can be considered transient
<b>Probability</b> (likelihood of impact occurring)	<b>Improbable</b> – where the possibility of the impact materialising is very low <b>Probable</b> – where there is a good possibility (<50% chance) that the impact will occur <b>Highly probable</b> – where it is most likely (50-90% chance) that the impact will occur <b>Definite</b> – where the impact will occur regardless of any prevention measures (>90% chance of occurring)
<b>Status of impact</b>	<b>Positive</b> - a “benefit” <b>Negative</b> - a “cost” <b>Neutral</b>
<b>Degree of confidence</b> (specialist’s level of confidence in predictions +/- or information on which it is based)	<b>Low</b> <b>Medium</b> <b>High</b>

### Assigning significance ratings

The application of all the above criteria to determine the significance of potential impacts uses a balanced combination of duration, extent and intensity, modified by probability, cumulative effects and confidence.

### Significance is described as follows:

**Low:** Where the impact will have a negligible influence on the environment and no modifications or mitigations are necessary for the given programme description. This would be allocated to impacts of any severity/magnitude, if at a local scale and of temporary duration.

**Medium:** Where the impact could have an influence on the environment, which will require modification of the programme design and/or alternative mitigation. This would be allocated to impacts of moderate severity/magnitude, locally to regionally, and in the short-term.

**High:** Where the impact could have a significant influence on the environment and, in the event of a negative impact the activities causing it, should not be permitted (i.e. there could be a ‘no-go’ implication for the programme, regardless of any possible mitigation). This would be allocated to impacts of high magnitude, locally for longer than a month, and/or of high magnitude regionally and beyond.

The relationship between the significance ratings and decision-making can be broadly defined as follows:

**Low:** Will not have an influence on the decision to proceed with the proposed programme, provided that recommended measures to mitigate impacts are implemented;

**Medium:** Should not influence the decision to proceed with the proposed programme, provided that recommended measures to mitigate impacts are implemented; and

**High:** Would strongly influence the decision to proceed with the proposed programme.

## CHAPTER 4:

### POLICY, LEGAL, AND REGULATORY FRAMEWORK

#### 4.1 THE CONSTITUTION OF KENYA, 2010

The Constitution provides that every person has the right to a clean and healthy environment (Article 42). The State is obliged to ensure that the environment and natural resources are conserved and genetic resources and biological diversity are protected. In that regard it must eliminate any processes or activities that would be likely to endanger the environment. Everyone is expected to cooperate with the State organs and other people to protect and conserve the environment and ensure that the use and development of the natural resources are ecologically sustainable (Article 69). These environmental rights are enforceable in a court of law (Article 70). Land must be used in a sustainable manner, and in accordance with the principles of sound conservation and protection of ecologically sensitive areas. The State may regulate the use of any land or right over any land in the interest of land use planning (Article 66).

The Constitution of Kenya gives recognition to public, community and private land. Land use regulation goes beyond exploitation merely for economic purposes, and lays emphasis on conservation. It is required that wildlife conservation promotes sustainable development which includes both environmental conservation and economic development. Parliament has five years from the date of promulgation to enact legislation to give full effect to the provisions relating to the environment. Community land vests in communities identified on the basis of ethnicity, culture, or other similar common interest. Apart from land registered or transferred, it consists of land that is lawfully held, managed or used by specific communities as grazing areas or shrines, and ancestral lands (Articles 60 – 72). The State is generally mandated to regulate the use of any land in the public interest. Public land is described as including: all minerals and mineral oils; specified government forests; government game reserves; water catchment areas; national parks; government animal sanctuaries; specially protected areas; and all rivers, lakes and other water bodies as defined by law. However, land on which mineral and mineral oils exist is held by the national government in trust for the Kenyan people (Article 62).

The landmark decision of the case, *Centre for Minority Rights Development (Kenya) and Minority Rights Group International on behalf of the Endorois Welfare Council vs. Kenya* (Case No. 276 of 2003), brought before the African Commission on Human and People's Rights (ACHPR), will have a significant bearing on activities in the Lake Bogoria region. The genesis of the matter was the expulsion in 1973 of over 20,000 people of the Endorois, an indigenous pastoral community in the Lake Bogoria area, by the Kenyan Government, to make room for a game reserve and a tourist resort. The Endorois community ('the Complainant') protested the decision, going through the Kenyan judicial hierarchy for decades without success. Finally, in 2003, they took their case to the ACHPR. The Complainant had a chain of allegations, chief of which were that they had occupied the land for centuries, it was essential to their preservation as a people, and their health, livelihood, religion and culture were intimately connected to it because their pastures, sacred religious sites and traditional herbs were all situated around the shores of Lake Bogoria. Another complaint was that concessions for ruby mining on their land were granted in 2002 to a private company. This included the construction of a road in order to facilitate access for heavy mining machinery. The complainant claimed that these activities created a high risk of pollution of the waterways that they used for domestic consumption and for their livestock. The African Commission (at the 45<sup>th</sup> Ordinary Session in Banjul, Gambia) found Kenya to have violated the provisions of the African Charter to which she is bound. It stated that the eviction of the Endorois denied them access to their sacred sites that were vital to the

practice of their religion; they had a legal right to ownership of the land and that right had been infringed by their forcible removal without any compensation; Kenya had denied them their right to their culture by keeping them away from the resources that were essential to the health of their livestock; they had been denied their right to natural resources by the granting of mining rights on Endorois land to a private company without consulting the community or sharing the benefits with them; and their right to development had been violated by the failure of the government to provide them with alternative land of sufficient quality to support their way of life. Kenya was ordered to return the land to the Endorois and to give them compensation. The decision, issued on February 4, 2010, is not subject to appeal.

Lake Bogoria is one of five Kenyan lakes in the Rift Valley Province that are on the Ramsar List and are therefore protected sites<sup>1</sup>. The four others are Lakes Baringo, Elementaita, Naivasha and Nakuru. Lake Bogoria was the third of Kenya's lakes to be designated a Ramsar Site (August 27, 2001). Lake Baringo was designated on January 10, 2002. Lakes Nakuru, Naivasha and Elementaita were placed on the List on June 5, 1990, April 4, 1995 and September 5, 2005 respectively.

## **4.2 THE POLICY FRAMEWORK**

### **4.2.1 Environment and Development Policy**

The Environment and Development Policy is outlined in the draft Sessional Paper No.6 of 1999. It covers the following environment and development issues: biological diversity; land and land based resources; water resources; fisheries and marine resources; energy resources; atmospheric resources; waste management; management of toxic and dangerous chemicals; radiation management; environmental health and occupational safety; human settlements; disaster management; implementation strategies; priorities for action; human resources development; environmental planning; environmental laws; environmental impact assessment; environment and land use practices; environment, industry and economic development; environment, research and technology coordination and participation; regional and international cooperation; and environmental management authority.

It outlines the following principles, goals and objectives:

#### ***Principles***

- a) Environmental protection is an integral part of sustainable development.
- b) The environment and its natural resources can meet the needs of present as well as those of future generations if used sustainably.
- c) All the people have the right to benefit equally from the use of natural resources as well as an equal entitlement to a clean and healthy environment.
- d) Poverty reduction is an indispensable requirement for sustainable development.
- e) Sustainable development and a higher quality of life can be achieved by reducing or eliminating unsustainable practices of production and consumption, and by promoting appropriate demographic policies.
- f) Endogenous capacity building is essential for development, adaptation, diffusion, and transfer of technologies for sustainable development.
- g) Indigenous/traditional knowledge and skills are vital in environmental management and sustainable development.
- h) Effective public participation is enhanced by access to information concerning the environment and the opportunity to participate in decision-making processes.

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<sup>1</sup> 'The List of Wetlands of International Importance', April 7, 2011, The Secretariat of the Convention on Wetlands (Ramsar, Iran, 1971)

- i) Public participation including women and youth is essential in proper environmental management.
- j) For sustainable management, the polluter pays principle should apply.
- k) Access to judicial and administrative proceedings, including redress and remedy, is essential to environmental conservation and management.
- l) Private sector participation in environmental management is essential for sustainable development.
- m) Effective measures should be taken to prevent any threats of damage to the environment, notwithstanding lack of full scientific certainty.
- n) Peace, security, development, and environmental protection are interdependent and indivisible.
- o) International co-operation and collaboration is essential in the management of environmental resources shared by two or more states.

### **Overall Goal**

The overall goal is to integrate environmental concerns into the national planning and management processes and provide guidelines for environmentally sustainable development.

### **Specific Goals**

- a) To incorporate environmental management and economic development as integral aspects of the process of sustainable development.
- b) To promote maintenance of a quality environment that permits a life of dignity and well-being for all.
- c) To encourage sustainable use of resources and ecosystems for the benefit of the present generations, while ensuring their potential to meet the needs of future generations.
- d) To promote maintenance of ecosystems and ecological processes essential for the functioning of the biosphere.
- e) To promote the preservation of genetic resources, biological diversity, their cultural values and their natural heritage.
- f) To incorporate indigenous knowledge, skills, and interests for effective participation of local communities in environmental management and sustainable development.

### **Objectives**

- a) To conserve and manage the natural resources of Kenya including air, water, land, flora, and fauna.
- b) To promote environmental conservation with regard to soil fertility, soil conservation, biodiversity, and to foster afforestation activities;
- c) To protect water catchment areas;
- d) To enhance public awareness and appreciation of the essential linkages between development and environment;
- e) To initiate and encourage well-coordinated programmes of environmental education and training at all levels of society;
- f) To involve NGOs, private sector, and local communities in the management of natural resources and their living environment;
- g) To support a coordinated approach to policy formulation on environmental matters;
- h) To ensure development policies, programmes, and projects take environmental considerations into account;
- i) To ensure that an acceptable environmental impact assessment report is undertaken for all public and private projects and programmes;
- j) To develop and enforce environmental standards;

- k) To enhance, review regularly, harmonize, implement, and enforce laws for the management, sustainable utilization, and conservation of the natural resources;
- l) To provide economic and financial incentives for sustainable utilisation, conservation, and management of natural resources;
- m) To apply market forces, taxation, and other economic instruments including incentives and sanctions to protect the environment and influence attitudes and behaviour towards the environment;
- n) To ensure adherence to the polluter pays principle; and
- o) To develop adequate national laws regarding liability and compensation for the victims of pollution and other environmental damage.

#### **4.2.2 National Policy on Water Resources Management and Development (Sessional Paper No.1 of 1999)**

The management of water resources in Kenya is guided by four specific policy objectives, namely:

1. Preserve, conserve and protect available water resources and allocate it in a sustainable, rational and economic way.
2. Supply water of good quality in sufficient quantities to meet the various water needs, including poverty alleviation, while ensuring the safe disposal of wastewater and environmental protection.
3. Establish an efficient and effective institutional framework to achieve a systematic development and management of the water sector.
4. Develop a sound and sustainable financing system for effective water resources management, water supply and sanitation development.

#### **4.2.3 Energy Policy (Sessional Paper No. 4 of 2004)**

The broad objective of the national energy policy is to ensure adequate, quality, cost-effective and affordable supply of energy to meet development needs, while protecting and conserving the environment. The specific objectives are to:

- (i) provide sustainable quality energy services for development;
- (ii) utilise energy as a tool to accelerate economic empowerment for urban and rural development;
- (iii) improve access to affordable energy services;
- (iv) provide an enabling environment for the provision of energy services;
- (v) enhance security of supply;
- (vi) promote development of indigenous energy resources; and
- (vii) Promote energy efficiency and conservation as well as prudent environmental, health and safety practices.

#### **4.2.4 Land Policy (Sessional Paper No. 3 of 2009)**

The overall objective of the National Land Policy is to secure land rights and provide for sustainable growth, investment and the reduction of poverty in line with the Government's overall development objectives. Specifically, it seeks to develop a framework of policies and laws designed to ensure the maintenance of a system of land administration and management that will provide:

- a) all citizens with the opportunity to access and beneficially occupy and use land;
- b) an economically, socially equitable and environmentally sustainable allocation and use of land;
- c) effective and economical operation of the land market;

- d) efficient use of land and land-based resources; and
- e) efficient and transparent land dispute resolution mechanisms.

#### **4.2.5 Mining Policy**

The National Mineral Resources and Mining Policy is currently at an advanced stage of being adopted. In tandem with this process, the Government has developed new mining legislation (currently The Mining and Minerals Bill, 2011) to replace the *Mining Act, Cap.306* of 1940, which is both antiquated and ineffective. Under the new mining legislation, rights and interests in minerals of all kinds, including commonly found minerals, will be regulated. The new mining legislation is being harmonised with existing environmental legislation. In particular, mining companies will be required to comply with the requirements of the Environmental Management and Co-ordination Act and other applicable environmental legislation and, the new legislation will provide that mining licences may not be granted unless the applicant has obtained an Environmental Impact Assessment ('EIA') Licence.

#### **4.2.6 Health Policy**

The Kenya Health Policy Framework (1994) sets out the policy agenda for the health sector up to the year 2010, so this is likely to be reviewed in the near future. The policy includes strengthening of the central public policy role of the Ministry of Health (MoH), adoption of an explicit strategy to reduce the burden of disease, and definition of an essential cost-effective healthcare package. To make this Health Policy Framework Paper operationally viable, the National Health Sector Strategic Plan (NHSSP, 1999-2004) was developed in 1994. The strategic plan emphasized the decentralisation of healthcare delivery through redistribution of health services to rural areas. The plan is currently being revised to reflect the Poverty Reduction Strategy Paper (2001-2004) agenda. The new plan focuses on the essential key priority packages based on the burden of disease and the required support systems to deliver these services to the Kenyans. Major players in the health sector include the government represented by the Ministry of Health and the Local Government, private sector and non-governmental organisations (NGOs). The organisation of Kenya's healthcare delivery system revolves around three levels, namely the MoH headquarters, the provinces and the districts. The headquarter sets policies, coordinates the activities of NGOs and manages, monitors and evaluates policy formulation and implementation. The provincial tier acts as an intermediary between the central ministry and the districts. It oversees the implementation of health policy at the district level, maintains quality standards and coordinates and controls all district health activities. In addition, it monitors and supervises district health management boards (DHMBs), which supervise the operations of health activities at the district level.

#### **4.2.7 Economic Recovery for Wealth and Employment Creation Strategy**

The overall goal of the Strategy is to ensure clear improvements in the social and economic well-being of all Kenyans, thereby giving Kenyans a better deal in their lives and in their struggle to build a modern and prosperous nation (GVEP Kenya, 2006). The key areas covered in the Strategy are:

- (i) expanding and improving infrastructures;
- (ii) reforms in Trade and Industry;
- (iii) reforms in forestry;
- (iv) affordable shelter and housing;
- (v) developing arid and semi-arid lands; and
- (vi) safeguarding environment and natural resources.



The Strategy, which has commanded a great deal of attention in recent years, essentially subsumes the Poverty Reduction Strategy Paper (PRSP).

#### 4.2.8 Kenya Vision 2030

Kenya Vision 2030 was launched on October 30, 2006, and is the country's new development plan for the period 2008 to 2030. It seeks to transform Kenya into an industrialized "middle-income country providing a high quality of life to its citizens by the year 2030".

Vision 2030 is based on three 'pillars': the economic, the social and the political. The adoption of the Vision follows the successful implementation of the Economic Recovery Strategy for Wealth and Employment Creation (ERS) launched in 2002. The Vision is to be implemented in successive five-year medium-term plans, with the first such plan covering the period 2008-2012.

The economic, social and political pillars of Kenya Vision 2030 are anchored on macroeconomic stability, continuity in government reforms, enhanced equity and wealth-creation opportunities for the poor, infrastructure, energy, science, technology and innovation, land reform, human resources development, security, as well as public sector reforms.

The foundations for the Vision are:

- 1. Macroeconomic Stability for Long-term Development:** The Vision places the highest premium on Kenya's current stable macroeconomic environment which works in favour of the poor, and expects it to continue in the future as a matter of policy. The projects proposed under Vision 2030 will be subjected to the parameters set under the macroeconomic stability framework.
- 2. Continuity in Governance Reforms:** These will be accelerated in order to create a more conducive environment for doing business, and also to enable Kenyans to fully enjoy their individual rights under the Constitution. Towards this end, the government will intensify the anti-corruption programme through more efficient investigation and prosecution; eliminating bribery in the public service and increasing public education and judicial and legal reform. The government will also fully support the people of Kenya, parliament, civil society and the press, recognising that they are the ultimate defence against abuse of office.
- 3. Infrastructure:** The Vision aspires for a country firmly interconnected through a network of roads, railways, ports, airports, water and sanitation facilities and telecommunications. This is a high priority issue.
- 4. Enhanced Equity and Wealth-Creation Opportunities for the Poor:** The Vision includes equity as a recurrent principle in economic, social and political programmes. Special attention has been given to arid and semi-arid districts, communities with high incidence of poverty, the unemployed youth, women, and all vulnerable groups.
- 5. Science, Technology and Innovation (STI):** The government will intensify the application of STI to increase productivity and efficiency levels across all three pillars. It recognises the critical role played by research and development in accelerating development in the emerging nations. The government will create and implement an STI policy framework to support Vision 2030.

- 6. Land Reform:** Land is a vital resource for the socio-economic and political developments set out in the Vision. It is recognized that respect for property rights to land, whether owned by individuals, communities or companies, is key to rapid economic growth (A national land use policy has now been created to enable this growth) (section 4.2.4).
- 7. Human Resources Development:** Kenya will create a globally competitive and adaptive human resource base to meet the needs of a rapidly industrializing economy through training and education, raising labour productivity to international levels, creating a human resource database to facilitate better planning, and establish more training institutions.
- 8. Security:** The government will increase security in order to lower the cost of doing business and provide Kenyans with a more secure environment to live and work in. The strategies will include improving community policing, reducing the police-to-population ratio, and adopting information and communication technology in crime detection and prevention. These measures will be supported by judicial reforms.
- 9. Energy:** Since development projects recommended under Vision 2030 will increase demand on Kenya's energy supply, she must generate more energy at a lower cost and increase efficiency in energy consumption. The government is committed to continued institutional reforms in the energy sector, including a strong, regulatory framework, and will encourage more power generation by the private sector. New sources of energy will be found through the exploitation of geothermal power, coal, and renewable energy sources.
- 10. The Public Sector:** An efficient, motivated and well-trained public service is expected to be one of the major foundations of the Vision. Kenya intends to build a public service that is more citizen-focused and results-oriented. The government will intensify efforts to bring about an attitudinal change in public service that values transparency and accountability to the citizens of Kenya.

## 4.3 KENYA LEGISLATION AND REGULATIONS

### 4.3.1 The Petroleum (Exploration and Production) Act, Cap. 308

The purpose of this legislation is to regulate the Government's negotiation of petroleum agreements relating to oil exploration, among other things. The Act, its regulations, and the terms and conditions of the petroleum contract, together govern oil operations. The Minister has the power to make regulations for the conservation of petroleum resources, the safety measures to be taken on site, environmental protection and the prevention of pollution, waste and accidents. The contractor<sup>2</sup> is expected to take necessary measures to conserve petroleum and other resources, as well as protect the environment and human life. Should the rights of the owner or occupier be infringed in the course of the petroleum operations, the contractor must pay a fair and reasonable compensation (Sections 4, 6, 9, 10). In our view, precedent cases of compensation under similar conditions, where they exist, should be considered as guidelines to the level of compensation.

### 4.3.2 The Petroleum (Exploration and Production) Regulations

The existence of a petroleum agreement or the issue of a permit under the parent Act does not authorize the contractor or the grantee to occupy or exercise any rights in a) any burial land in the locality of any church, mosque or other places of worship; b) any area within fifty metres of any building in use, or any reservoir or dam; c) any public road; d) any area within

<sup>2</sup> "Contractor" here means the individual(s) or company undertaking the work or project.

a municipality or township; d) any land within one thousand metres of the boundaries of any aerodrome; and any land declared to be a national park or national reserve under the Wildlife (Conservation and Management) Act. However, directional drilling into the subsurface from land adjacent to the mentioned areas is permitted with the consent of the competent authority (Regulation 6).

It relates to interference with sensitive cultural, natural heritage sites, and the use of vibroseis machines, dynamite charges and exhaust emissions from vehicles, machines and equipment such as generators, etc. It also relates to disturbance of flora and fauna.

#### **4.3.3 The Explosives Act, Cap. 115**

There are restrictions on transport, storage and possession of both authorized and unauthorized explosives. A permit is required to purchase and use blasting materials as well as to convey explosives within Kenya (Sections 6, 7, 11, 13). It applies to noise and vibrations from dynamite charges.

#### **4.3.4 The Explosives (Blasting Explosives) Rules**

The use of explosives in the vicinity of any public road is not permitted. Also prohibited is the use or transport of explosives in the working of a mine, quarry, excavation or other project, unless an “explosives manager<sup>3</sup>” has been appointed and the inspector notified in writing. The explosives manager is responsible for the safety and security of all explosives used, transported or stored, until they are handed to the blaster for use. He is also responsible for the safety of every person who may be employed on the project, whether under his direct supervision or not (Rules 78 – 80) in the context of the use of explosives. Also, such responsibility does not extend to a situation where the person was operating under the direct supervision or control of someone else who holds a valid permit to use explosive materials when the prevailing rules were contravened, or an accident occurred.

#### **4.3.5 The Energy Act, No. 12 of 2006**

Anyone in the petroleum business must comply with the Kenya Standard or other approved standard on environment, health and safety and in conformity with the relevant laws in that regard. A person transporting petroleum by inland waters, pipeline or any other mode must institute measures to ensure that the mode of transportation is safe. Anyone engaged in any licensed undertaking must notify the Energy Commission of any accident or incident causing loss of life, personal injury, explosion, oil spill, fire or any other accident or incident causing significant harm or damage to property or to the environment (Sections 98, 117).

It relates to the health and safety of the project crew and the environment.

#### **4.3.6 The Public Health Act, Cap. 242**

This legislation focuses on securing and maintaining health. It is the duty of every local authority to take measures to prevent any pollution dangerous to the health of any supply of water which the public uses for domestic purposes. They must purify the water supply should it become polluted, and take appropriate action against any person polluting any such water supply or any stream so as to cause a nuisance or danger to health (Section 129). They are also obligated to take measures to maintain the locality in clean and sanitary condition and to prevent or remedy any nuisance that may cause injury to health (Section 116). The Minister may make rules (a) as to the standard or standards of purity of any liquid which may be discharged as effluent after treatment, (b) establish or prohibit trade premises

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<sup>3</sup> “Explosives Manager” here means any person assigned to be responsible for the explosives.

or factories likely to cause offensive smells, or (c) to discharge liquid or other material prone to cause such smells, or to pollute streams, or are likely in any way to be a nuisance or dangerous to health (Section 126).

This statute relates to the waste generated at the camp and worksite(s) and its safe discharge.

#### **4.3.7 The Occupational Safety and Health Act, No. 15 of 2007**

This legislation applies to all workplaces. Every occupier must ensure the health, safety and welfare at work of all the people working in his workplace as well as protect other people from risks to safety and health occasioned by the activities of his workers. The occupier's duty to ensure the safety, health and welfare of all persons at work in his premises includes providing a working environment and work procedures that are safe. The likely emission of poisonous, harmful, or offensive substances into the atmosphere should be prevented, and where such incidents occur, they must be rendered harmless and inoffensive. Machinery, protective gear, and tools used in all workplaces have to comply with the prescribed safety and health standards. Dust, fumes or impurity must not be allowed to enter the atmosphere without appropriate treatment to prevent air pollution or harm of any kind to life and property. Highly inflammable substances must be kept in a safe place outside any occupied building. Where dangerous fumes are liable to be present, there must be a means of exit and suitable breathing apparatus made available. Means for extinguishing fire must be available and easily accessible, and evacuation procedures tested regularly (Sections 6, 21, 47, 55, 64, 78, 79, 81, 82).

This covers activities that may be a hazard to the health and safety of the project workers and other persons both onshore and offshore, due to accidents caused by, for instance, vehicle collisions, collisions with animals, and vessel to vessel collisions. It includes injury involving equipment, as well as emissions from vehicles, equipment and vessels. It also relates to vibroseis machines and dynamite charges.

#### **4.3.8 The Water Act, Cap. 372**

The Minister is mandated to prescribe a system for classifying water resources in order to determine resource quality objectives of each water resource. It is an offence to wilfully obstruct, interfere with, divert or obstruct water from any watercourse or water resource, or to negligently allow such acts, or to throw any dirt, effluent, trade waste or other offensive or unwholesome matter or thing into or near any water resource in such a way as to cause or be likely to cause pollution of the water resource (Sections 12, 44 and 94).

This relates to storage of oil and chemicals, and waste generation – solids, effluents and oils at camp and work areas – and its safe discharge.

#### **4.3.9 The Water Resources Management Rules, 2007**

No one may discharge any toxic or obstructing matter, radioactive waste or other pollutants into any water resource unless the discharge has been treated to permissible levels. Discharge of effluent into a water resource requires a valid discharge permit issued by NEMA. The wilful and deliberate spilling into any water source or onto land where such spillage may contaminate any surface or groundwater is not permitted. Any threat of contamination must swiftly be dealt with (Regulations 81, 82, 88). NEMA may identify a catchment area or part of a catchment area or water resource to be identified as protected areas or designated as groundwater conservation areas if it is satisfied that it is necessary to protect the water resource and its multiple uses (Regulation 123).

This applies to the safe discharge of waste emanating from camp and worksites.

#### **4.3.10 the Local Government Act, Cap. 265 (Revised 2010)**

This Act gives local authorities the power to control or ban businesses, factories and workshops which may emit smoke, fumes, chemicals, gases, dust, smell, noise or vibration, and in so doing become a danger or annoyance to the vicinity. The local authority may therefore lay down conditions under which such enterprises may carry on business (Section 163). A local authority may refuse to grant or renew a licence, or cancel it on various grounds, some of which are (a) that it would cause nuisance or annoyance to the residents; and (b) that the method adopted or proposed to prevent noxious or offensive vapours, gases or smells arising from the trade are not efficient (Section 165). However, the Local Government Bill, 2009, is intended to repeal and replace this statute and will provide for various classes of local authorities. It is worth noting that the Bill provides that a municipality will be granted city status and a city metropolitan status only if they demonstrate an effective programme of environmental conservation and the ability to render environmental conservation services within their areas respectively. The Bill went through the second reading in Parliament in June 2010.

This relates to the project's compliance with the laws and regulations regarding the protection of the environment from forms of pollution that may occur as a result of the use of vibroseis machines, dynamite charges, waste discharge and disposal, storage of oil and chemicals, as well as exhaust emissions from vehicles, machines and equipment.

#### **4.3.11 The Physical Planning Act, Cap. 286**

The statute establishes Physical Planning Liaison Committees to determine development applications relating to industrial location, dumping sites or sewerage treatment which may have adverse impact on the environment. If a local authority is of the opinion that a proposed development, dump site, sewerage treatment plant, quarry or other development activity will impact on the environment adversely, it will require the applicant to submit an environmental assessment report for consideration (Section 36).

This covers all development activities that may result in adverse effects on the environment, particularly the generation of waste and the method of its discharge.

#### **4.3.12 The Wildlife (Conservation and Management) Act, Cap. 376**

Where the Minister is satisfied that in order to secure the safety of the flora and fauna or to preserve the habitat and ecology within a national park, reserve or sanctuary, it is necessary to restrict or forbid any activity in the adjacent area, he may declare it a protected area and prohibit those activities. The Wildlife Director or his agent or any authorized officer of the Service may close a portion of a national park or any road or part of a road within the park to the public or any class of people, for a period for the protection of animal or plant life, or for the safety of the public, or for the protection of a road, or for climatic reasons, or for any other reason (Regulation 4). The Minister may declare that any provision of the Act shall apply to non-game animals, or to any trophy or meat of any such animal, and on publication of the notice the animal concerned will be deemed to be a game animal or game bird (Section 15).

This statute relates to the disturbance of, and interference with, sensitive cultural, natural heritage and archaeological sites.

#### **4.3.13 The National Museums and Heritage Act, Cap. 216**

The Minister may prohibit or restrict access or any development which in his/her opinion is liable to damage a monument or object of archaeological or palaeontological interest there. A protected area means a site which has been and remains so declared by the Minister under section 25 (1). These include (a) an open space, (b) a specified site on which a buried monument or object of archaeological or palaeontological interest exists, including the adjacent area, or (c) a geo-park. The protected area may be placed under the control of the National Museums of Kenya. Where private land is included in a protected area, the owner of the land is entitled to compensation. All antiquities lying in or under the ground, or on the surface of any land protected under the law as a monument, or being objects of archaeological, palaeontological and cultural interest are the property of the Government (Sections 25, 34, 35, 46).

This statute relates to the disturbance of, and interference with, sensitive cultural, natural heritage and archaeological sites.

#### **4.3.14 The Penal Code, Cap. 63**

The following acts constitute offences under section 191 to 193 of the Penal code:

- Voluntarily fouling the water of any public spring or reservoir, thereby making it less fit for its normal purpose.
- Corrupting the atmosphere in any place, so as to make it noxious to the health of people in the vicinity.
- For trade or other purposes, making loud noises or offensive smells in circumstances causing annoyance to others.

This relates to compliance with the law as regards air and water pollution from site activities.

### **4.4 NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY - ACT AND REGULATIONS**

#### **4.4.1 The Environmental Management and Co-ordination Act, 1999**

The Environmental Management and Co-ordination Act, 1999, provides for the establishment of an appropriate legal and institutional framework for the purpose of managing the environment and matters connected with it. The National Environment Management Authority (NEMA) is established under section 7 of the Act. Its mandate is to monitor the operations of industries, projects or activities to determine their immediate and long-term effects on the environment. TKBV, being a project whose activities fall within the ambit of the Act, is therefore subject to its provisions. The Act (Part VIII) lays down provisions pertaining to environmental quality standards. It establishes a Standards and Enforcement Review Committee whose broad functions are to (a) advise NEMA on how to establish criteria and procedures to measure water and air quality and (b) issue standards and guidelines for the safe and proper disposal of waste (Sections 70, 71, 78, 86). Where Kenya is a party to an international convention, treaty or agreement on the management of the environment, NEMA must initiate legislative proposals to give effect to them (Section 124). The law does not permit anyone to deposit any substance in a lake, river or wetland or in, on or under its bed, if that substance is likely to cause adverse environmental effects. NEMA may prescribe measures to ensure that the biological resources in place are preserved, issue guidelines to promote the conservation of the various terrestrial and aquatic systems, and protect species, ecosystems and habitats threatened with extinction. Any area of land, lake or river may be declared a protected natural environment in order to promote

and preserve specific ecological processes, natural environment systems or species of indigenous wildlife. It is an offence to discharge pollutants into the aquatic environment. No one is permitted to discharge any hazardous substance, chemical, oil or mixture containing any oil into any waters or any other parts of the environment. Noise must not be emitted in excess of the laid-down standards (Sections 42, 43, 51, 54, 71, 72, 93, 102, 108).

This statute regulates all the activities of projects that may have adverse environmental impacts.

#### **4.4.2 The EIA Guidelines and Administrative Procedures**

The Environment Impact Assessment and Administrative Procedures arose from the policy framework and the legislative and regulatory (the Environmental Management and Co-ordination Act, 1999, and its regulations) procedures in order to assist in the integration of environmental concerns in economic development so as to foster sustainable development. The document sets out guidelines for carrying out Environmental Impact Assessment, Environmental Audit and Monitoring, Strategic Environmental Assessment and dealing with issues of transboundary, regional and international conventions, treaties and agreements. It sets out the procedure in EIA studies and Environmental Audits as well as the contents and format of the reports required to be submitted to NEMA for consideration. The EIA study review process and decision-making are also explained. The guidelines are mainly intended to assist project proponents, EIA practitioners, lead agencies and members of the public to understand the process and the basis on which decisions are made.

#### **4.4.3 The Environmental Management and Co-ordination (Water Quality) Regulations, 2006**

Everyone is required to refrain from any act which directly or indirectly causes water pollution, and no one may throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such material in or near it so as to cause pollution. No one is permitted to carry out any activity near lakes, streams, springs and wells that is likely to have an adverse impact on the quality of the water without an environmental impact assessment licence. It is an offence to discharge or apply any poison, toxic or obstructing matter, radioactive wastes or other pollutants or permit the dumping or discharge of any such matter into water meant for fisheries and wildlife (Regulations 4-8, 12 and 24).

This applies to solid or liquid waste generated from the campsite or from the project site(s) and other work areas, and the manner of disposal of such waste in, or close to, the named water sources.

#### **4.4.4 The Environmental (Impact Assessment and Audit) Regulations, 2003**

Any project that is likely to have a negative impact on the environment must be submitted to an environmental impact assessment process. The terms of reference must include matters considered germane in the environmental impact assessment process as set out in the Second Schedule to the Regulations. In addition, the study must take into account environmental, social, cultural, economic, and legal considerations. The report must state: a) the proposed location of the project and a description of the environment likely to be affected; b) the products, by-products and waste generated by the project; c) the project's environmental effects, including the socio-cultural consequences and the anticipated direct, indirect, cumulative, irreversible, short-term and long-term impacts; d) an environmental management plan proposing the measures for eliminating or mitigating adverse impacts on the environment; e) an action plan to prevent and manage foreseeable accidents and dangerous activities in the course of carrying out the project; and f) the measures to prevent

health hazards and to ensure security in the workplace for the employees (Regulations 4, 7, 11, 16 and 18).

It applies to the requirements of the environmental impact assessment process.

#### **4.4.5 The Environmental Management and Co-ordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit-Sharing) Regulations, 2006**

Regulation 4 provides that no person shall engage in any activity that may have an adverse impact on any ecosystem or lead to the unsustainable use of natural resources. The conservation of biological diversity applies to any area of land, lake or river which the Minister has declared to be a protected natural environment system for purposes of promoting and preserving biological diversity in accordance with section 54 of the parent Act (Regulation 8).

This relates to disturbance of flora and fauna, vegetation disturbance and removal, and the disturbance of soil, surface and groundwater, and the marine environment.

#### **4.4.6 The Environmental Management and Co-ordination (Wetland, Riverbank, Lakeshore and Seashore Management) Regulations, 2009**

These Regulations aim to ensure the sustainable use of wetlands for ecological and aesthetic purposes and in addition seek to prevent and control pollution and siltation as well as other activities that may degrade the environment. All wetland resources must be used in a sustainable manner compatible with the continued presence of wetlands and their hydrological, ecological, social and economic functions and services. Some permitted uses of wetlands include cultivation, fishing (subject to the Fisheries Act), small-scale fish farming, domestic consumption, grazing, and hunting (subject to the Wildlife (Conservation and Management) Act). Areas that have national significance may be declared to be protected wetlands due to their biological diversity, ecological importance, natural heritage, aesthetic value or landscape. Environmental Restoration orders may be given to allow a wetland, riverbank or lakeshore that has been degraded to regenerate. Local authorities are mandated to make bye-laws to manage solid waste and waste waters on lakeshores and riverbanks in accordance with the Public Health Act, Cap. 342 (Regulations 4, 5, 8, 11, 16, 17, 22, 24).

This applies to interference with fishing and other marine activities, and the possible disturbance of aquatic life, flora and fauna. In addition it relates to interference with grazing and other economic activities close to the project area, as well as visual aesthetics, and interference with the natural heritage.

#### **4.4.7 The Environmental Management and Co-ordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009**

The Regulations prohibit the making of loud, unreasonable, unnecessary or unusual noise or excessive vibrations which annoy, disturb, injure or endanger the comfort, repose, health or safety of other people and the environment. There are laid-down permissible noise levels which no one may exceed unless the noise is reasonably necessary to preserve life, health, safety or property. Any person intending to engage in any commercial or industrial activity likely to emit noise or excessive vibrations must carry out that activity within the prescribed level (Regulations 3-5, 11, 20).

These regulations relate to noise and vibrations from the use of vibroseis machines, dynamite charges, vehicles, machines and equipment such as generators, etc.



#### **4.4.8 The Environmental Management Co-ordination (Fossil Fuel Emission Control) Regulations, 2006**

Every person in Kenya is entitled to a clean and healthy environment and is obligated to safeguard and enhance that environment. Internal combustion engines are subject to inspection and must pass tests to show that they comply with the standards and requirements for the control of air pollution or contamination. It is an offence to operate an internal combustion engine which emits smoke or other pollutant in excess of the emission standards. NEMA may approve any substance to be used as a fuel catalyst if it improves fuel economy, enhances combustion and reduces harmful emissions that adversely affect human, animal and plant health and degrade the environment. The cost of clearing the pollution through fuel emission is borne by the polluter (Regulations 4, 7, 12).

This relates to vehicular exhaust emissions that could be potentially harmful to the project crew as well as to other persons in the vicinity. It includes all other equipment that emits fumes.

#### **4.4.9 The Environmental Management and Co-ordination (Waste Management) Regulations, 2006**

Anyone generating waste must minimize it by adopting cleaner production methods. This may be done by improving the production process through conserving raw materials and energy, eliminating the use of toxic raw materials and reducing toxic emissions and wastes. Other methods would be to monitor the product cycle by identifying and eliminating the product's potential negative impacts, recovering and reusing the product where possible, and reclaiming and recycling it. Waste can also be minimized by incorporating environmental concerns in the design and disposal of the product. Every industrial undertaking must mitigate pollution by installing at its premises anti-pollution equipment for treating the waste it generates. Discharge or disposal of any waste in any form into the environment is not permitted without prior treatment. An Environmental Impact Assessment licence must be obtained by anyone intending to engage in any activity likely to generate hazardous waste. Anyone generating toxic or hazardous waste must have it treated according to the laid-down guidelines (Regulations 14, 15, 17).

This applies to waste generation at camp and the work site(s), and its disposal in a way that does not endanger human health and the environment.

### **4.5 INTERNATIONAL PRACTICES, STANDARDS AND CONVENTIONS**

#### **4.5.1 International Best Practices**

Useful guidelines and practices on the best international practices in the oil exploration and production industry can be drawn from international best practices developed by the industry. Some of the major ones are: a) the International Association of Oil and Gas Producers (OGP) guidelines on best practices to improve health, safety, environment, security, corporate social responsibility, engineering and operations, b) the International Association of Geophysical Contractors (IAGC) whose focus areas include government issues, standards and best practices with an emphasis on health, safety and the environment, and c) the E&P Forum which has specific guidelines for the development and application of health, safety and environmental management systems, among others.

The E&P Forum (Oil Industry International Exploration and Production Forum) is an international association of oil companies and petroleum industry organizations. It deals with all aspects of exploration and production operations with major emphasis on health, safety and environment. The Forum is continuously engaged in developing guidelines and codes of

practice based on the experiences of both UNEP and the oil industry. These guidelines have become widely accepted as providing a strong basis for preparing regulations, policies and programmes to minimize the impact that these operations visit on the environment.

E&P, jointly with UNEP, published a document on the best approaches to achieving high environmental performance and standards worldwide. Within the framework provided, various technical reviews and guidelines already available from other relevant sources can be applied. It developed a common management system to deal with health, safety and environmental (HSE) issues. Its key elements are as follows:

## **1. Leadership and commitment**

It is vital to have a senior management committed to ensuring that the management system is developed and maintained, and that the company's policy and strategic objectives are achieved. Management should ensure that the policy requirements are adhered to during operations and support local initiatives to protect health, safety and the environment. Management commitment will involve delegating responsibility, providing resources and motivation, and ensuring participation and open communication.

## **2. Policy and strategic objectives**

The HSE management system requires that the company's policies and strategic objectives are well-defined and documented. The policies must be relevant and consistent and should be on a par with other company policies and objectives. Here also, commitment to carrying out the company's policies towards protecting people's health and safety as well as the environment, is vital, as are responses to community concerns. Partnerships with stakeholders are just as essential. Where relevant legislation and regulations do not exist, the company must commit to apply responsible standards.

## **3. Organization, resources and documentation**

Organization of personnel, resources and documentation make for a sound HSE management system. Roles must be clearly defined from the beginning to the end of the project. Appropriate periodic training and review will enhance competence and effective performance.

## **4. Evaluation and risk management**

Procedures must be in place to identify on a regular basis the dangers and effects of the undertaking. This identification should apply to all the activities from the start to the decommissioning of the project. Environmental impact assessment study becomes a suitable criterion to gauge what is acceptable, particularly in the absence of appropriate legislative control.

## **5. Planning**

Environmental planning and compliance programmes should include ways and means of preventing or minimizing adverse impacts, as well as enhancing the beneficial impacts that may accrue. It is also imperative that internal standards and targets are set for compliance. A detailed decommissioning plan should be considered in the initial planning of the project, and a plan to restore the environment should be developed before the end of the project.

## 6. Implementation and monitoring

The purpose of monitoring is to ensure that the results forecast at the planning stage are being achieved, and where the contrary is the case, to identify the cause and take action to correct the situation. Managers must strictly adhere to legal and statutory requirements and controls as well as the company's own commitment to responsible management of the environment. Monitoring will indicate whether or not commitments and compliance with legal and corporate requirements are being met. It also provides the basis for audit.

## 7. Audit and review

This management tool enables the senior management to regularly assess its performance, effectiveness and suitability. It also provides an opportunity to obtain feedback on the effectiveness of the organization and its environmental performance. It is also useful in verifying compliance with monitoring programmes and ensuring that plans, procedures and standards are working effectively.

Other renowned national and international standards for best practice, particularly the ISO 9000 and 14000 series, also offer management systems models that can be used by companies to enhance their environmental performance.

### 4.5.2 International Conventions

The Kenya Constitution provides that the general rules of international law shall form part of the laws of Kenya, as shall any treaty or convention that she ratifies (Article 2). Kenya has ratified or subscribed to a number of international conventions that relate to the environment within her borders.

**Table 4.1: International conventions that Kenya has ratified.**

	Convention	Entry into force	Date of ratification
1.	African Convention for the Conservation of Nature and Natural Resources, Algiers, 1968 Parties must conserve their natural resources – soil, water, flora and fauna – ensuring that they are used and scientifically developed in a manner that will benefit their people.	16 June, 1969	12 May, 1969 (accession)
2.	African Convention on the Conservation of Natural Resources (Revised Version) Maputo, 2003 Parties must ensure that developmental and environmental needs are met in a sustainable, fair and equitable manner.	11 July, 2003	17 December, 2003 (signature)
3.	Convention on Wetlands of International Importance Especially as Waterfowl Habitat, Ramsar, 1971 It provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.	21 December, 1975	5 October, 1990
4.	Convention Concerning the Protection of the World Cultural and Natural Heritage, Paris, 1972 It establishes a system of collective protection of cultural and natural heritage of outstanding universal value.	17 December, 1975	1 July, 1983
5.	Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, 1973 It aims at ensuring that international trade in specimens of wild animals and plants does not threaten their survival.	1 July, 1975	13 March, 1979
6.	Convention on the Conservation of Migratory Species of Wild Animals, Bonn, 1979 It aims to protect those species of wild animals that migrate across or outside of national boundaries. Parties must protect them, conserve and restore their habitat, mitigate obstacles to migration and control other factors that might endanger them.	1 November, 1983	
7.	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, Basel, 1989 It aims at protecting human health and the environment against the adverse effects resulting from the generation, management, transboundary movements and disposal of hazardous wastes.	5 May, 1992	2000 (accession)
8.	Amendments to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, Geneva, 1995 The amendment prohibits exports of hazardous wastes destined for final disposal or recycling purposes from Annex VII countries to non-Annex VII countries (Annex VII	5 May, 1992	9 September, 2009 (acceptance)

	not yet in force).		
9.	United Nations Framework Convention on Climatic Change, New York, 1992 It sets an overall framework for intergovernmental efforts to tackle the challenge posed by climatic change, recognizing that the climate system can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases.	21 March, 1994	30 August, 1994
10.	Kyoto Protocol to the United Nations Framework Convention on Climate Change, Kyoto, 1997 It sets binding targets for 37 industrialized countries and the European Community as well as for countries undergoing the process of transition to a market economy in order to reduce greenhouse gas emissions.	16 February, 2005	2005 (accession)
11.	Convention on Biological Diversity, Rio de Janeiro, 1992 It aims at granting the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the use of genetic resources.	29 December, 1993	27 June, 1994
12.	Stockholm Convention on Persistent Organic Pollutants, Stockholm, 2001 It protects human health and the environment from chemicals that remain intact in the environment for long periods, become widely distributed geographically and accumulate in the fatty tissue of humans and wildlife. It requires Parties to take measures to eliminate or reduce the release of persistent organic pollutants into the environment.	17 May, 2001	24 September, 2004
13.	Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa, Bamako, 1991 It binds Parties to take appropriate legal, administrative and other measures within the area under their jurisdiction to prohibit the import of all hazardous wastes, for any reason, into Africa from non-Contracting Parties.	22 April, 1998	17 December, 2003 (signature)

#### 4.6 TULLOW OIL PLC POLICIES

(next two pages)

# Environmental, health and safety policy



At Tullow Oil, we are committed to high standards of Environment, Health and Safety (EHS) performance across our business.

Our goal is to preserve biodiversity and promote sustainable development by protecting people, minimising harm to the environment and reducing disruption to our neighbouring communities.

**We seek to achieve continual improvement in our EHS performance.**

**Tullow Oil has established an EHS management system to ensure that:**

- We plan and organise EHS efficiently and effectively.
- Safe places, safe systems of work and suitable procedures are provided and maintained.
- We minimise discharges, emissions and waste that adversely affect the environment.
- Staff and contractors are given appropriate EHS training to perform their tasks competently, safely and with due regard for the environment.
- Risks from our activities are assessed and either eliminated or reduced to acceptable levels.
- We comply with all applicable EHS laws and regulations, and apply responsible standards where the legislation is inadequate or non-existent.
- We are comprehensively prepared to respond effectively in the event of an emergency.
- We promote a culture of reporting and investigating accidents, incidents and near misses, and the sharing of lessons learned.
- We have an audit programme which verifies compliance with this policy and monitors our EHS performance.
- We are all empowered to stop any activity if there is an unacceptable risk of accident or environmental incident.

This EHS policy is reviewed periodically to ensure its ongoing suitability and effectiveness.

Whilst we provide a strong and visible leadership commitment to EHS, everyone in Tullow Oil has individual authority, responsibility and accountability for the safety of themselves and others, and an obligation to actively participate in promoting an effective EHS culture. We will regularly set and review our EHS objectives and targets with the aim of driving continual improvement in EHS knowledge and performance.

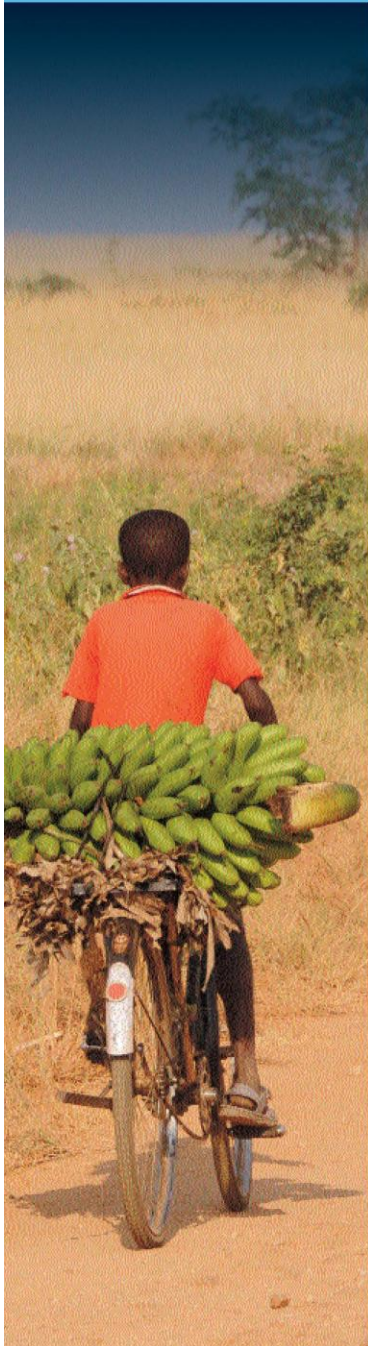
**Aidan J Heavey,**  
Chief Executive Officer, Tullow Oil plc  
May 2009



TO-EHS-POL-001-Rev7



# Corporate social responsibility policy



**Tullow Oil's policy is to conduct all our business operations to best industry standards and to behave in a socially responsible manner.**

**Our goal is to behave ethically and with integrity in the communities where we work, and to respect cultural, national and religious diversity.**

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**Directors, company personnel and contractors are responsible for ensuring compliance with this policy, and specifically to:**

- Respect the rights of all employees, treating them fairly and without discrimination
- Commit to providing opportunities for staff development
- Provide equal employment opportunities
- Recognise individual and team contributions
- Ensure compliance with Tullow's EHS policy by all personnel involved in our activities
- Provide clear direction on key CSR initiatives, policies, performance data and targets
- Actively engage with communities in areas where we operate
- Support selected social and community development projects
- Maintain high ethical standards and support transparency in our activities
- Encourage our partners and stakeholders to observe similar standards wherever possible

**Tullow is committed to continual improvement in all its standards and practices.**

A handwritten signature in black ink, reading "Aidan J Heavey".

**Aidan J Heavey,**  
Chief Executive Officer, Tullow Oil plc  
May 2009



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## **CHAPTER 5:**

### **BASELINE ENVIRONMENTAL AND SOCIAL PARAMETERS**

#### **5.1 INTRODUCTION**

##### **5.1.1 Project Location and Layout of the Chapter**

This chapter provides a description of the current environment and the socio-economic situation in the project area upon which the potential impacts of the proposed seismic survey may be assessed and future environmental changes monitored. It provides details of the desktop studies, field survey, and results from laboratory analyses of samples collected in the field, which are based on the methods applied as outlined in Chapter 3.

The project area, classified as Block 12A by NOCK, covers parts of Turkana East, East Pokot, Marakwet West, Baringo Central, Marigat, Keiyo South, Baringo North, and Mogotio Districts (Figure 5.2). It is bounded by latitudes ca.0.2°N and 2°N, longitudes ca.36.5°E and 36.6°E and covers an area of 15389.39 km<sup>2</sup>. In terms of its geological setting, it covers parts of the Kerio Basin, Baringo Basin and the Suguta Trough. These Tertiary age half-graben basins generally trend north-south.

The baseline draws from both primary and secondary data sources. Primary data sources involved the visit to the project area and undertaking a baseline survey, while secondary sources of data include various research and published literature including social and economic data from Government reports. It should be noted that some of the information in this chapter may be limited due to lack of previous research. Thus, for the data- and information-poor areas, TKBV should undertake monitoring programs with the relevant authorities to ensure compliance with the environmental guidelines (Table 5.1).

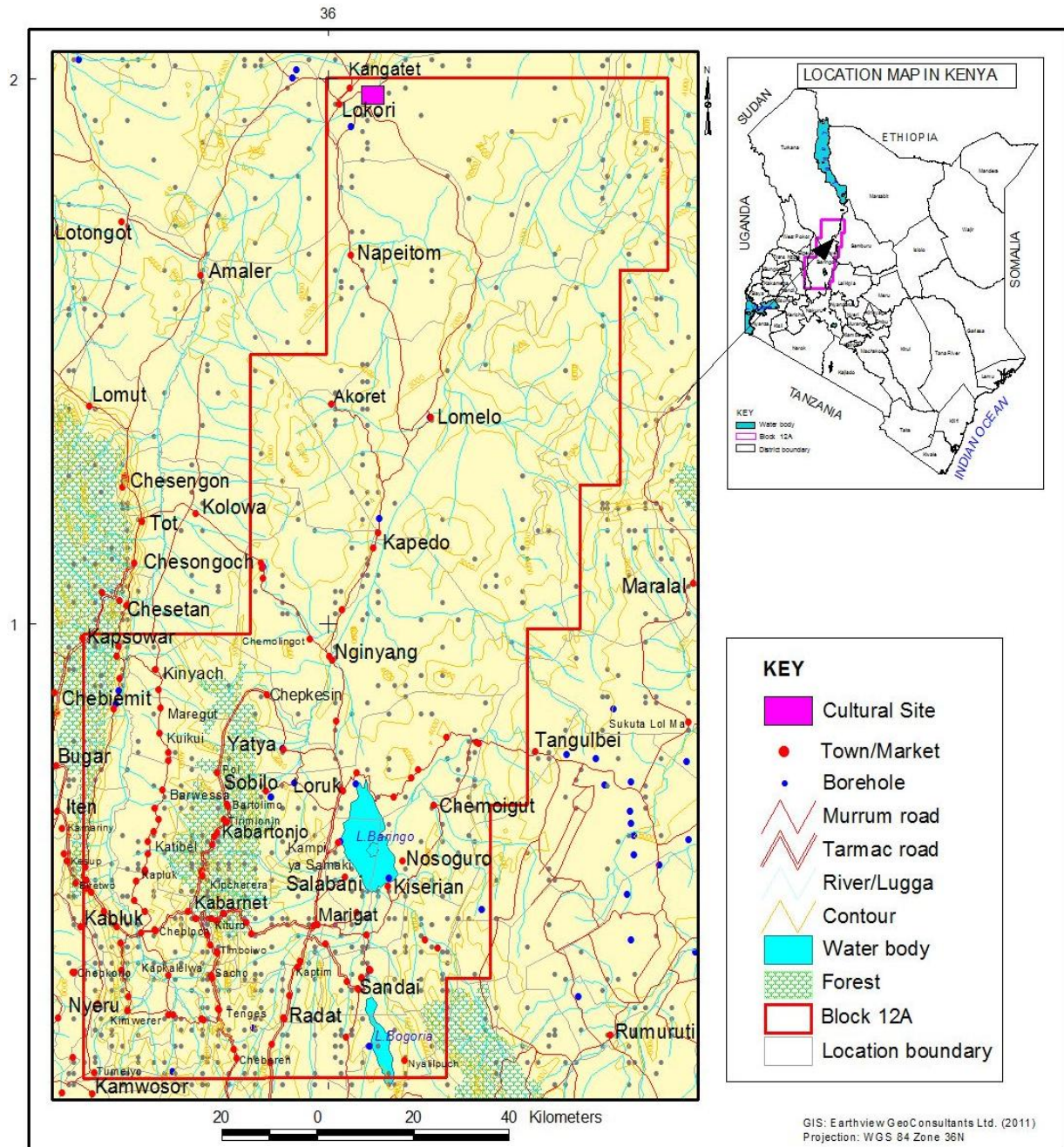


Figure 5.1: Location of the project area.



**Table 5.1: Chapter layout of the baseline environment which was covered in the EIA study.**

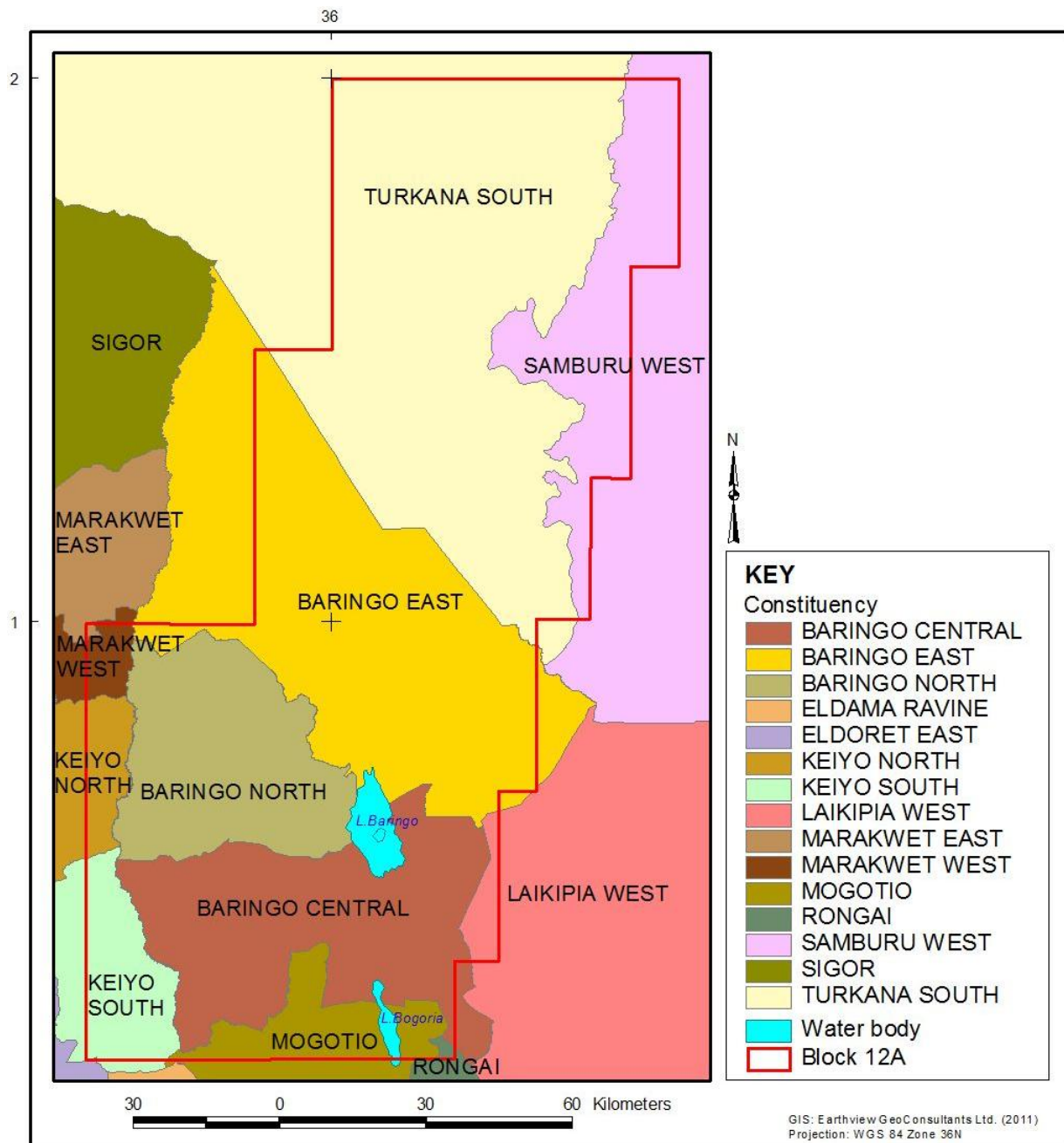
Major Sections in this Chapter	Issues Addressed
Introduction	<ul style="list-style-type: none"> <li>• Project Location and Layout of the Chapter(*)</li> <li>• Geographical Aspects and Boundaries(*)</li> <li>• Administrative setup (*)</li> <li>• Communications and transport (*)</li> <li>• Government, Non-Governmental and Community Based Organisations(*)</li> </ul>
Environmental baseline survey	<ul style="list-style-type: none"> <li>• Physiography and Geology</li> <li>• Soils</li> <li>• Climate(*)</li> <li>• Air Quality(*)</li> <li>• Surface and Groundwater Resources</li> <li>• Water Quality</li> <li>• Terrestrial Environment</li> <li>• Land Resources and National Parks</li> <li>• Archaeological, Historical and Cultural Sites(*)</li> <li>• Visual Aesthetics(*)</li> <li>• Noise and Vibrations(*)</li> <li>• Solid and Liquid Wastes(*)</li> </ul>
Environment-related Social and Economic baseline	<ul style="list-style-type: none"> <li>• Demography</li> <li>• Education</li> <li>• Housing</li> <li>• Energy sources</li> <li>• Land tenure systems</li> <li>• Labour force</li> <li>• Livestock and crop production</li> <li>• Trade, commerce and industry</li> <li>• Health settings</li> <li>• Security and public safety</li> <li>• Community views and concerns</li> <li>• Corporate Social Responsibility</li> </ul>

### 5.1.2 Geographical Aspects and Boundaries

The project area lies in parts of Turkana East, East Pokot, Marakwet West, Baringo Central, Marigat, Keiyo South, Baringo North, and Mogotio Districts, and a small section of Samburu District to the eastern side of Suguta Valley (Figure 1.1). It covers the central part of the Kenya Rift, and is bounded by latitude ca.0.2°N and 2°N and longitudes ca.36.5°E and 36.6°E. In the north, it is bounded by the impressive Suguta Valley and in the south by Lake Bogoria. The eastern and western boundaries are marked by the topographic highs of the fault-stepped rift shoulders.

### 5.1.3 Administrative Set-up

Block 12A covers a vast area that fully encompasses or partly straddles seven administrative districts. These include most parts of Turkana East, East Pokot, Marakwet West, Baringo Central, Marigat, Keiyo South, Baringo North, Mogotio, and Samburu Districts in the central to northern parts of Kenya. Several constituencies are found within the block (Figure 5.2 below).



**Figure 5.2: Administrative boundaries in the project area**

### 5.1.4 Communication and Transport

Transport and communication infrastructure within the project area is poorly developed in the north and well developed in the south. Most of the major roads that link district headquarters in the south are tarmac and well maintained. In the northern sector, the infrastructure is in a poor state, particularly the road network within Turkana East District, which is impassable during the rainy season (Plate 5.1).

Airstrips are available in almost all the major centers which include Lokori, Lomelo, Kapedo, Nginyang and Kabarnet. Telecommunication services are available in the southern part of the block but are unreliable and/or non-existent in the north.



**Plate 5.1: A washed away bridge in Nginyang and flooded earth road in Tanglubei respectively.**

### **5.1.5 Government, Non Governmental and Community-Based Organizations**

Several government agencies can be found within Block 12A as it has several district headquarters. The NGOs found within the project area deal with security, water, and nutrition among other needs, and mainly operate in the northern part of the block, which is arid. They include Action Aid International and World Vision among others.

## **5.2 ENVIRONMENTAL BASELINE SURVEY**

### **5.2.1 Physiography and Geology**

#### **5.2.1.1 Physiography**

The area is divisible into five main physiographic zones which are broadly coincident with the main tectonic elements of the rift, and these are:

- The inner trough
- The western margin
- The eastern margin
- Kerio and Baringo Basins in the south
- The Suguta Valley to the north

**The Inner Margin:** The inner trough of the rift is a NNE-trending zone of Quaternary volcanism and sedimentation, varying in width from between 35km in the south and 17km in the north, and is bounded to the west and the east by escarpments that are controlled by normal step faults. In the south of the area the trough is an asymmetrical graben structure, delimited on the west by the impressive escarpment of the Saimo fault system, and in the east by a series of smaller escarpments which step up to the Laikipia Plateau. The major faults die-out towards the north where the inner trough takes on the form of an asymmetrical valley bounded by escarpments that are mainly controlled by monoclinical faults (Figure 5.3). The floor of the trough has a marked northward gradient. Lake Baringo in the south of the area has an altitude of approximately 990m a.s.l. and from here the floor descends gradually towards the north, reaching an elevation of 270m a.s.l. Between Lake Baringo and Emuruangogolak the floor of the inner trough also has a marked westerly tilt. Thus, the Komol River which flows from east to west between Korosi and Paka, drops 300m across the floor of the trough. Similarly, the Amaya River falls 200m across the floor of the trough between Paka and Silali.



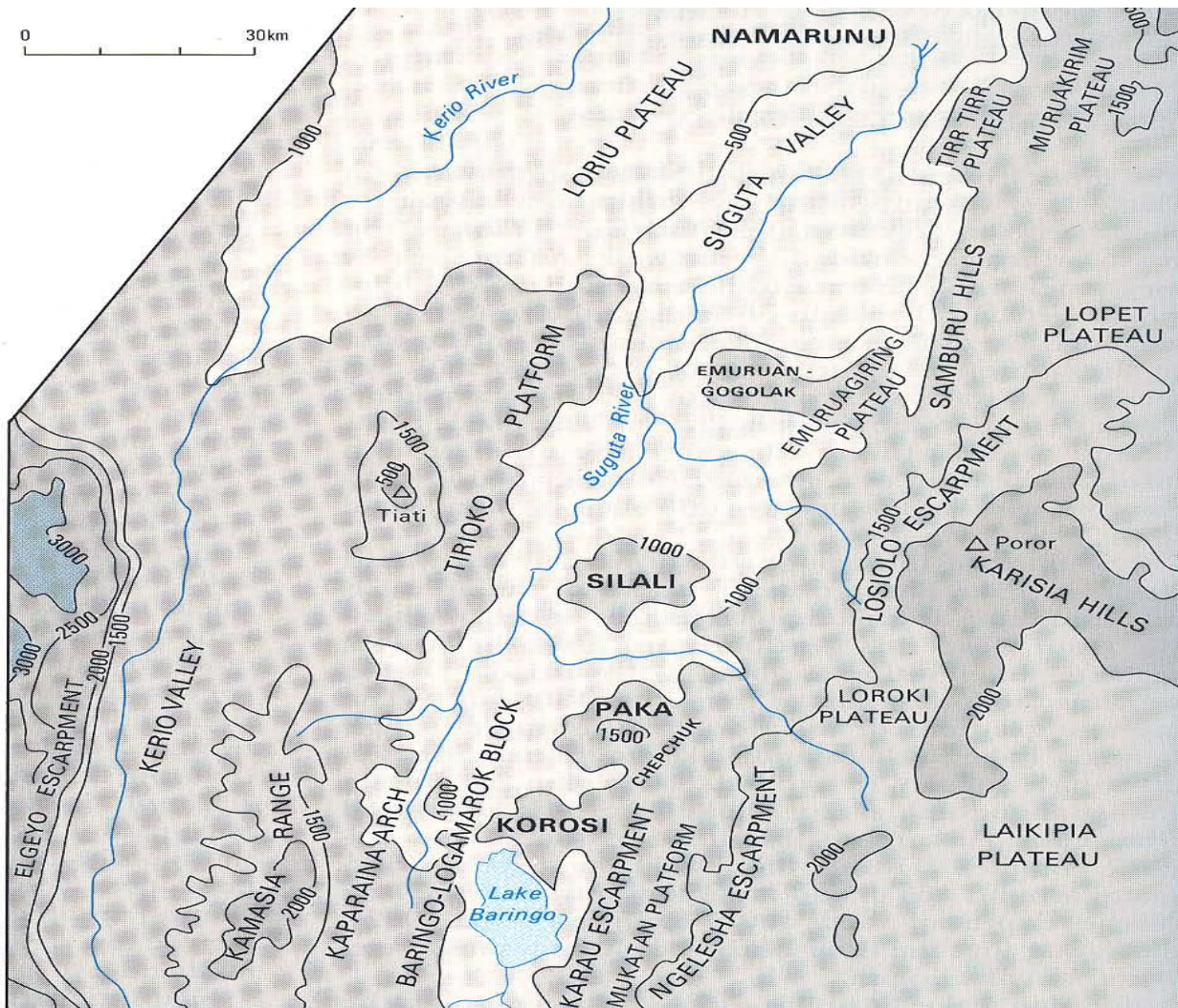


Figure 5.3: Simplified physiography map of the study area (modified from Hautot S. Smith, 2005).

**The Eastern Margin of the rift:** The eastern margin of the rift is mainly composed of neogene volcanic rocks that flank the margin of the Rift and are separated from the inner trough by a complex shoulder made up of a series of westerly facing escarpments controlled by a combination of steeply dipping step faults and west-facing monoclines.

In the south of the project area the trough is bounded along its eastern margin by a broad zone of step faulting approximately 20km wide in this part of the rift. Several major fault systems occurring within this zone are manifested by prominent west-facing escarpments. To the east of Lake Baringo and Korosi the boundary of the inner trough is delineated by the Karau-fault scarp, and approximately 10km further to the east a second fault system gives rise to the Ngelesha escarpment, the crest of which is more than a 1000m above the trough floor (Figure 5.3).

**The Western Margin of the Rift:** In the south of the area of study the rift has a double western margin controlled by the Elgeyo and Saimo faults, both of which give rise to impressive east-facing escarpments that expose metamorphic basement rocks in Kaptubei area that are overlain by Neogene phonolites and trachytes. The Elgeyo Escarpment forms the western margin of the rift system and rises to more than 200m above the floor of the Kerio Valley. This is a major graben structure parallel to the inner trough that is separated from the intervening westerly fault block of the Kamasia Range (Figure 5.3). The escarpment of the Kamasia Range rises approximately 1000m above the inner trough floor and is

controlled by the Saimo fault. Northwards the Elgeyo fault displays a rapid decrease in displacement, bifurcating and passing into the Kula fault which has got no topographical expression.

The Loru is underlain by Pliocene and Pleistocene lavas which form an extensive and gently undulating region extending northwards from the area of Pliocene shield volcanoes. The shoulder between the southern part of the Loru Plateau and the inner trough is represented by a series of easterly-facing fault scarps, but northwards these pass into a single large escarpment which is largely controlled by an easterly-facing monocline that has been locally modified by large-scale landslips. To the west of the rift shoulder the surface of the Plateau dips gently westwards down the Kerio River.

**Kerio and Baringo Basins:** Between the Equator and 1° latitude north, extension mechanisms occurred during Palaeogene time (Mugisha *et al.*, 1997; Hautot *et al.*, 2000), contemporaneous with rifting in Northern Kenya, Southern Sudan and Ethiopia (Morley *et al.*, 1992; Hendrie *et al.*, 1994). This resulted in the initiation of the two oldest deep rift basins of the Central Kenya Rift, the Kerio Basin to the west, and the Baringo Basin to the east (Plate 5.2 and Figure 5.3) (Tiercelin and Lezzar, 2002). Exposed lake- and fluvial-type sediments of possible Palaeogene age are green laminated shales and sandstones forming the Kimwarer and Kamego formations that outcrop in the Kerio and Baringo Basins, respectively (Renaut *et al.*, 1999; Hautot *et al.*, 2000) (Figure 5.4). These two formations represent the upper part of a several-km-thick sediment pile of possible Palaeogene age that is only illustrated by geophysical methods (Mugisha *et al.*, 1997; Hautot *et al.*, 2000). They lie at the base of a nearly entire rift-fill sequence (known as the Tugen Hills sequence) that is considered as one of the best exposed successions of Neogene sediments in the East African Rift System (e.g., Andrews and Banham (eds.), 1999). Thick basaltic and phonolitic series more or less extensively capped the Kerio and Baringo Basins (Samburu, Sidekh and Elgeyo Formations) between 23 and 10 Ma (Chapman and Brook, 1978; Hill *et al.*, 1986). During this period, fluvio-lacustrine sedimentation continued to develop in the Kerio Basin of Central Kenya, with the deposition of the 400-m-thick Tambach Formation dated between 16 and 14 Ma (Renaut *et al.*, 1999). The Tambach formation was in turn capped by the Uasin Gishu phonolites by 12 Ma (Lippard, 1973; Chapman and Brook, 1978), and was followed by a second phase of rift tectonics that affected the Kerio Basin, initiating the deposition of the Ngorora fluvio-lacustrine formation in an almost 100-km long and 40-km wide faulted basin (Tiercelin and Lezzar, 2002). The lower half of this thicker Ngorora Formation is only "geophysically" represented while the upper 400 m of sediments outcrop largely in the Tugen Hills region between the Kerio and Baringo Basins (Tiercelin and Lezzar, 2002).

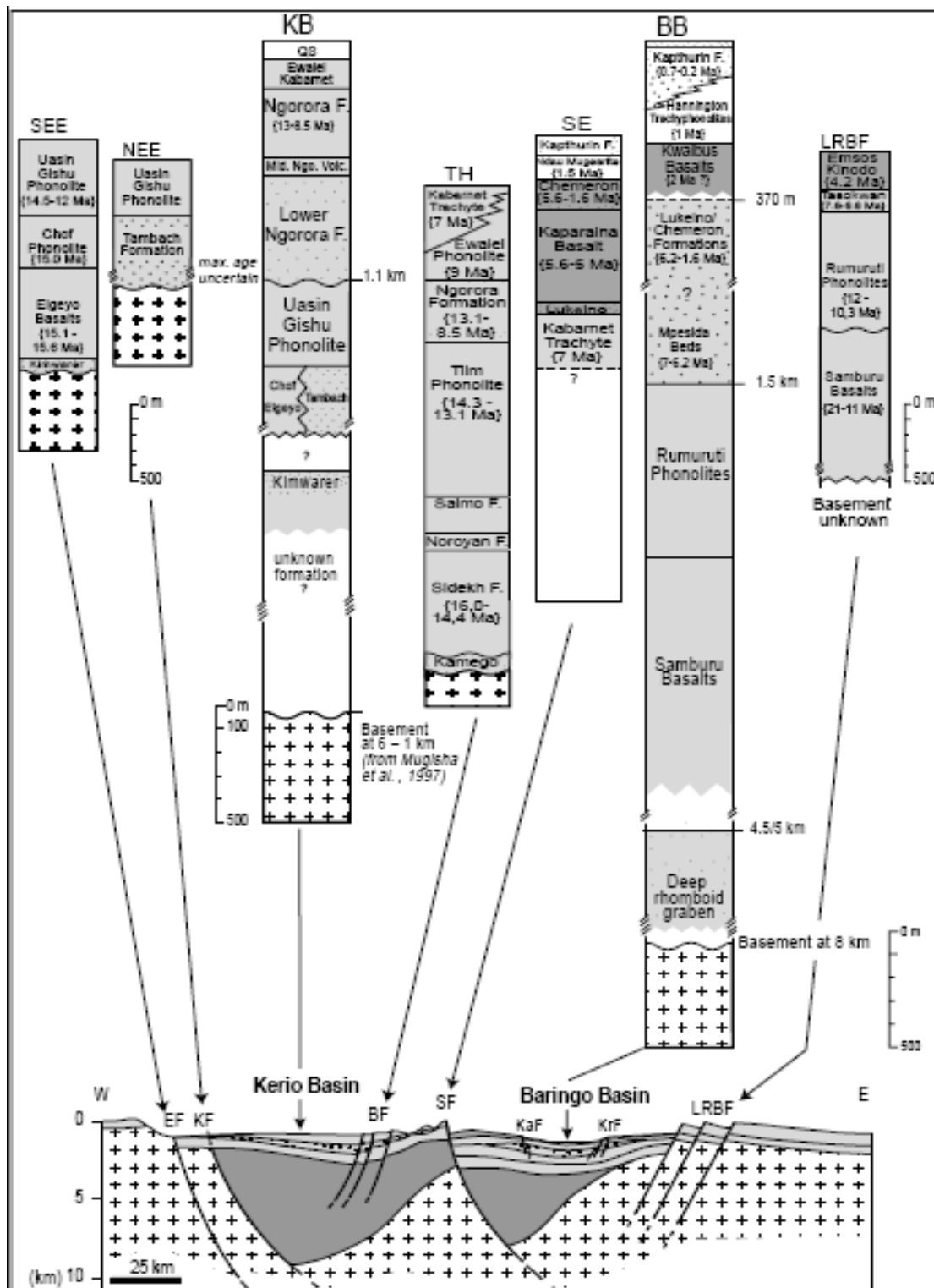


Figure 5.4: Structural cross-section through the Central Kenya Rift showing the deep structure of the Palaeogene Kerio and Baringo Basins, and general stratigraphy of the volcanic and sedimentary series filling these basins from Palaeogene to Recent (SEE, NEE: South and North Elgeyo Escarpment; KB: Kerio Basin; TH: Tugen Hills; SE: Saimo Escarpment; BB: Baringo Basin; EF: Elgeyo Fault; KF: Kerio Fault; BF: Barwesa Fault; SF: Saimo Fault; KaF: Kapthurin Fault; KrF: Karau Fault; LRBF: Laikipia Rift Border Fault (from Mugisha *et al.*, 1997; Hautot *et al.*, 2000; in Tiercelin and Lezzar, 2002).





**Plate 5.2: View of Kerio and Baringo Basins respectively.**

**Suguta Valley:** The Suguta Valley occupies the present axis of the Gregory Rift south of Lake Turkana. Since the Pliocene, faulting has been focused along a 35 km wide belt between the Ng'iro basement uplift and the Loru Plateau, producing an eastward thickening asymmetric basin (Plate 5.3).

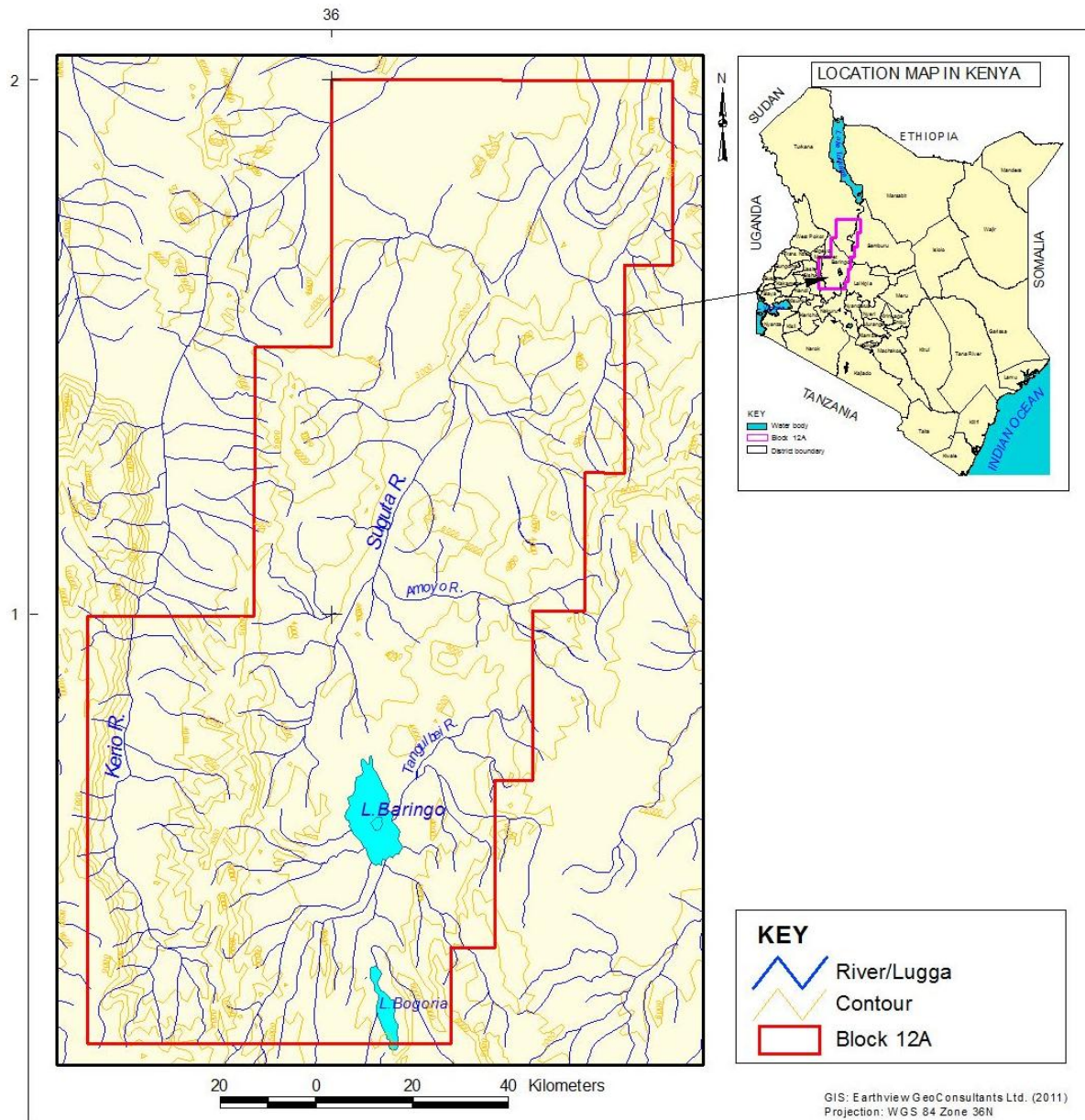
The oldest exposed volcanic rocks are basalts, tuffs and ashes dated 4.2–3.8 Ma. These were followed by a shift to trachytic volcanism, starting at about 3.8 Ma and continuing at least to 2.7–2.6 Ma. Feeder dykes to the trachytes strike NW–SE, suggesting a NE–SW least horizontal stress direction in the Early Pliocene. The trachytes were followed by a return to basaltic and alkali basaltic volcanism, which continues to the present. The structural evolution of the Suguta rift was similar to parts of the central and southern Gregory Rift, with early, broad basin development followed by constriction of deformation to an axial zone of grid faulting. This later structuring rotated flows and strata by as much as 35° in the past 3.8 Ma, or 9° per Ma. Rotational rates of this magnitude are extremely high in comparison to other continental rift settings.



**Plate 5.3: Section of Suguta Valley, photo taken from Kamuge area on the western side of the valley.**

Formation of the Suguta Basin also resulted in renewed uplift of the Ng'iro footwall and large-scale monoclinal flexuring of volcanic flows in the vicinity of the basin border faults. The intense basement structuring and accompanying footwall uplift led to the formation of large-scale land slips that carried large volumes of rock into the basin axis. Patterns of fluvial and deltaic sedimentation similarly reflect direct control by rift structures.

**Surface Hydrology:** Most of the rivers within the region are seasonal, except for the Suguta, Kerio, Molo, Pekerra, Endau, Mukutan and Waseges which flow throughout the year (Figure 5.5). Drainage in the project area is strongly controlled by the main structural elements of the region. The crest of the eastern shoulder of the rift acts as a watershed between rivers that flow westwards through steep gorges into the inner trough, and rivers with gentler profiles that drain the high Plateau areas and flow eastwards to the Ewaso Ng'iro which eventually discharges into the Indian Ocean.



**Figure 5.5: Drainage patterns in the study area.**

Within the inner trough there are two main drainage systems, namely the Lake Baringo catchment in the south and the Suguta in the north. Lake Baringo is fed by several rivers flowing from the south, south-east and west. The main feeder is the Molo which rises far to the south on the Mau escarpment but is joined by numerous tributaries flowing off the eastern flanks of the Kamasia range. The Pekerra and Endau also drain the Kamasia Range and flow into the west side of the Lake, whilst the Mukutan and Ol Arabel drain the Ngelesha Escarpment and flow into the south-east side. Lake Baringo has no surface outflow but is a fresh water lake, and therefore must have a significant sub-surface outflow. The waters of



Lake Baringo (970m, 22km long and up to 13km broad) are believed to egress at its northern end by subsurface seepage, to emerge at Kapedo Springs 110km to the north (McCall, 1967).



**Plate 5.4: Aerial view of part of Suguta Valley. Note the presence of diatomite at the foreground.**

The Suguta River is the main drainage system within the inner trough (Figure 5.5). It is strongly influenced by the north-westerly tilt of the inner trough floor and the location of the axial volcanoes. As a result, the overall directions of the drainage channels are located on the western side of the inner trough. The Suguta *sensu stricto* rises at Kapedo where it is fed by hot springs issuing from the base of the western flanks of the Silali. During wet periods it is joined from the south by the seasonal Nginyang River which is fed by various water courses draining the eastern and western shoulders of the rift and the volcanoes on the floor of the inner trough. The Nginyang and Suguta Rivers flow along the western side of the inner trough, but north of Emuruangogolak. Where there is no westerly tilt in the valley floor, the Suguta passes into a braided river system located along the axis of the trough. After passing through the narrowest part of the inner trough in the vicinity of Namarunu, the Suguta splits into a complex system of distributaries which feed a small group of highly saline and ephemeral lakes. Several hot spring systems also feed into this distributaries system.

The Kerio River has a closely spaced dendritic drainage network on its south-eastern side of the Loriu Plateau. However none of these tributaries join the Kerio River; rather, they disappear into an extensive flood plain incising older alluvium. This is most probably because of the present arid climate and also Quaternary tilting eastwards of the western Rift shoulder. The tilting has effectively removed the hydraulic gradient in the watercourses, and caused river capture of the upper parts of many streams by Suguta River directed drainages, (e.g. the Kamuge and Lomelo River Systems). The watershed ridge between the Kerio and Suguta River drainages is extremely narrow.

To the west, across the Laikipia Escarpment complex, the internal drainage shows many interesting features. There are four river systems flowing north-west into the rift - the Waseges-Sindai, the Ol Arabel, the Mukutan-Tangulbei system and the Amaya. Their courses exemplify the inability of geomorphic processes to keep pace with the volcano-tectonic evolution of the rift. The lower Waseges (Sindai) has incised a tortuous ravine between the Bechot and Waseges ranges (forming a ridge of Pleistocene trachyphonolite)

immediately above its entry into the Kisibor Swamp on the Laboi Plain. Waseges feeds Lake Bogoria to the north while Emsos to the south.

### **5.2.1.2 Geology**

#### **5.2.1.2.1 Geological Setting**

The region is characterized by four dominant geological formations which include:-

- Precambrian Basement system rocks referred to as the Mozambique Belt.
- Tertiary volcanic rocks.
- Quaternary volcanic rocks.
- Quaternary to Recent sediments.

The Mozambique Belt rocks underlie the western region in the Elgeyo Escarpment and the eastern side in Samburu area except within the Rift Valley which are completely covered by volcanic formations. The Mozambique Belt formation is found in the entire West Pokot District and most of Samburu District (Carney, 1972). These are the main mineral-bearing rocks in the region. Tertiary (to Quaternary) volcanic formations occur over a vast portion of the region. They stretch from the Lokori in a south–north direction. The volcanic activities associated with these rocks formed the Tugen Hills and the Keiyo escarpment. The geology of the rest of the region is characterized by the deposits of sediments originating from Quaternary to Recent period. These formations occur almost entirely over Turkana District except for limited areas around Lakes Baringo and Bogoria and on the upper Kerio valley. The sediments are basically lacustrine and fluviated deposits.

#### **5.2.1.2.2 Surface Geology**

This section describes the geology of the area and currently active geological processes (Table 5.2), focusing on those rock-types and geological processes and hazards that are of significance or relevance with respect to the proposed seismic survey operation in the project area, based on field evaluations (Figure 5.6).

Quartz-feldspar and biotite gneisses outcrop at Elgeyo Escarpment, Kito Pass, and Karamuk, where they form steep ridges and rugged topography (Plates 5.5 and 5.6). Biotite migmatites outcrop in Katwein and Takwata areas, forming part of the Elgeyo Escarpment with steep scarps and valleys (Plate 5.7). Trachyphonolites cover the south-eastern side of Lake Baringo as well as the south and south-western part of Lake Bogoria, and give rise to a much more rugged and steep sided topography than the surrounding country. The Baringo trachyte outcrops at Kapedo, Ainamoi, Kabarnet hills, and part of Tugen Escarpment, Tangelbei Hills, Nginyang and west of Kampi ya Samaki on Lake Baringo. It also forms Chemolingot Hill and Karuwen Hill, with clear layering (Plate 5.8). This formation extends south of Kapedo area. In some areas it is gullied and eroded and vertical exposures up to about 10m high can be observed (Plate 5.8). Basalts occur around Loru Plateau, Kabarnet Hills, Kabartonjo Scarps, Lokori and Tugen Escarpment. Olivine basalts tend to give rise to a much more rugged topography than other basalt types. In Lokori area, the rocks are highly jointed with the main structural form being columnar joints (Plate 5.9). Crystalline limestones outcrop within the Basement System rocks in Aror area, along the Elgeyo Escarpment (Plate 5.10). They are also found in Kapdei and Karamuk Hills west of Kerio Valley. In some areas they form small ridges and rough topography. Phonolites outcrop in Kubulwo area and give rise to some rugged topography. Volcaniclastic materials, such as agglomerates (Plate 5.11) and volcanic ash (Plate 5.12) are also common.

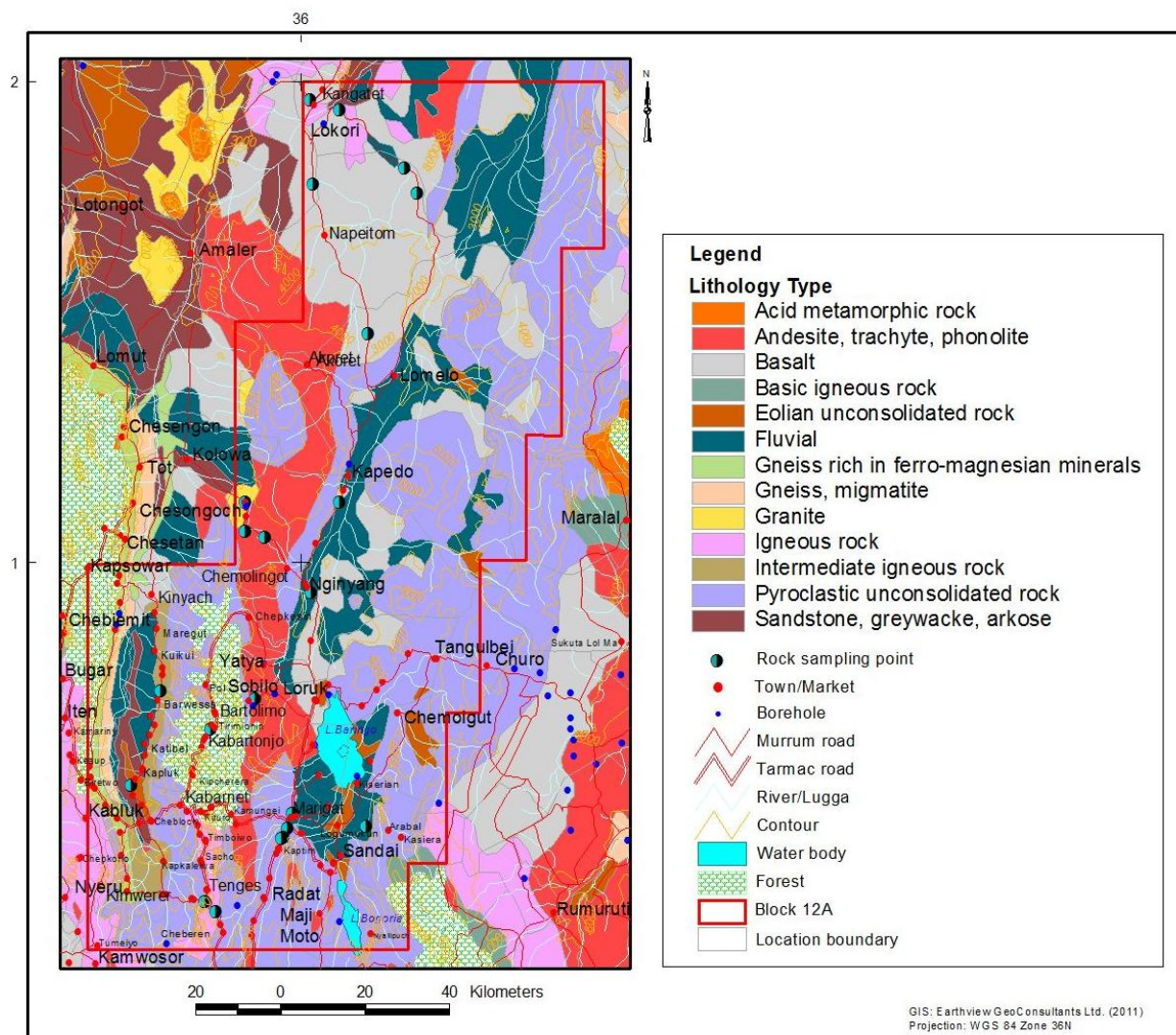


Figure 5.6: Geology of the area.



Plate 5.5: Biotite gneiss, Karamuk area.



Plate 5.6: Quartz feldspar gneiss, Kito Pass area.





**Plate 5.7: Migmatite outcrop, Katwein area.**



**Plate 5.8: Chemolingot trachyte exposure, Chemolingot area.**



**Plate 5.9: Basalt outcrop, Lokori area.**



**Plate 5.10: Crystalline limestone, Karamuk area.**



**Plate 5.11: Exposure of agglomerate, Kiserian area.**

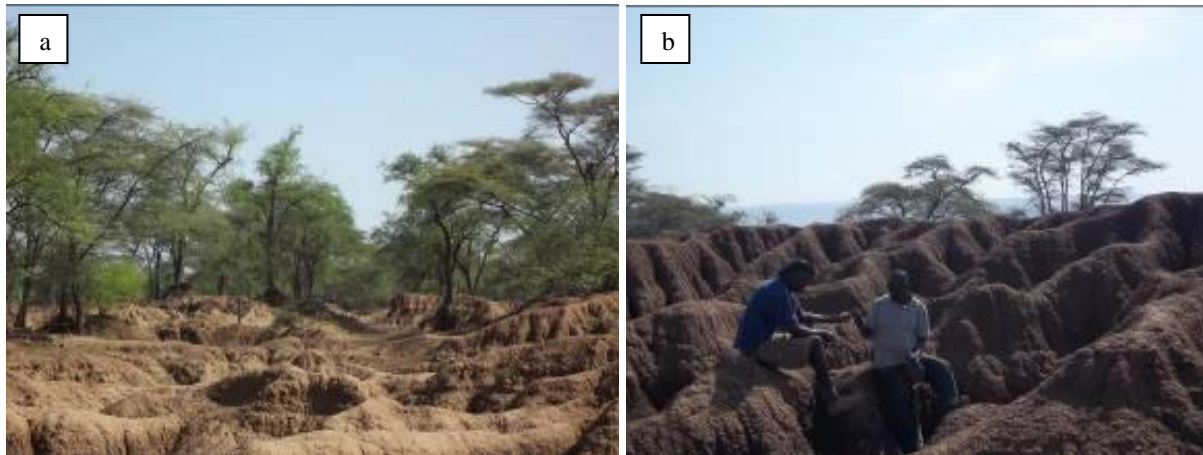


**Plate 5.12: Volcanic ash, Suguta Valley.**

Four large (>5 Richter Magnitude) earthquakes (two centred in the lake) have been recorded in the lake during the period 1900 to 2010. No major earthquake has been recorded since 1973.

**Table 5.2: Active geological processes observed during the field surveys that are significant for project logistics and EMP.**

Feature	Locality	Brief Description	Natural Hazards	Implications for the Project and EMP
Badlands	South of Ainamoi, within Kerio River floodplain (Plate 5.13)	The landscape is susceptible to gully erosion. Continuous erosion has caused the development of deep furrows and grooves leading to the formation of rugged topography	<ul style="list-style-type: none"> <li>• Minor land slips</li> </ul>	<ul style="list-style-type: none"> <li>• Irregular, rugged terrain will slow down vehicular movement</li> <li>• Cut lines may enhance gulleying and erosion</li> <li>• Difficult to manoeuvre vehicles, particularly when wet.</li> </ul>

**Plate 5.13 a & b: Developing badlands, south of Ainamoi Shopping Centre. Note the ruggedness of the surface.**

## 5.2.2 Soils

### Soil Mapping Units

Block 12A is a varied topography and a toposequence that constitute of mountains, hills, step-faulted scarps of the rift valley, uplands, plateaus and high level structural plains, step-faulted floor of the Rift Valley, foot slopes, and piedmont plains. Floodplains and lava flows are also present in the unit. These units have been described below. The soil classification process follows the FAO-UNESCO legend that accommodates the worlds' soils in order to overcome gaps in national classification systems and to provide a common basis for soil correlation. The identification of soils is based on the presence of diagnostic horizons and diagnostic properties which are defined by measurable morphological, physical and chemical criteria related to soil characteristics that are the result of soil formation. There are 26 soil units recognized by FAO-UNESCO legend of which Kenya has 23. The soil mapping unit description refers mainly to the characteristics of the subsoil, usually 'B' horizon, to a depth of 100cm (less if impenetrable material such as bedrock occurs at a shallower depth). Among the parameters described is: drainage condition, effective soil depth, colour (moist condition), mottling (if present), consistence (moist condition), calcareousness (if present), salinity, sodicity (if present), rockiness (if present), stoniness(if present), cracking (if present), texture, additional information on special topsoil or subsoil features, landform, geology, inclusions of other soils, etc. (Sombroek *et al*, 1982). For mapping units the first letter represents the landform while the second letter represents the geology of the unit. For example 'MP' would be read thus: 'M' represents Mountains and major scarps, while P would represent pyroclastics rocks. Thus the unit, from a geological point of view - within the mountain, would be described as 'soils developed on ashes and other pyroclastic rocks of recent volcanoes.



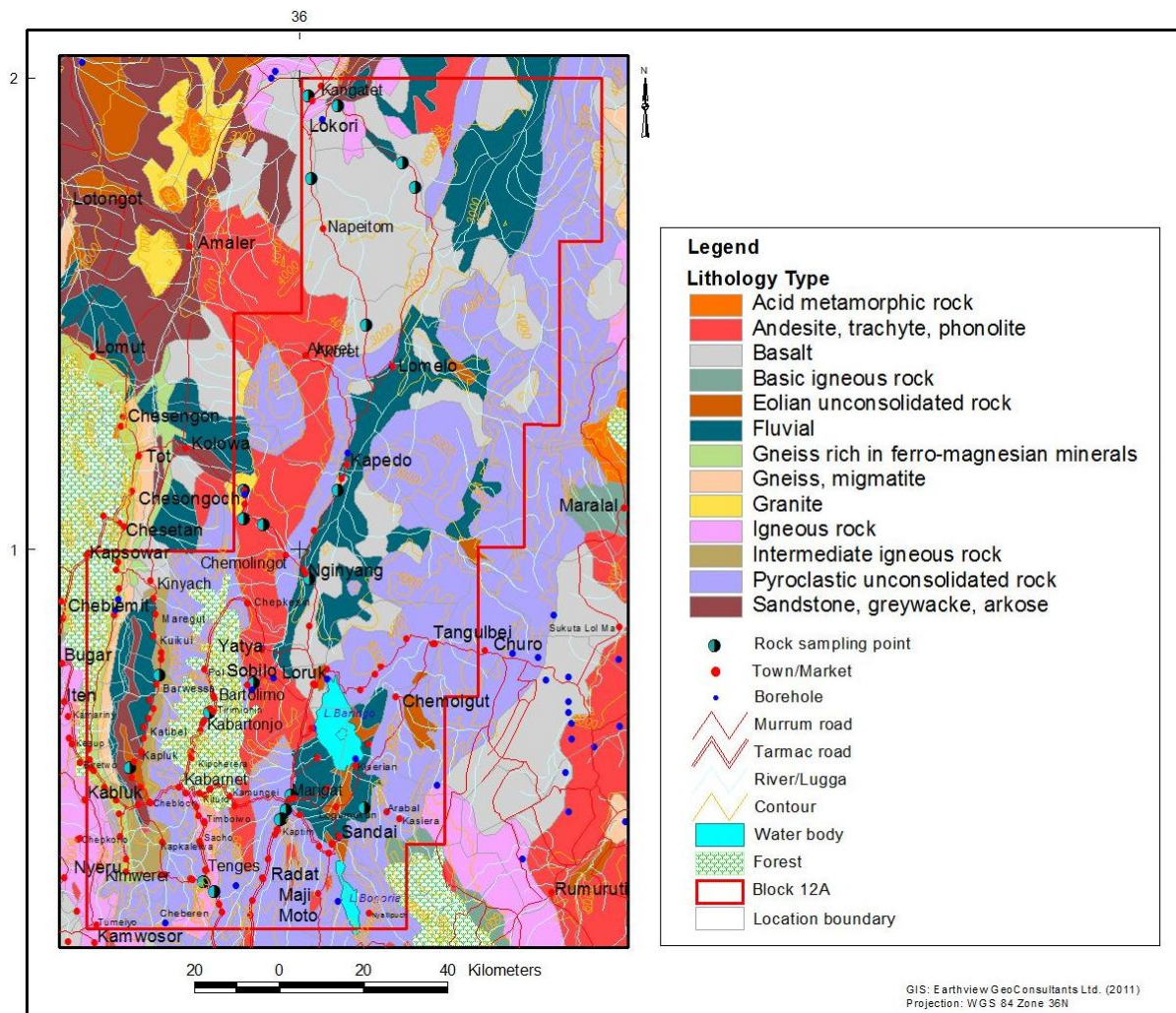


Figure 5.7: Soil Map of the study area and the sampling points.

### 5.2.2.2 Soil Mapping Units

The following soil mapping units are found within the study area and have been captured in Figure 5.7 and described below.

#### 1. Mapping Units M1, M6, M10 and H9 (Mountains and Hills)

The mountains are found west of Suguta valley and also in the south-west part of the study area. The hills are found towards the north and western part of the block 12A (Figure 5.7). The soils are a complex of well drained soils to somewhat excessively drained, ranging from shallow to deep, brown to dark reddish brown, friable to firm, in places rocky and bouldery gravely clay loam to sandy clay and in places saline and/or sodic and with inclusions of lava fields (Plate 5.14). They classify as Cambisols, Phaeozems and Leptosols (Sombroek et al. 1982).

#### 2. Mapping Units Hs1 and Ls1 (Step-faulted scarps of the Rift valley and step-faulted floor of the Rift Valley)

This unit is located to the south-east and central part of the study area. The unit is also found in the south of the study area. It surrounds both Lakes Baringo and Bogoria to the southern border of Block 12A. Hs1 unit forms part of the Suguta Valley landscape, bounding it on the eastern side and north-eastwards to the border (Figure 5.7). The soils

are well drained, shallow to moderately deep, reddish brown, friable to firm, in places stony and bouldery, clay loam to clay, in places calcareous and saline. Hs1 unit is dissected with shallow and broad interfluvial floors within the floors of the scarps. Ls1 unit supports human settlement, farming and grazing of livestock. The surface soils exhibit sealing and the unit is susceptible to erosive action due to resultant runoff after rains (Plate 5.14). The soils classify as Cambisols, Leptosols and Xerosols (Sombroek et al. 1982).

### **3. Mapping Units F8, F9 and F13 (Foot slopes)**

F8 unit is found in the north western part of the study area. F9 unit is found in the south-western part of the study area. The unit is also found around Chebloch to Kimwerer. F13 unit forms the foot slopes of M10 unit and is found in the south-eastern part of block 12A starting at Kapsowar to Kapluk (Figure 5.7). The soils are a complex of well drained to imperfectly drained, deep, dark reddish brown to dark greyish brown, friable to firm, in places saline and sodic, sand to sandy clay loam to clay; in many places with a humic topsoil and/or cracking and/or moderately calcareous and bouldery. They classify as Arenosols, Ferralsols, Luvisols, Phaeozems and Vertisols and Xerosols (Sombroek et al. 1982). The footslopes have narrow and shallow interfluvial floors that support vegetation. They also have sealing soils and severely eroded soils where deeply incised gullies have formed due to erosion. There are surface stones and rock outcrops in places.

### **4. Mapping Unit Ux7 (Uplands)**

This unit is found in the north-western part of the study area from Kangatet to Napeitom (Figure 5.7). The soils are well drained, shallow, dark brown, friable, strongly calcareous, moderately sodic, stony loam, with a stone surface. The soils classify as Regosols (Sombroek et al. 1982). The surface is stony and with rock outcrops. The surface soil exhibits sealing and crusting and gullies form where interfluvial floors cross access ways. There is ponding in depressions during the wet season and the unit is also susceptible to wind erosion with common dust storm incidences (Plate 5.15).

### **5. Mapping Units Y5, Y9 (Piedmont Plains)**

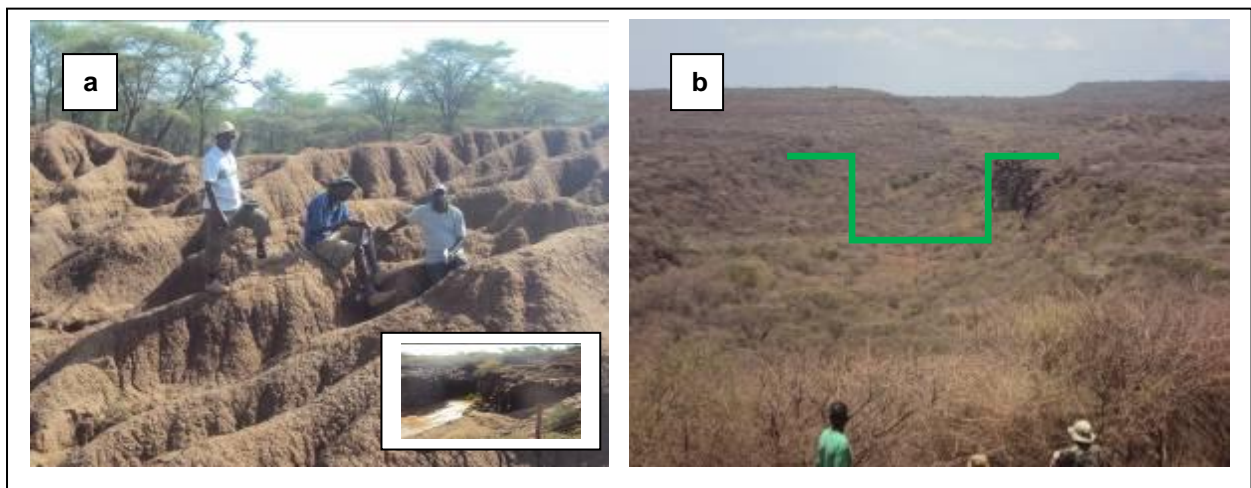
Y5 is found from the northern boundary and bounding the Suguta Valley on the eastern side past Kapedo to Loruk. The unit is also found to the north-east and south-west of Lake Baringo. Y9 unit is found in the south-western part of the study block from Arror to Chebloch (Figure 5.7). The soils are moderately well drained to well drained, deep to very deep, dark brown to greyish brown, friable to firm, calcareous, moderately to strongly saline and sodic, fine sandy loam to clay loam, in places with a stone surface. They classify as Cambisols and Solonchaks (Sombroek et al. 1982). Parts of the piedmont plains support human settlement and are grazed by livestock. Y5 unit is prone to surface ponding during the rains and is susceptible to periodic windblown erosion.

### **6. Mapping Units L6 and La (Plateaus /high level structural plains and Lava Flows)**

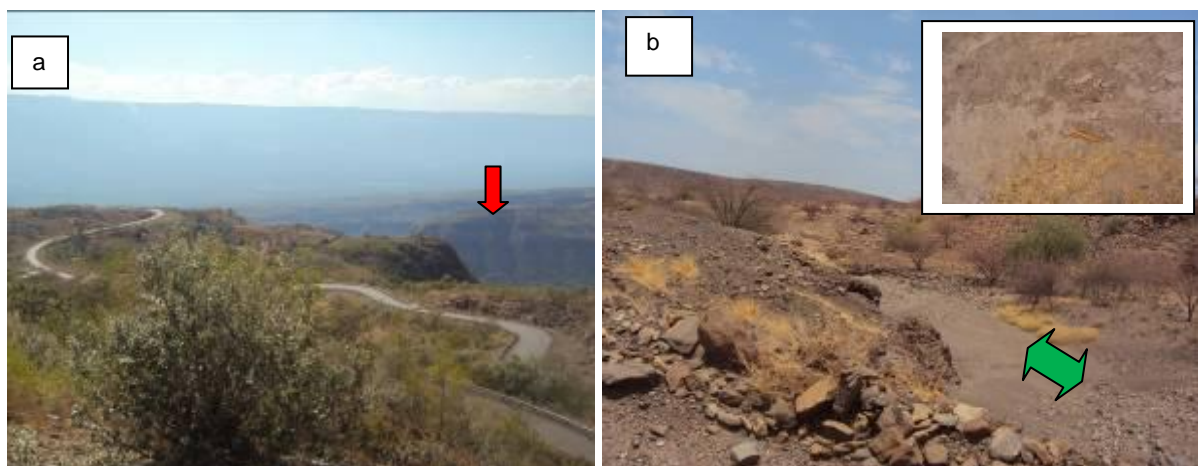
La unit is found to the north-eastern border of block 12A along the Suguta Valley. L6 unit is found in the east of Napeitom and bordering the Suguta Valley. The unit is also found in the east of Suguta Valley (Figure 5.7). La unit consists of scoria rocks and rock outcrops and very shallow sandy surface soils. L6 unit's soils are well drained, shallow to moderately deep, dark reddish brown, firm, strongly calcareous clay loam, with a stony to bouldery surface, partly saline and sodic. The soils classify as Xerosols (Sombroek et al. 1982). L6 surface consists of dark red sealing soils with rock outcrops and surface pebbles and stones that form extensive bare patches.

## 7. Mapping Units A4 and A8 (Floodplains)

A4 unit forms the Suguta River floodplain and is found in the north- eastern border of block 12A. The unit is also found in pockets around Lakes Baringo and Bogoria. A8 unit is found in the north-western border of the study area. It is also found to the south-west of the study block from Arror to Chebloch (Figure 5.7). The soils are well drained to poorly drained, very deep, dark brown to light olive brown, stratified, micaceous, strongly calcareous, saline and sodic in places, predominantly loamy to clay soils. They classify as Fluvisols and Solonchaks (Sombroek et al. 1982). The floodplains are susceptible to flooding and ponding. Irrigation farming is practiced in the A8 unit. The unit is extremely eroded forming into badlands at Chebloch (Plate 5.14), The road leading to the A4 unit has been cut off towards Suguta Valley due to soil erosion.



**Plate 5.14(a):** A8 unit at Chebloch that forms the Kerio River floodplain showing an extremely eroded surface that has become badlands and (inset) Chebloch Gorge within the unit and (b) Ls1 unit at Katuwit, Loruk showing the step faulted floor of the Rift Valley (green-step highlight) with dense vegetation.



**Plate 5.15(a):** M6 unit near Kabarnet showing winding road at the crest and major scarp (red arrow) and (b) Ux7 unit at Kamge-Lokori junction, showing dissected topography with deep interfluvial sandy soils (green arrow) and surface stones and rocks on slopes. Inset, surface sealing and crusting that enhances runoff along interfluvial.



### 5.3.1 Soil fertility sample results for selected agricultural schemes in the study area

#### Morlem Irrigation Scheme Lokwii. Lokori

The soils have medium alkaline pH which is generally unsuitable for crop growth. However with soil enhancement, the pH could be improved to suit most crops. Soil phosphorous, organic carbon and nitrogen are low in supply. However the macronutrients potassium and calcium are in adequate supply. Magnesium content is high which contributes to the saline nature of the soil. All the micronutrients are in adequate supply save for iron which is deficient (soil sample—WP 409K, Table 5.5). To improve the soil, soil organic matter should be raised by applying 5 tons/acre of well-decomposed manure or compost or 2 tons/acre of manure and 200kg/acre of elemental sulphur. However when sulphur is applied irrigation of the soils is necessary to leach out excess sulphur and unwanted by-products of the soil reaction. During planting, diammonium phosphate (DAP) should be applied at the rate of 120kg/acre to improve soil phosphorus.

#### Sample farm for rain-fed agriculture, Katupen, Kito Pass

The soils have medium alkaline pH which is generally unsuitable for crop growth. However with soil enhancement, the pH could be improved to suit most crops. Soil phosphorous, organic carbon and nitrogen are low in supply. However, the macronutrients potassium, calcium and magnesium are in adequate supply. All the micronutrients are in adequate supply (soil sample—WP 736, Table 5.5). To improve the soil, soil organic matter should be raised by applying 5 tons/acre of well-decomposed manure or compost. During planting diammonium phosphate (DAP) should be applied at the rate of 120kg/acre to improve soil phosphorous.

### 5.3.2 Soil fertility status of selected mapping units

#### Mapping Unit A4

The soil pH is slight alkaline to extreme alkaline which is generally unsuitable for growing crops. Nitrogen, organic carbon, and phosphorous nutrients are deficient. Soil potassium and magnesium varies from low to high in supply while soil calcium is adequate to high. The micronutrients manganese and copper are adequately supplied into the soil while iron and zinc are deficient to adequately supplied. Sodium is high in supply making the unit sodic (soil sample—WP 499K, WP 686, WP 698 and WP 894; Table 5.5).

#### Mapping Unit A8

The soil pH is slight alkaline to medium alkaline which is generally unsuitable for growing crops, save for plants that are salt tolerant. Nitrogen and organic carbon nutrients are deficient, while phosphorous is adequate in supply. Calcium and potassium are adequately supplied into the soil while soil magnesium is highly supplied. The micronutrients magnesium, copper and sodium are adequately supplied while iron and zinc are deficient to adequate in supply. (Soil sample—WP 509K, WP 823; Table 5.5).

#### Mapping Unit Y5

The soil pH is medium alkaline to extreme alkaline which is generally unsuitable for growing crops. Nitrogen, organic carbon, iron and phosphorous nutrients are deficient. Calcium and potassium are adequate to highly supplied into the soil while soil magnesium is low to high in supply. All the micronutrients are adequately supplied into the soil save for iron which is deficient and sodium which is adequate to high in supply (soil sample—WP 691, WP 700, WP 701; Table 5.5).

Mapping Unit F8

The soil pH is medium alkaline which is generally unsuitable for growing crops, save for plants that are salt tolerant. Nitrogen, organic carbon, iron and phosphorous nutrients are deficient. Soil calcium, potassium and magnesium are all in high supply making the unit saline. All the micronutrients are adequately supplied into the soil save for iron which is deficient (soil sample—WP 684; Table 5.5).

Mapping Unit F9

The soil pH is medium acid to slight acid which is generally suitable for crop growing with a bit of amelioration. Nitrogen and organic carbon nutrients are deficient while phosphorous is deficient to adequate in supply. Calcium and potassium are adequately supplied into the soil while soil magnesium is adequate to high in supply. The micronutrients sodium, iron and manganese are adequately supplied into the soil while zinc is deficient to adequately supplied. However the micronutrient copper, is deficient (soil sample—WP 822, WP 885; Table 5.5).

The Foot slopes F13

The soil pH is slight acid which is generally suitable for growing crops. Nitrogen and organic carbon nutrients are deficient while phosphorous is high in supply. Soil magnesium is high in supply while calcium and potassium are in adequate supply. The micronutrients manganese, iron and sodium are adequately supplied into the soil. However, zinc and copper are deficient. (Soil sample—WP 828; Table 5.5).

Mapping Unit L6

The soil pH is medium acid which is generally suitable for crop-growing with some amelioration. Nitrogen and organic carbon nutrients are deficient while phosphorous is adequately supplied. Soil potassium and calcium are adequately supplied while magnesium is high in supply. All the micronutrients are adequately supplied into the soil save for iron which is deficient (soil sample—WP 839K; Table 5.5).

Mapping Unit Ls1

The soil pH is medium alkaline which is generally unsuitable for growing crops, save for plants that are salt tolerant. Nitrogen, organic carbon, and phosphorous nutrients are deficient. Soil calcium and potassium are adequate in supply while magnesium is in high supply. All the micronutrients are adequately supplied into the soil save for zinc which is deficient (soil sample—WP 755; Table 5.5).

Mapping Unit Hs1

The soil pH is medium alkaline which is generally unsuitable for crop-growing, save for plants that are salt tolerant. Nitrogen, organic carbon, and phosphorous nutrients are deficient. Soil calcium and potassium are adequate in supply while magnesium is in high supply. All the micronutrients are adequately supplied into the soil save for iron which is deficient (soil sample—WP 692; Table 5.5).

Mapping Unit H9

The soil pH is medium alkaline which is generally unsuitable for growing crops, save for plants that are salt tolerant. Nitrogen, organic carbon, and phosphorous nutrients are

deficient. Soil calcium, potassium and magnesium are all in adequate supply. All the micronutrients are adequately supplied into the soil (soil sample—WP 736; Table 5.5).

**Table 5.5 Soil sample results for selected sites in the study area**

	<b>Soil Analytical Data</b>					
Field	<b>WP 684 Lokori</b>		<b>WP 686 Lomomug</b>		<b>WP 691 Naroo</b>	
Sample designation	<b>12A-SL 001</b>		<b>12A-SLK 002</b>		<b>12A-SN 003</b>	
Lab. No/2011	1616		1617		1618	
Fertility results	value	class	value	class	value	class
Soil pH	8.26	Medium alkaline	8.16	medium alkaline	8.39	Medium alkaline
Total Nitrogen %	0.08	low	0.06	low	0.06	low
Org. Carbon %	0.42	low	0.22	low	0.30	low
Phosphorus ppm	2.9	low	3.3	low	1.2	low
Potassium me%	1.96	high	1.00	adequate	0.68	adequate
Calcium me%	20.0	high	8.0	adequate	8.0	adequate
Magnesium me%	5.44	high	5.22	high	4.49	high
Manganese me%	0.45	adequate	0.65	adequate	0.72	adequate
Copper ppm	3.4	adequate	4.4	adequate	4.1	adequate
Iron ppm	0.80	low	2.13	low	1.87	low
Zinc ppm	22.9	adequate	61.8	adequate	73.7	adequate
Sodium me%	1.87	adequate	0.79	adequate	0.77	adequate
Elect. Cond. mS/cm	1.12	adequate	0.21	adequate	0.14	adequate

	<b>Soil Analytical Data</b>							
Field	<b>WP 692 Kapetakinei</b>		<b>WP 499K Suguta Valley</b>		<b>WP 509K Morlem-Lokwii</b>		<b>WP 698 Lomelo</b>	
Sample designation	<b>12A-SPK 004</b>		<b>12A-SS 005</b>		<b>12A-SML 005</b>		<b>12A-SSL 006</b>	
Lab. No/2011	1619		1620		1621		1622	
Fertility results	value	class	value	class	value	class	value	class
Soil pH	8.40	medium alkaline	10.1	extreme alkaline	8.36	medium alkaline	7.56	medium alkaline
Total Nitrogen %	0.07	low	0.08	low	0.06	low	0.07	low
Org. Carbon %	0.28	low	0.35	low	0.26	low	0.41	low
Phosphorus ppm	1.8	low	7.6	low	6.7	low	10.7	adequate
Potassium me%	0.54	adequate	0.18	low	1.20	adequate	2.00	high
Calcium me%	11.0	adequate	34.5	high	13.0	adequate	22.0	high
Magnesium me%	3.95	high	0.30	low	5.55	high	4.95	high
Manganese me%	0.33	adequate	0.33	adequate	0.88	adequate	1.14	adequate
Copper ppm	3.6	adequate	3.6	adequate	5.5	adequate	3.8	adequate
Iron ppm	N/D*	low	N/D*	low	3.00	low	5.77	low
Zinc ppm	6.60	adequate	2.10	low	68.3	adequate	40.9	adequate
Sodium me%	1.25	adequate	3.39	high	1.41	adequate	1.99	adequate
Elect. Cond. mS/cm	0.30	adequate	8.47	high	0.42	adequate	0.50	adequate

Soil Analytical Data								
Field	WP 700 Kamusing		WP 701 Ngirusio-Kapedo		WP 736 Katupen		WP 755 Maratuko-Loruk	
Sample designation	12A-SKK 007		12A-SNK 008		12A-SK 009		12A-SML 010	
Lab. No/2011	1623		1624		1625		1626	
Fertility results	value	class	value	class	value	class	value	class
Soil pH	7.55	medium alkaline	10.3	extreme alkaline	8.07	medium alkaline	7.87	medium alkaline
Total Nitrogen %	0.07	low	0.06	low	0.09	low	0.06	low
Org. Carbon %	0.33	low	0.21	low	0.59	low	0.31	low
Phosphorus ppm	8.6	low	6.6	low	17.2	low	2.4	low
Potassium me%	2.04	high	1.52	high	0.76	adequate	0.44	adequate
Calcium me%	20.8	high	35.7	high	4.9	adequate	3.6	adequate
Magnesium me%	0.17	low	1.55	adequate	1.09	adequate	6.14	high
Manganese me%	1.26	adequate	0.64	adequate	0.89	adequate	0.61	adequate
Copper ppm	4.20	adequate	3.70	adequate	4.90	adequate	0.43	adequate
Iron ppm	4.77	low	N/D*	low	26.9	adequate	38.9	adequate
Zinc ppm	100	adequate	5.70	adequate	38.8	adequate	N/D*	low
Sodium me%	2.03	high	3.51	high	0.47	adequate	0.44	adequate
Elect. Cond. mS/cm	0.38	adequate	19.3	high	0.29	adequate	0.14	adequate

Soil Analytical Data								
Field	WP 822 Kapkelewa		WP 823 Chebloch (KRFP)		WP 828 Kapchakwel		WP 839K Kinyach	
Sample designation	12A-SKK 011		12A-SRKC 012		12A-SKK 013		12A-SKB 014	
Lab. No/2011	1627		1628		1629		1630	
Fertility results	value	class	value	class	value	class	value	class
Soil pH	5.16	medium acid	6.37	slight acid	6.60	slight acid	5.40	medium acid
Total Nitrogen %	0.06	low	0.10	low	0.06	low	0.06	low
Org. Carbon %	0.31	low	0.68	low	0.32	low	0.33	low
Phosphorus ppm	23	low	87	adequate	230	high	22	adequate
Potassium me%	0.72	adequate	1.17	adequate	0.68	adequate	0.60	adequate
Calcium me%	2.6	adequate	12.0	adequate	2.8	adequate	2.4	adequate
Magnesium me%	1.17	adequate	5.22	high	3.25	high	1.72	adequate
Manganese me%	1.53	adequate	1.49	adequate	0.58	adequate	1.21	adequate
Copper ppm	0.32	low	1.09	adequate	0.69	low	0.31	low
Iron ppm	32.8	adequate	186	adequate	51.3	adequate	23.4	adequate
Zinc ppm	0.88	low	2.74	low	N/D*	low	N/D*	low
Sodium me%	0.14	adequate	1.14	adequate	0.14	adequate	0.12	adequate

	Soil Analytical Data			
Field	WP 885 Machukwo-Kapluk		WP 894 Logumukum	
Sample designation	12A-SKT 015		12A-SLE 018	
Lab. No/2011	1631		1632	
Fertility results	value	class	value	class
Soil pH	6.70	slight acid	7.27	slight alkaline
Total Nitrogen %	0.14	low	0.08	low
Org. Carbon %	1.05	low	0.40	low
Phosphorus ppm	39	adequate	7.5	low
Potassium me%	1.80	high	0.54	adequate
Calcium me%	6.0	adequate	8.2	adequate
Magnesium me%	3.95	high	5.47	high
Manganese me%	1.90	adequate	0.87	adequate
Copper ppm	0.40	low	2.32	adequate
Iron ppm	39.8	adequate	61.3	adequate
Zinc ppm	11.4	adequate	N/D*	low
Sodium me%	0.20	adequate	0.88	adequate
Elect. Cond. mS/cm			0.23	adequate

### 5.2.3 Climate

In the northern part of the Block 12A area is the Suguta Valley which constitutes the most arid environment in Kenya (Ojany and Ogendo, 1973) and probably represents the most arid place on planet Earth located in the immediate vicinity of the Equator (Garcin et al., 2009). Exact data on climate conditions are not available due to its remote location. However, limited available data document rainfall  $<300 \text{ mm yr}^{-1}$ , which is distributed following a unimodal cycle, with a peak between May and July (East African Meteorological Department, 1975). Mean annual temperature ranges between 28 and 31°C, and mean annual evaporation ranges between 3000 and 4000 mm yr<sup>-1</sup> (Dunkley et al., 1993).

In the Baringo-Bogoria basin, precipitation ranges from about 700 mm on the Lobo Plain to 1200 mm on the adjacent highlands, with most of the rain falling in and around April and November (Owen et al., 2004). Potential evaporation is  $>2500 \text{ mm}$ , producing a budget deficit and semi-arid conditions over most of the lower parts of the Bogoria Basin. El Nino years are correlated with increased rainfall (LaVigne and Ashley, 2002), and flooding around the shores of Lake Bogoria (Owen et al., 2004).

### 5.2.4 Air Quality

The study area is largely rural and sparsely populated in the north, but more densely populated and agricultural in the south. Much of the area is arid to semi-arid except in the south which is sub-humid. Given the loose, often fine grained and unconsolidated Quaternary to Recent sub-aerial sediments and the occasionally strong winds and sparse vegetation, air-borne particulate matter is continuously transported from one area to another. This is the significant contributor of particulate air pollution in the area.

Minimal and transient air pollution is also as a result of the few vehicles traversing the project area and raising dust as well as releasing exhaust fumes. In addition, herds of grazing animals contribute to a substantial amount of particulate air pollution as they raise dust in the course of movement from one point to another.

## 5.2.5 Surface and Groundwater Resources

### 5.2.5.1 Surface Water Resources

Water resources contribute enormously to economic productivity and the social well-being of the human and livestock populace. The water resources are categorised as follows:

- Surface water resources
- Groundwater resources

Water is one of the natural resources the area is endowed with especially in the sub-humid southern part of the study area. While this is true, the western region of Sibilio area experiences scarcity of water due to lack of sufficient water and low precipitation in the area. The surface water in the area (Sibilio and Yatia) comes from Sibilio River which is a seasonal river and only floods its channel during the rainy seasons. Even during the most severe droughts, the locals always seem to manage to water their stock, so that they hardly ever lose any of their animals through lack of water; but persistent long droughts sometimes decimate their livestock.

The surface water sources are confined to five drainage basins as follows:-

- Lakes Bogoria and Baringo basin with approximate area of 4,835km<sup>2</sup> and have rivers Perkerra, Molo, Waseges and Rongai with a total discharge of 237 million cubic metres annually.
- Suguta River catchment with an area of 12,900km<sup>2</sup> lies between Kerio River Basin to the west and Ewaso Nyiro River Basin to the east. While there is perennial flow in the upper Suguta River (Plate 5.16a), it is highly saline except during periods of heavy rains.
- Kerio River Basin covering 17,800 km<sup>2</sup>, with the rivers Kerio, Aror and Embobut. The annual discharge is 331 million cubic metres.

Perennial supplies of surface water are confined to the southern region of the Block and its western counterpart. Perkerra, Molo, Waseges, Kerio, Aror and Ebobut are permanent rivers and the locals benefit from their waters throughout the year (Figure 5.8). Their presence in the area has contributed to the agricultural activities through various irrigation schemes such as Perkerra Irrigation Scheme, Lakubai Irrigation Scheme and Morulem Irrigation Scheme. Whereas these rivers are perennial, their tributaries are seasonal and dry up during the dry seasons.

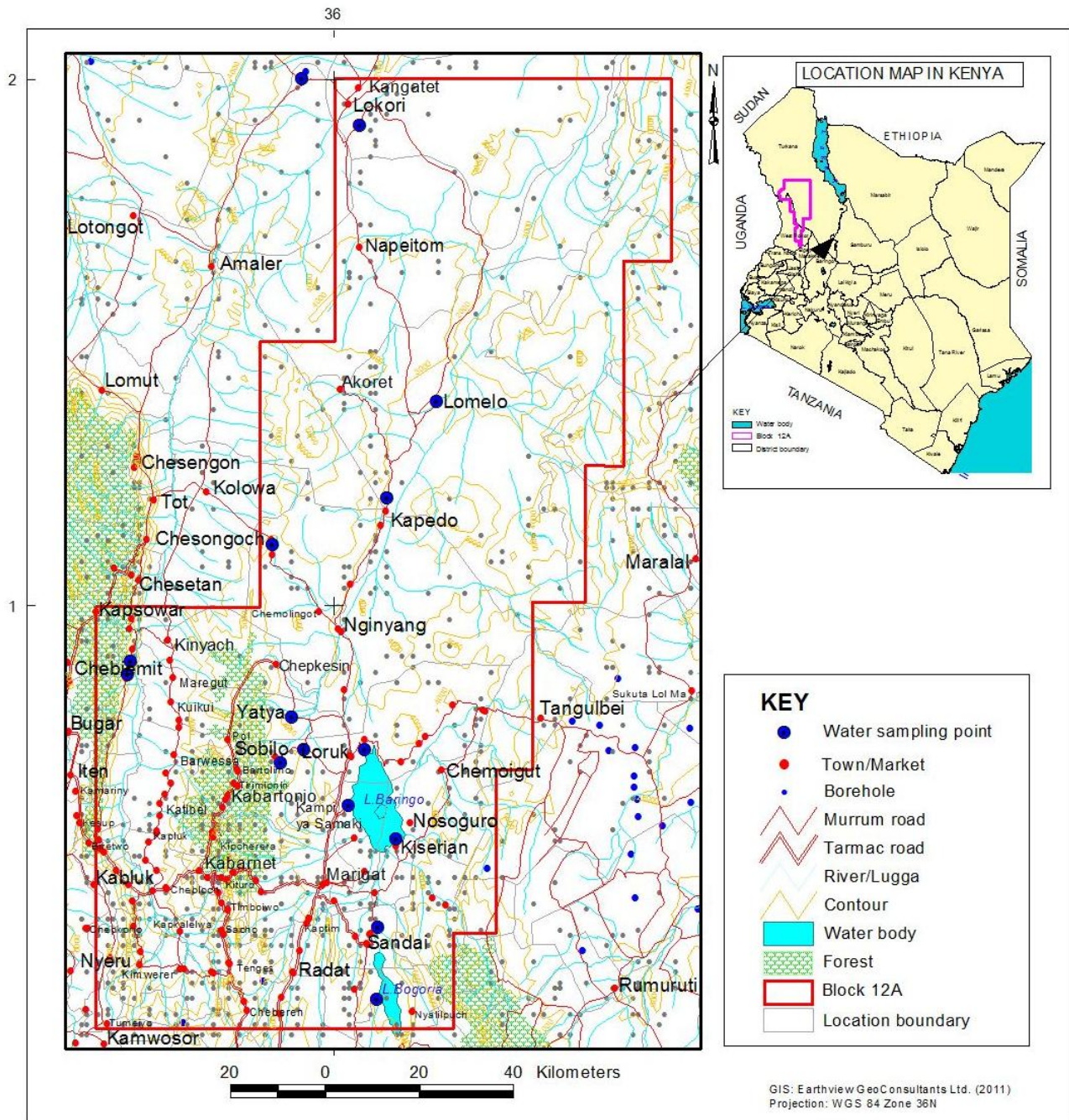
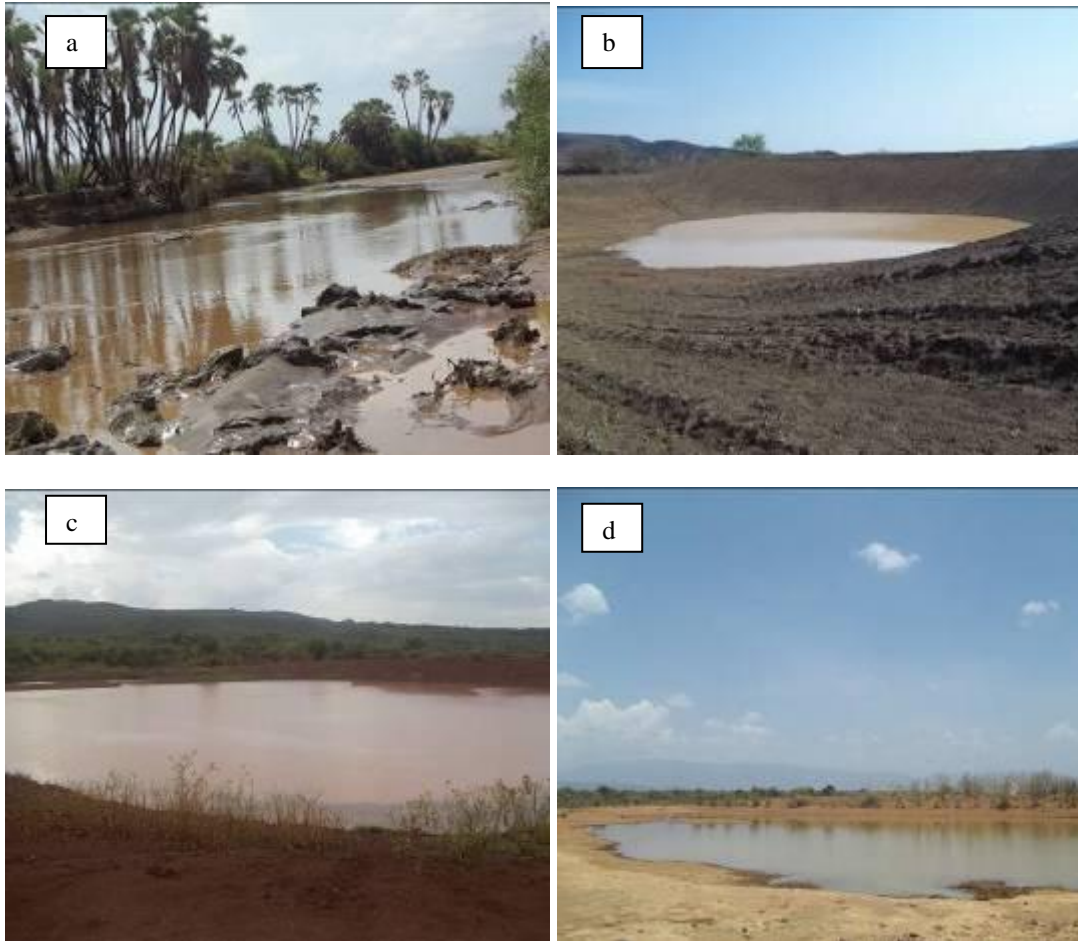
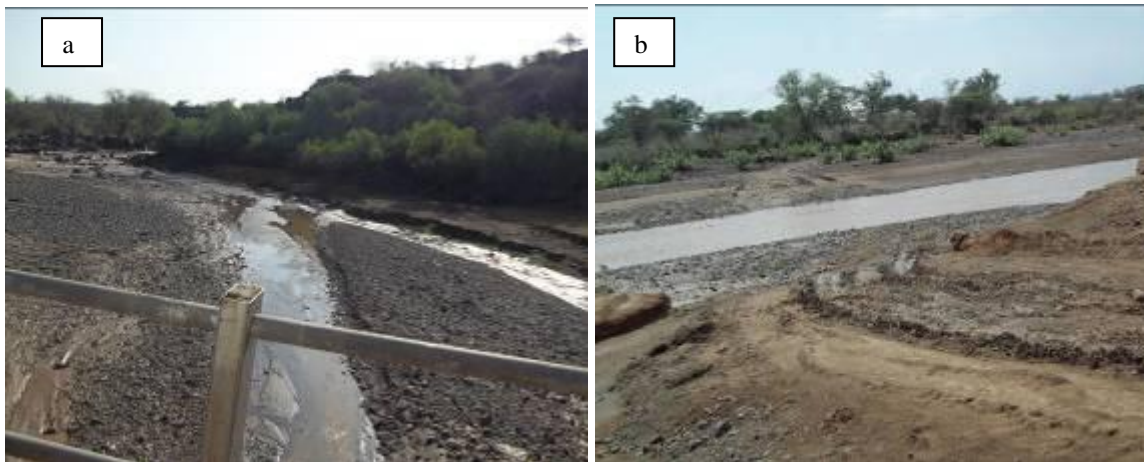


Figure 5.8: Water sampling points.





**Plate 5.16: a) Suguta River, Lomelo area. b) Cheset water pan, Cheset area, c) Loyete earth dam, Tangulbei area, and d) Chepalit water pan, Loruk area.**





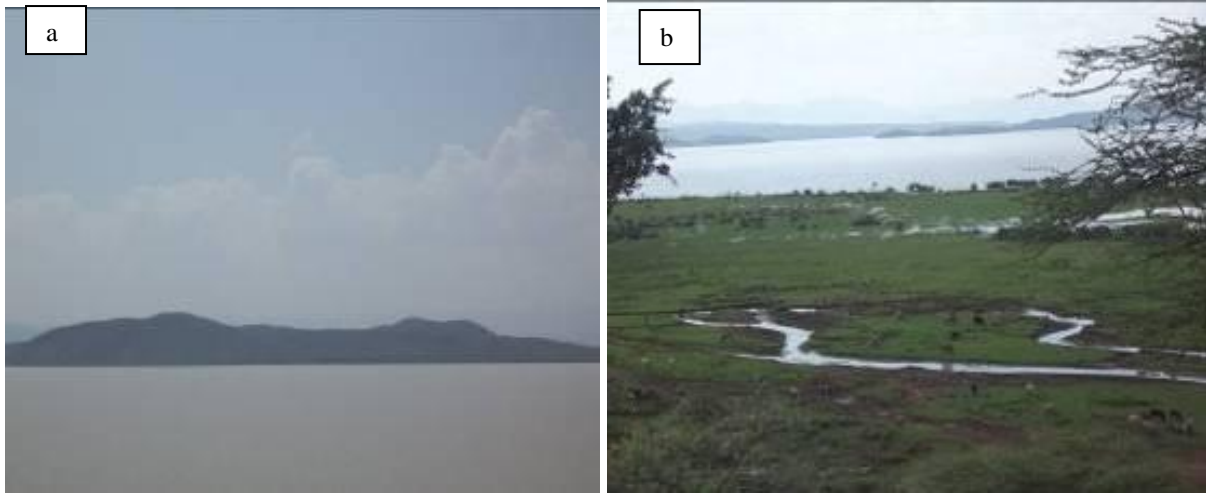


**Plate 5.17: a) Kanukurion River, Kapedo area, b) Nginyang River, Nginyang area, c) Tangelbei River, Tangelbei area, and Kerio River, Yatia area.**

Other sources of surface water are seasonal rivers (luggas) and water pans. The seasonal rivers can only hold their water during and shortly after the rains. Some of the seasonal rivers in the area are Nginyang, Lomelo, Kasakaram, Tangelbei and others (Plates 5.16 and 5.17). Water pans and earth dams like Totum and Opelion water pans in Tangelbei are significantly few in the study area. The construction of the existing water pans and earth dams was sponsored by the Kerio Valley Development Authority (KVDA) especially in the eastern part of the area of study. However, the water pans appear to be unable to retain water for significantly long periods of time during dry seasons or droughts due to seepage and evaporation.

Within the Suguta Valley, perennial supplies of surface water are confined to the upper reaches of the Suguta River and the upper part of its western bank tributaries. The rivers are fed from cold and hot (saline) springs. No dams have been constructed to trap seasonal run-off. Seasonal pools remain in the shadier parts of large rivers. Seasonal pans and water pools are rare, although northern Suguta Valley floods following heavy prolonged rains. The Kerio River may dry up during very dry seasons, but during the rains it may cause flash floods in the Lokori area. Water trapped in the sandy infills of the larger rivers is generally palatable: it is exploited by means of shallow, hand-dug wells. Unfortunately this shallow groundwater resource is alkaline in the alluvial deposits of the Suguta River.

Lake Baringo (Plate 5.18) is fed by several permanent and semi-permanent freshwater inflows from the Mau and Tugen hills. The permanent rivers include the Molo and the Pekerra Rivers, whereas the seasonal rivers are the Dau, Araben and Mungun. These rivers play a major role in the biological and physico-chemical make-up of Lake Baringo. The lake has no visible surface outflow, although it has been documented that the hot springs at Kapedo result from the recharge of the lake. The lake is used by locals for fishing, watering of their livestock, and for domestic purposes.



**Plate 5.18: a) Lake Baringo and b) Perkerra River joins Lake Baringo at Kiserian mission area.**

Lake Bogoria is part of the Bogoria/Baringo basin. The area is highly faulted and fissured, with the major rivers flowing north along the fault-lines. Geothermal activity is evidenced by the presence of steam vents, hot springs, and geysers within the lake and along its shores.



**Plate 5.19: a) Northern part of Lake Bogoria, b) Geyser at the central part of Lake Bogoria, c) Hot spring at the central part of Lake Bogoria, and d) Steam from the hot spring central part of Lake Bogoria.**

Lake Bogoria has a unique hydrology in that it is a saline-alkaline lake, with a meromictic regime and high hydrothermal activity. It is principally fed by the Waseges-Sandai River, and also by a number of hot springs (Plate 5.19). Due to its salinity and alkalinity, the lake's

water is not fit for human consumption but rather supports wildlife like Flamingo. The availability of surface water for domestic and livestock use in the region is limited due to: the poor water sources distribution in both time and space; destruction of water catchment areas, and; uncontrolled abstraction.

### 5.2.5.2 Groundwater Resources

The ground water found in the region occurs in weathered and fractured zones in metamorphic and volcanic rocks and sediments that are inter-bedded between volcanic rocks.

Groundwater is exploited through boreholes and to some extent shallow wells dug in dry river bed as witnessed in Lokori area where a shallow well was dug within the dry Kerio River bed. The water is used both for domestic and livestock consumption. Some boreholes have, however, dried up due to lack of recharge, whereas others have slightly saline water particularly the one at Sibilio.



**Plate 5.20: a) Super-heated spring (Lorusio hot spring), north of Kapedo Town, b) Salt marsh of the Lorusio hot spring, north of Kapedo, c) Kapedo hot spring, Kapedo area, and d) Katupen spring water point, Kito Pass area.**

A shallow water borehole at Lokori augments supplies from hand-dug wells in the sandy bed of the Kerio River. The borehole at Kapedo has a high yield of water of uncertain quality.

Spring water is relatively common, either on the high basement terrains or in the volcanic terrains. Seepage of cold water from springs was noted at Kapedo and Kamuge (Plate 5.20).



Hot saline water seepages was also noted to occur at Kapedo, and Lorusio (3km south of the confluence of the Kamuge and Suguta Rivers). The Katupen spring in Kito Pass area produces a lot of water which is tapped and supplied by gravity to the locals. The spring produces fresh and clean water and is used both in watering livestock, horticultural farming and for domestic tasks. Another spring with clean and fresh water is located in Lokomosai area where the community together with the ministry of water and irrigation has initiated a process to develop it to a larger scale so as to provide the community with much needed water.



Plate 5.21: a) Sibilio borehole, Sibilio Centre, b) Karamuk spring, Karamuk area

### 5.2.6 Water Quality

The surface and groundwaters were analysed for their physico-chemical parameters. Microbiological analysis of both surface and groundwater was not undertaken due to technical logistics relating to sample preservation time (only six hours maximum before they are analysed) and lack of water analysis laboratories in the project area.

**Surface water:** The water quality in the lakes from the project area is not fit for human consumption. Lake Baringo (sampled at both central and outlet sections) and Bogoria (sampled at both inlet and central sections), has a strong colour, as well as high pH, turbidity, fluoride, and iron. This makes the water chemically unsuitable as a source of quality drinking water (Table 5.6). Lake Bogoria is quite saline. Springs and water pans in the project area do not have good water quality fit for human consumption. Kubululo River water can also be a good source of quality drinking water except for its high turbidity (Table 5.6).

**Groundwater.** Water from the Katulei shallow well and Endau borehole have permissible limits for most of the parameters at both the sampling locations. Of all the boreholes and shallow wells sampled, with the exception of Katulei and Endau wells, the TDS value is found to be relatively high indicating high salinity levels above the WHO limit for potable water quality (Table 5.6). Turbidity is also relatively high across the sampled waters; all the shallow wells and boreholes sampled have high turbidity value (Table 5.6). The concentration of heavy metal (iron) in groundwater in the project area is well above the desirable limits of drinking water quality standards (Table 5.6). Sodium concentration level is also above the required drinking water quality standard. Fluoride levels are relatively high in the shallow wells, and suggest that it may be concentrated in shallow groundwater through surface enrichment of fluoride in soils as a result of rock-weathering and antecedent soil formation, and by wind transportation of fine detrital particles from areas where the soils are rich in fluoride. Chloride concentration levels are relatively high in both shallow and deep wells, and, being a conservative ion, may indicate long residence time of groundwater in the

aquifers. Thus, the groundwater from these locations can be used for drinking only after appropriate treatment.

**Table 5.6: Water quality in the project area (SW – Surface Water; S/W - Shallow Well; B/H – Borehole). WHO limits are for drinking water quality; pink shaded boxes show the limits are exceeded.**

PARAMETERS																
Lab Sample Nos.	2553	2552	2551	2550	2549	2548	2547	2546	2545	2544	2542	2541	2535	2537	2540	WHO limits
	Kaitu lei S/W	L.Bogoria central SW	L.Bogoria Inlet SW	L.Baringo, Inlet SW	L.Baringo, outlet SW	L.Baringo, Central SW	Kubululo River SW	Katupen Spring SW	Chepo lat Water pan SW	Lomelo B/H	Lodapa Ng'ora Spring	Yatia B/H	Kapedo B/H	Lorusio Spring	Endau B/H	
pH	8.4	10.2	8.56	8.56	8.53	7.83	7.99	7.78	6.88	8.67	8.87	8.58	8.29	8.82	7.93	6.5-8.5
Colour	5	225	250	225	200	200	5	20	150	10	20	20	5	5	5	15
Turbidity	32	183	369	153	74	84	19	15	118	39	4	6	Nil	12	7	5
Permanganate Value (20 min. boiling)	2.7	69	41.0	39	39	7.9	1.58	-	39	11.0	2.7	2.7	1.58	0.79	1.9	<100
Conductivity (25°C)	363	52,600	16,900	663	629	631	297	212	56.9	7770	2120	1339	1064	7670	681	
Iron	0.09	2.1	4.23	3.94	2.36	0.82	< 0.01	0.42	3.44	2.15	0.53	0.57	0.15	< 0.01	0.35	0.3
Manganese	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.14	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.1
Calcium	16.8	8	8	8.8	5.6	8.0	20.8	4.8	5.6	15.2	12	12	0.8	0.8	9.6	<100
Magnesium	21.9	14.6	4.86	8.75	10.72	8.26	4.38	1.95	0.97	9.22	12.2	8.75	0.97	0.49	23.8	
Sodium	21.8	12,060	3865	124.8	116.9	119.3	35.6	39.1	4.43	1751	450.3	276.8	241.5	1759	99.6	200
Potassium	0.6	3	6.0	1.4	1.4	1.4	0.6	0.6	0.6	1.6	0.2	1.0	0.8	5.6	0.6	<10
Total Hardness	132	80	40	58	58	54	70	20	18	50	80	66	6	4	122	500
Total Alkalinity	154	9466	5800	272	256	252	126	88	24	2786	854	572	434	3172	326	<500
Chloride	14	10,000	1400	35	32	36	6	10	1	500	130	50	30	310	8	250
Fluoride	0.24	625	242	2.8	2.8	2.8	0.27	0.26	0.43	10	3.3	2.8	13	10	0.64	1.5
Nitrate	0.86	10.0	3.7	0.33	0.29	0.24	0.70	0.15	0.35	13	0.68	0.42	3.5	1.9	0.43	10
Nitrite	< 0.01	< 0.01	< 0.01	0.17	< 0.01	< 0.01	< 0.01	< 0.01	0.53	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
Sulphate	3.43	834.3	< 0.3	< 0.3	4	3.14	10.29	1.43	< 0.3	300	8.57	17.14	8.57	180	< 0.3	1000
Free Carbon Dioxide	Nil	Nil	Nil	Nil	Nil	Nil	10	14	16	Nil	Nil	Nil	12	Nil	14	
Total Dissolved Solids	225	32612	10,478	411	390	391	184	131	35.3	4817	1314	830	660	4755	422	500





include: riverine forest, wooded bushland, bushed thicket, bushland, bushed grassland and swamps. Depressions (wadis) harbour varied vegetation types such as those found in the Loboï swamps and grasslands. Evergreen and semi-deciduous bushland cover large areas along stream, valley and other inhospitable areas. *Spirulina platensis* and other species of phytoplankton, which occur depending on season and water chemistry, dominate the lake's open water. A small forest of *Ficus sp.* occurs at the southern end of the lake associated with freshwater springs. Because of the gentle topography of the land around Lake Bogoria, human beings have settled on it and disturbed it. This has promoted the invasion of *Prosopis juliflora* (Mathenge weed) which is rampant especially adjacent to major settlements. Examples in the block include Lokwii settlement (Plate 5.22).



**Plate 5.22: *Prosopis juliflora* (Mathenge) propagating itself (red arrows) near Lokwii settlement (blue arrow). Mathenge is found near settlements and is an indicator of a disturbed environment. This shrub produces good timber and firewood. However, this plant is a noxious weed that is associated with tooth loss in goats that browse on it.**

### 5.2.7.1 Habitat types and associated floral characteristics

#### (a) Moderately dense bushland- piedmont plains

These are undifferentiated sedimentary plains situated at the foot of mountains or hills and are generally continuous and gently sloping (0-5 %). This habitat type occurs at different elevations in the block and slight variations were noted. At an elevation of above 500m .a.s.l. the bush species tends to be dominated by *Acacia nubica*, *Maerua spp* and *Salvadora persica*. The observations were made following a downpour and it was observed that some patches of bare land had perennial grass species dot the landscape in areas such as Kamwosing and Lomelo (Plate 5.23). *Sarcostema andogense* is also dominant in this ecosystem. However, at a higher elevation (1000m. a.s.l.) piedmont plains receive seasonal flooding in areas and intersect major luggas. In this case the density increases forming moderately dense bushes to *Acacia* woodland. Dominant species, being *Acacia tortilis*, *Acacia zanzibarica*, *Acacia senegal*, and *Croton megalocarpus*, can also be found in this habitat, as well as *Lantana* species which dominates the herbaceous growth.





**Plate 5.23: Moderately dense vegetation in the Lomelo area. Note the Itiati Hills in the background (Red arrow).**

In this habitat there are some variations in characteristics, especially in areas where there is a change in the underlying geology of the landform. A good example is seen at Chesakam area at an elevation of 742m. a.s.l. *Adenium obesum* is the most apparent shrub in this rocky inclusion. Other species include *Sarcostema andogense*, *Acacia tortilis*, *Euphorbia heterochroma*, and *Euphorbia uhligiana* (Plate 5.24).



**Plate 5.24: Variation of the piedmont plain, under the influence of localized Scoria rocky outcrops in Chesakam area.**

### (b) Grassed bushland- High level structural plain

This habitat type can be described as a plateau on an elevated tract of comparatively level ground. These interfluvies influence the vegetation of the region, leading to the establishment of a scattered *Acacia* bushland association. They occur in Kapetakinei area at an elevation of 708m. a.s.l. Dominant bush species include *Acacia tortilis*, *Acacia mellifera*, *Acacia senegal*, *Boscia coriacea* and *Salvadora persica*. These bushes are carpeted with perennial grass species as well as *Indigofera spinosa* and *Hirpicum diffusum* dwarf shrubs (Plate 5.25).



Plate 5.25: A high level structural plain in Kapetakinei.

### (c) Dense bushland (thicket) - Stepped faulted plain

This habitat is found on stepped faulted floors of the Rift Valley in areas of Loruk enroute to Tangelbei. Vegetation here is dense and generally impenetrable – that is, to the deep well-drained loamy soils found in this habitat (Plate 5.26). Vegetation composition is made up predominantly of *Acacia tortilis*, *Acacia mellifera*, and *Acacia reficiens* in association with *Euphorbia cuneata*.



**Plate 5.26: Step faulted plain in Loruk area. Note the different floor levels (Red arrows).**

#### **(d) Dense bushland (thicket) - Faulted scarps**

This habitat is characterized by scarps as the outstanding landform. Interfluvies in this habitat type were typically narrow and shallow, and in some instances broad with their intensity increasing as one approaches the crest of the faulted scarp. This kind of landscape is found in areas such as Cheparara and Dongee areas adjacent to Karuweti and Chesawat Hill respectively, with elevation between 1000 and 1078m a.s.l. (Plate 5.26). The vegetation in this topography is dominated by *Acacia* thickets that are dense and generally impenetrable. Major floral species found in this landscape include: *Acacia tortilis*, *Acacia mellifera*, *Acacia Senegal*, *Acacia nubica*, *Maerua* species and *Sansevieria* spp. *Adenium obesum* (Desert rose) dominates on landscapes with rocky outcrops. In areas where interfluvies interrupted the landscape, species such as *Commiphora* spp, *Salvadora persica*, *Euphorbia schimperiana* and *Sericocomopsis* are dominant (Plate 5.26).



**Plate 5.27: Dense bush in Cheparara area. Note the scarp in the background (Red arrow).**



### (e) Near barren vegetation - Uneven valley bottom

The Suguta Valley at an altitude of 426m a.s.l. (Plate 5.28) is characterised as an uneven valley floor landscape. The landscape is near barren, with annual grasses and dwarf shrubs being dominant. Annual grasses were emerging following the rains that were pouring during the course of the fieldwork.



**Plate 5.28: Valley bottom Suguta valley. Note the near barren vegetation save for the annual grasses sprouting (Red arrow).**

### (f) Scattered bushland - Uplands

In areas of undulating land that border either a hill or a mountain, interfluvies tend to be narrow and deep. They have scattered vegetation that tend to be concentrated along waterways. The most notable vegetation are *Acacia mellifera*, *Acacia senegal*, *Acacia nubica*, *Cadaba spp*, *Commiphora spp* and *Sarcostema andogense*. In the block such a habitat can be seen in the Achor area (Plate 5.29).



**Plate 5.29: Scattered bush in the Achor area.**

A variation of this habitat is found at Kimwarer area at an elevation of 2077m. a.s.l. The topography of the landscape is undulating with clayey soils and the vegetation tends to increase in density and become a wooded bushland (Plate 5.30). Species found in this area include: *Acacia tortilis*, *Balanites glabra*, *croton st*, *Acacia polyacantha* and *lantana* species.



**Plate 5.30: Wooded bushland, Kimwarer.**

#### **(g) Riverine forests - Floodplains**

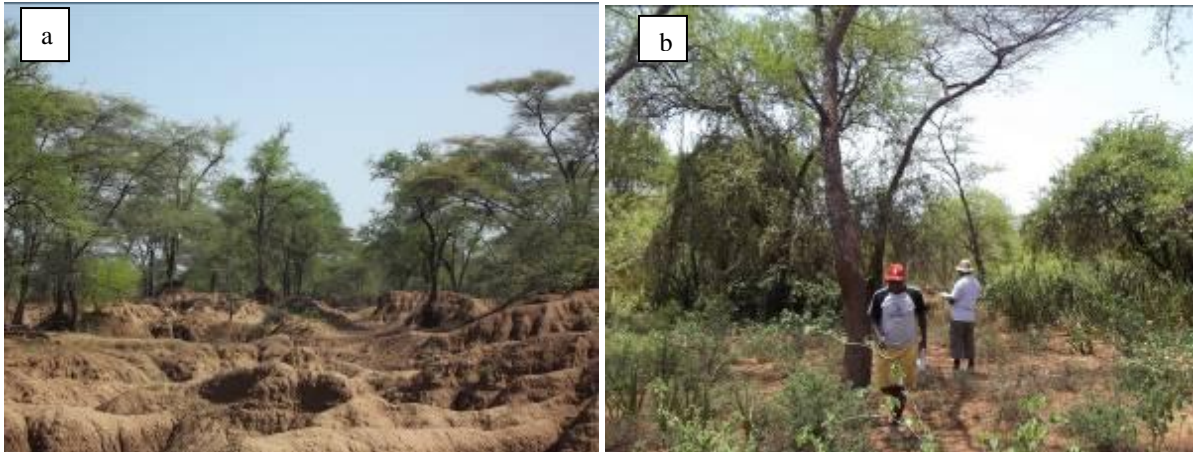
A floodplain is a strip of relatively smooth land adjacent to a river channel, formed or in the process of being formed, by the present river and covered with river water when flooded. It is generally characterized by riverine vegetation. Such a habitat frequently floods or ponds supporting riverine vegetation but the water also acts as an erosive agent and can lead to denudation of the land. An example can be found at the Suguta River crossing at an elevation of 366m a.s.l. The dominant vegetation is *Hyphaene Coriacea* and *Salvadora persica*. In Kamwosing area, in addition to these species, *Sueda monoica* and *Maerua spp* are also present, indicating an increase in salinity in the soil (Plate 5.31).



**Plate 5.31: Riverine vegetation in Kamwosing area at the River Suguta crossing.**

Different species of woody vegetation can also be found in floodplains at a higher elevation of 1143m a.s.l. The species include: *Acacia tortilis*, *Acacia mellifera*, *Acacia polyacantha*, *Maerua spp*, *Aloe spp* and *Lantana spp* (Plate 5.32).





**Plate 5.32: Floodplain vegetation in Chebloch area. Note: Poor soil structure and the occasional ponding in the area have led to the denudation of the landscape as shown in Plate (a).**

#### **(h) Woodland - Hills**

This kind of topography is characterized by wooded vegetation. Some of the species found in this landscape include *Rhus natalensis*, *Cordia africana*, *Croton megalocarpus*, and *Terminalia brownie* (Plate 5.33).

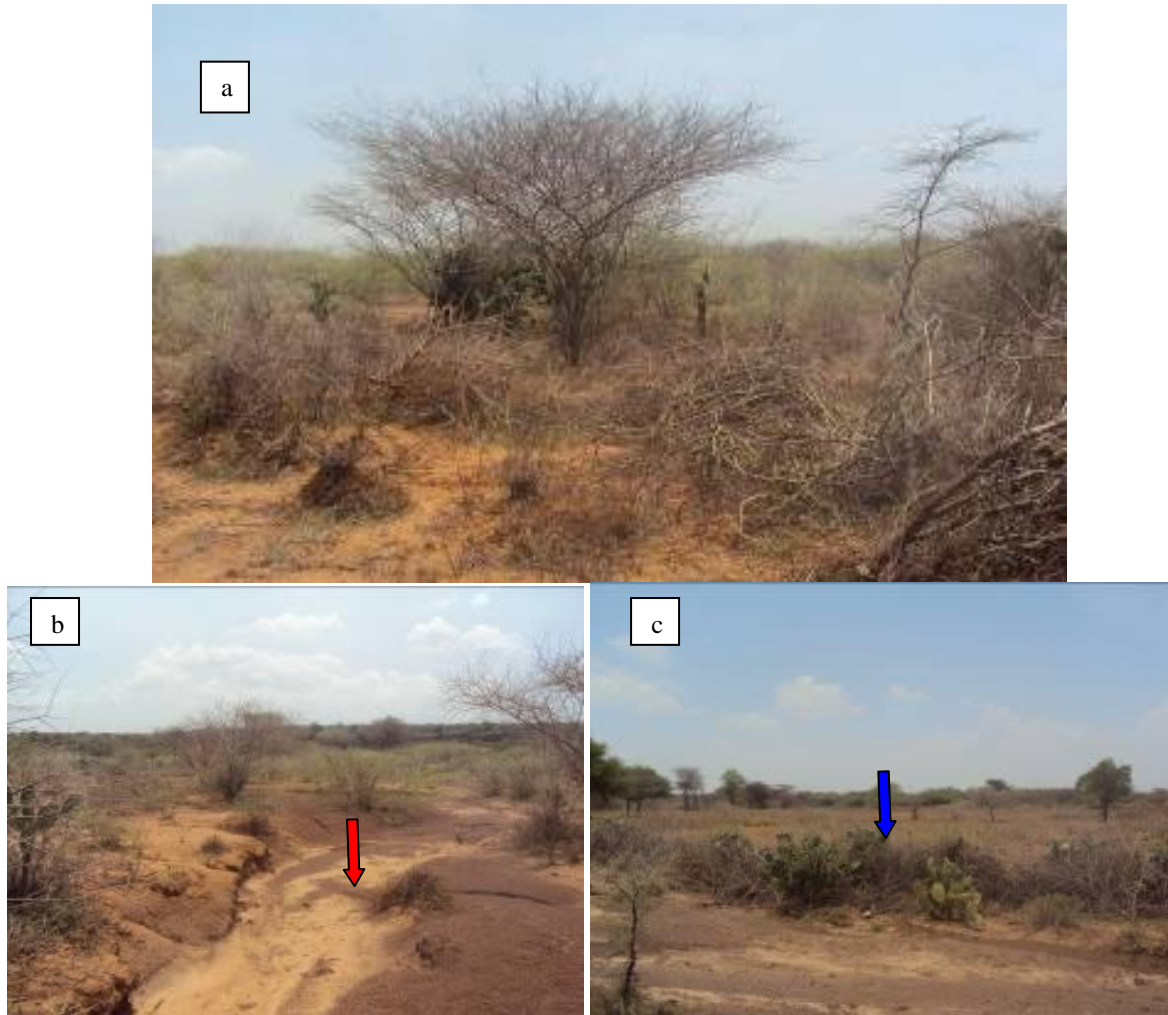


**Plate 5.33: A woodland in Kito Pass area.**

#### **(i) Wooded bushlands - Foot slopes**

This is a highly cultivated landform, thanks to its rich soils and its relatively smooth topography (see section 5.2.2.2). This habitat is found in areas like Kapchakwel. This area is highly cultivated. However, indigenous vegetation is still present (Plate 5.34). Species found in this habitat include: *Acacia mellifera*, *Grewia tenax*, *Balanites glabra*, *Sericocomopsis*, *Sansevieria spp*, *Aloe spp* and *Euphorbia uhligiana*





**Plate 5.34: Wooded bushlands, Kapchakwel area** a) Represents pristine habitat (Wooded bushland) within the foot slopes of Kapchakwel b) Note the interfluves in the foreground dissecting the landscape (Red arrow); these interfluves support vegetation growth c) Note that the area has been fenced off using cactus (Blue arrow). Most of the population in this area are farmers.

#### **(j) Forest - Mountains**

The mountains are mostly found at high elevation above 1500m. a.s.l. on the southern tip of the block, and tend to be forested. There are both high canopy and low canopy forests in the area. The forests are both natural and artificial, both exhibiting dense undergrowth. Some notable species found at the foot of the mountains include: *Tecla nobilis*, *Gomphocarpas stenophyllus*, *Croton megalocarpas*, *Croton microstachys*, *Senna didimobotrya*, *Senna bicapsularis*, *Acacia tortilis*, and *Acacia polyacantha* (See Plates 5.35 and 5.36).



**Plate 5.35: A mixed forest found in the block. Its species composition is both indigenous and propagated.**



**Plate 5.36: A propagated forest in Borowonin area.**

#### **5.2.7.2 Fauna**

In the protected areas of the block, are species such as bush pigs, waterbuck, buffalo, elephant, crocodile, warthog, yellow baboon, impala, leopard, zebra, mongoose, jackal, greater kudu, vervet monkey, Grant's gazelle, klipspringer civet, genet, cheetah, serval and striped hyena, Rothschild's giraffe and dik dik; and occasionally, sightings of Karakul Cat. Lake Kamnarok, which was once home to more than 15,000 crocodiles, however dried up and all the hundreds of elephants that used to inhabit the nearby game reserve fled to the



nearby Rimoi Game Reserve in the neighbouring Keiyo District. Rimoi National Reserve, in the Kerio Valley, is an important area for elephant migration.

Birds are also abundant, mainly water birds, some of which are of regional and global conservation significance. There are 310 resident and 50 migratory species of birds. Lake Bogoria alone supports more than 20,000 water birds throughout the year including significant numbers of migratory species. The lake is an important habitat for seven fish species, of which the tilapia *Oreochromis niloticus baringoensis* is endemic to the lake. The site provides critical refuge to hundreds of thousands and occasionally millions of the flamingo *Phoenicopterus minor*. Lake Bogoria supports an assemblage of 1.5 million flamingos and Palaearctic waders.

#### **5.2.7.2.1 Mammals**

The habitats found within the block are numerous and diverse. A few live observations were made but a majority of the mammalian life observed were made indirectly by signs of their activity. The animals include: Greater kudu, Dik dik, Cape hare, Silver backed jackal, Hedgehog, Porcupine, Impala (Plate 5.37), Elephant, Buffalo, Grant's gazelle, Cheetah, Leopard, Lion, Vervet monkey, Olive baboon and Hyena, among others (Plates 5.38 and 5.39).



**Plate 5.37: Impala grazing in the environs of Lake Bogoria.**



**Plate 5.38: Mongoose midden, Lake Bogoria.**



**Plate 5.39: Dik Dik midden.**

#### **5.2.7.2.2 Reptiles**

The semi-arid to arid climate in the block creates a suitable environment for reptilian life and thus it is expected that many reptilian species are present. They include: Snakes, Lizards, Tortoise, Crocodile, Gecko and Skinks. During the course of the field trip not many were encountered (Plates 5.40, 5.41 and 5.42).





**Plate 5.40: Red-headed Agama.**



**Plate 5.41: White-throated Monitor Lizard, Suguta River crossing.**





**Plate 5.42: Leopard Tortoise, Lake Bogoria.**

#### **5.2.7.2.3 Birds**

Birdlife in the area is diverse, supported by the numerous ecosystem types found within the confines of the block. Despite this, birdlife is sparsely populated and scattered in the area. They included: Fork-tailed Drongo, Yellow-vented Bulbul, Superb Starling, Rupelles Long-tailed Glossy Starling, White-crested Helmet Shrike, Kori Bustard, Northern White-crowned Shrike, Brown-necked Crow, Mourning Dove, White-bellied Cuckoo, Martial Eagle, Abyssinian Roller, Rufous-crowned Roller, Blue-headed Coucal, African Scops Owl, Grey-headed Kingfisher, Pied Kingfisher, Pied Wagtail, White-browed Sparrow-Weaver, Crested Lark, Variable Sunbird, Shinning Sunbird, Speckled Pigeon, Blue-headed Bee-eater, Carmine Bee-eater, Paradise Flycatcher, Namaqua Dove, White-headed Buffalo Weaver, White-browed Sparrow-Weaver, Nubian Woodpecker, Ring-neck Dove, Eastern Pale Chanting Goshawk, Sacred Ibis, Lesser Flamingo, Greater Flamingo, Lesser Egret, Intermediate Egret, Greater Egret, Goliath Heron, Yellow-billed Stork, Red-billed Hornbill, White-headed Moosebird, Somali Ostrich and African Hoopoe among others (Plate 5.43).



**Plate 5.43: Flamingos, Lake Bogoria.**

#### 5.2.7.2.4 Arthropods

This ecosystem has a rich diversity of invertebrate species, including insects such as: Odonata (Dragonflies), Orthoptera (Grasshoppers and crickets), Isoptera (termites), Coleoptera (Beetles), Lepidoptera (Butterflies and Moths), Diptera (Flies and Mosquitoes), Hymenoptera (Wasps and Bees), Blattodea (Cockroaches) and Phasmida (Walking sticks). Arachnids present include ticks, spiders and scorpions (Plate 5.44).



**Plate 5.44: Red Tick at Lokwii area. These ticks when spotted are usually an indicator that rain is coming.**

#### 5.2.8 Aquatic Environment

The major aquatic habitats in the block are: River Kerio, River Suguta, River Molo, Lake Baringo and Lake Bogoria. These aquatic ecosystems support aquatic flora and a host of fauna and play a key role in both the natural and human environment.

**River Phytoplankton, Zooplankton and Fish:** Based on an extensive literature review, it is clear that the phytoplankton, zooplankton groups and more generally the elements of the food web structure (including fish) in the river systems of the Rift Valley (and other rivers within that regional setting) have not been extensively studied, possibly due to inaccessibility, and poor security.

**Fish:** There is no published information on the fish species of the Kerio and Suguta Rivers, but those reported to occur include *Protopterus*, *Clarias* and *Oreochromis*.

**Macrophytes:** The emergent macrophytes which were observed as dominating the river channels of swamps and marshes associated with Kerio and Suguta Rivers (Plate 5.45) are *Cyperus papyrus*, *Phragmites spp.* and *Typha spp.* The submerged macrophytes include *Ceratophyllum demersum* and *Polygonum spp.*





**Plate 5.45:** Sedges (Red arrow) on an ephemeral section of the Suguta River at the Suguta Valley on the Eastern side of the block.

**Riverine Forest:** The riverine forest is largely dominated by *Acacia tortilis*, with *Faidherbia albida*, *Ficus sycomorus*, and *Hyphaene compressa* as sub-dominants on the riverbanks and *Balanites pedicellaris*, *Boscia coriacea*, and *Acacia nubica* on the dry edge of the riverine zone (Plate 5.46). These trees are often covered with lianas (e.g. *Leptadenia hastata*, *Coccolus hirsutus*, *Commicarpus plumbagineus*), while the understory mainly contains *Cadaba rotundifolia*, *Acalypha fruticosa*, and *Abutilon hirtum* (Van Bremen and Kinyanjui, 1992).



**Plate 5.46:** (a) Riverine vegetation on an ephemeral sector of the Suguta River, (b) Riverine vegetation along Kerio River.

## Lake Bogoria

### Phytoplankton

In general the open phytoplankton species that dominate are species of *Spirulina platensis*, *Microcystis flos-aquae*, and *Anabaenopsis arnoldii* (LBNR, 2007). Cyanobacterial communities in the hot springs at the shore of Lake Bogoria are dominated by the blue-green algae (*Synechococcus bigranulatus*, and *Spirulina subsalsa*), and the brown algae (*Phormidium terebriformis*, and *Oscillatoria willei*) (Owen et al., 2004), while flora in the lake littoral habitats are dominated by the cyanobacterium *Anabaenopsis fusiformis*, *Cyclotella meneghiniana*, *Thalassiosira rudolfii*, *Aulacoseira granulata*, *A. granulata* var. *angustissima*, and *A. ambigua* (Owen et al., 2004).

## Zooplankton

Zooplankton species in the area belong to three broad taxonomic orders: Copepoda, Cladocera and Rotifera. Species in the Copepoda group include *Mesocyclops sp*, *Thermocyclops emini*, *T. incisus*, *T. neglectus*, *Tropocyclops confinnis*, *T. tenellus*, *Thermodiaptomus galeoides*, *Harpacticoid copepods*, *Copepodites*, *Nauplius larva*. Species in Cladocera group include *Bosmina longirostris* and *Chydorus sp*, while the group Rotifera has the following species: *Asplanchna sp*, *Brachionus angularis*, *B. caudatus*, *B. dimidiatus*, *B. falcatus*, *B. forficula*, *Euclanis sp*, *Filinia longiseta*, *Hexarthra sp*, *Keratella cochlearis*, *K. tropica*, *Lecane bulla*, *Platyas quadricoris*, *Polyarthra vulgaris*, *Synchaeta spp.*, *Trichocerca cylindrical*. Other species present are *Caridina nilotica*, *Chaoborid larvae*, *Chironomid larvae*, *Ostracoda*. Zooplankton are also useful bio-indicators of water quality since factors such as eutrophication and pollution affect zooplankton community structure as observed in Lake Victoria (Mwebaza-Ndawula, 1994). Zooplankton species richness and total numerical abundance are usually higher downstream than upstream because zooplankton occur best close to the shoreline and/or in areas associated with calm embayments (Mwebaza-Ndawula et al., 2005).

## Macrophytes

The shoreline vegetation is dominated by plant species such as *Cyperus laevigatus*, *Sporobolus spicatus* and *Cynodon dactylon*.

## Birds

Lake Bogoria is one of the richest areas in terms of bird species diversity in Kenya (LBNR 2007). At least 373 species of birds have been recorded in the area, 50 of which are migratory species. This high species diversity attribute is linked to the fact that the area is located between the Ethiopian and Maasai zoogeographical regions (LBNR, 2007). The Lake attracts large flocks of Lesser and Greater Flamingo that feed on algae (Plate 5.47) Other bird species found in the area include: Beautiful Sunbird, Red-throated Tit, Eastern Violet-backed Sunbird, Ruff, Common Fiscal, Common Sandpiper, Long-tailed Fiscal, Wood Sandpiper, Grey-backed Fiscal, Little Swift, Common Bulbul, White-rumped Swift, African Thrush, Mottled Swift, Nyanza Swift, Spotted Morning Thrush, Eurasian Swift, Speckled Moosebird, Southern Black Flycatcher, Blue-naped Mouse Bird, African Grey Flycatcher, Red-faced Mouse Bird, Silverbird, Grey-headed Kingfisher, Rufous Chatterer, Woodland Kingfisher, Northern Pied Babbler, Malachite Kingfisher, White-bellied Tit, African Pigmy Kingfisher, Northern Grey Tit, Lesser Honeyguide, Tawny Eagle, Nubian Woodpecker, Steppe Eagle, Cardinal Woodpecker, Verreaux Eagle, Bearded Woodpecker, Martial Eagle, Grey Woodpecker, Pygmy Falcon, Fischer's Sparrow Lark, Peregrine Falcon, Rock Martin, Helmeted Guinea Fowl, Plain Martin, Red-rumped Swallow, Sand Martin, Lesser Striped Swallow, African Scops-owl, Barn Swallow, Verreaux's Eagle-owl, Wire-tailed Swallow, Pearl-spotted Owlet, African Pied Wagtail, Spur-winged Lapwing, Crowned Lapwing, Black-headed Heron, Black-headed Lapwing, and Hammerkop.



**Plate 5.47: Flamingos on the shores of Lake Bogoria.**

## **Lake Baringo**

### **Phytoplankton**

Production in open water is very low due to the turbid nature of the phytoplankton population which is limited to only the positively buoyant species including: *Microcystis aeruginosa*, *Melosira granulata* and *Anaebaena carinalis*. The main phytoplankton groups are: Cynophyceae, Bacillariophyceae, Euglenophyceae and Cryptophyceae (Ballot et al. 2003).

### **Macrophytes**

The area around the western shore is mainly *Acacia tortilis* woodland, with small bush-covered hills, gorges and cliffs. *Ficus* spp. grow on the cliff faces. The north and east have denser bush, thinning out towards the south, dominated by *Acacia mellifera*, *A. reficiens* and species of *Boscia*, *Commiphora*, *Terminalia* and *Balanites*. The open, flat, southern part is bushland interspersed with dry riverbeds and stands of *Acacia tortilis* and *A. Elatior*, swampy wetlands, with *Typha* reeds and *Echinochloa* marsh grass (Plate 5.48). Lake Baringo's extreme turbidity has led to near extinction of submerged macrophytes and a lake-bed virtually devoid of benthic fauna (Ssentongo 1995).





**Plate 5.48: Vegetation on the shores of Lake Baringo.**

## **Fish**

The fish community of Lake Baringo comprises only seven species. Predominant is the endemic *Oreochromis niloticus baringoensis* and this forms the basis of the commercial fishery. According to a 2001 publication of the Ramsar secretariat, other species are: *Protopterus aethiopicus*, *Clarias gariepinus*, *Barbus gregorii*, *Labeo cylindricus* (Endangered), *Barbus lineomaculatus* (Rare) and *Aplocheilichthys spp* (Rare).

## **Fauna**

Lake Baringo supports large populations of *Crocodylus niloticus* and *Hippopotamus amphibius*. An apparently range-restricted snake, *Coluber keniensis*, is known from only one specimen collected here (Birdlife International 2001).

## **Birds**

Over 500 bird species have been recorded including globally threatened species like the Lesser Kestrel (a passage migrant in small flocks), Lesser Flamingo (an occasional visitor, usually on passage), the Malagasy Pond Heron (a rare non-breeding visitor) and Pale Harrier (a regular passage migrant). A number of regionally threatened species are also recorded, namely Great Crested Grebe, African Darter, Great Egret, Saddle-billed Stork, White-backed Duck, White-headed Vulture, Martial Eagle, Bailon's Crake and African Skimmer. Other bird species associated with the lake are: Yellow-necked Spurfowl, White-bellied Go-away-bird, Donaldson-Smith's Nightjar, Abyssinian Scimitarbill, Eastern Yellow-billed Hornbill, Hammerkop (Plate 5.49), Jackson's Hornbill, Hemprich's Hornbill, Black-throated Barbet, Red-and-yellow Barbet, D'Arnaud's Barbet, Three-streaked Tchagra, Somali Tit, Mouse-coloured Penduline-tit, Pink-breasted Lark, Pale Prinia, Grey Wren-warbler, Rufous Chatterer, White-breasted White-eye, Bristle-crowned Starling, Magpie Starling, Brown-tailed Chat, African Grey Flycatcher, Kenya Violet-backed Sunbird, Hunter's Sunbird, Shining Sunbird, White-headed Buffalo-weaver, Blue-capped Cordonbleu, Purple

Grenadier, Red-rumped Waxbill, Grey-headed Silverbill, Steel-blue Whydah, Straw-tailed Whydah, Golden Pipit, Ethiopian Grosbeak-canary, White-bellied Canary, and Somali Golden-breasted Bunting.



**Plate 5.49: Hammerkop (Hammer-head Duck) at a crossing of the Perkerra River, a tributary of Kerio River.**

### 5.2.9 Land Resources and National Parks

Block 12A has numerous land resources ranging from vast tracts of land with near barren vegetation, bushland, woodlands, and man-made forests to high canopy indigenous forests. Vegetation in the area include species of *Acacia*, *Boscia*, *Euphorbia*, *Grewia* and *Balanites* that are useful as both fodder for livestock and herbal treatment for common human ailments in the area. The area residents are both pastoralists and farmers; pastoralists are mostly found in the northern expanses of the block, while farmers dominate the southern areas. The main livestock types kept are cattle, goats, donkey and sheep.

Agriculture takes place under irrigation schemes that draw water from the major rivers like Perkerra, Molo, Kerio and Ebofut. These schemes include the Perkerra Irrigation Scheme, Lakubai Irrigation Scheme and Morulem Irrigation Scheme.

There are three protected areas: Lake Kamnarok National Reserve, Rimoi National Reserve and Lake Bogoria National Reserve (Figure 5.10). These reserves play host to numerous Gazelles, Jackals, Porcupines and Elephants, among other creatures. Additionally, Lake Baringo and Lake Bogoria basin systems represent the two major heritage sites found within the block. They are Important Bird Areas (IBAs) and have been designated as Ramsar sites.



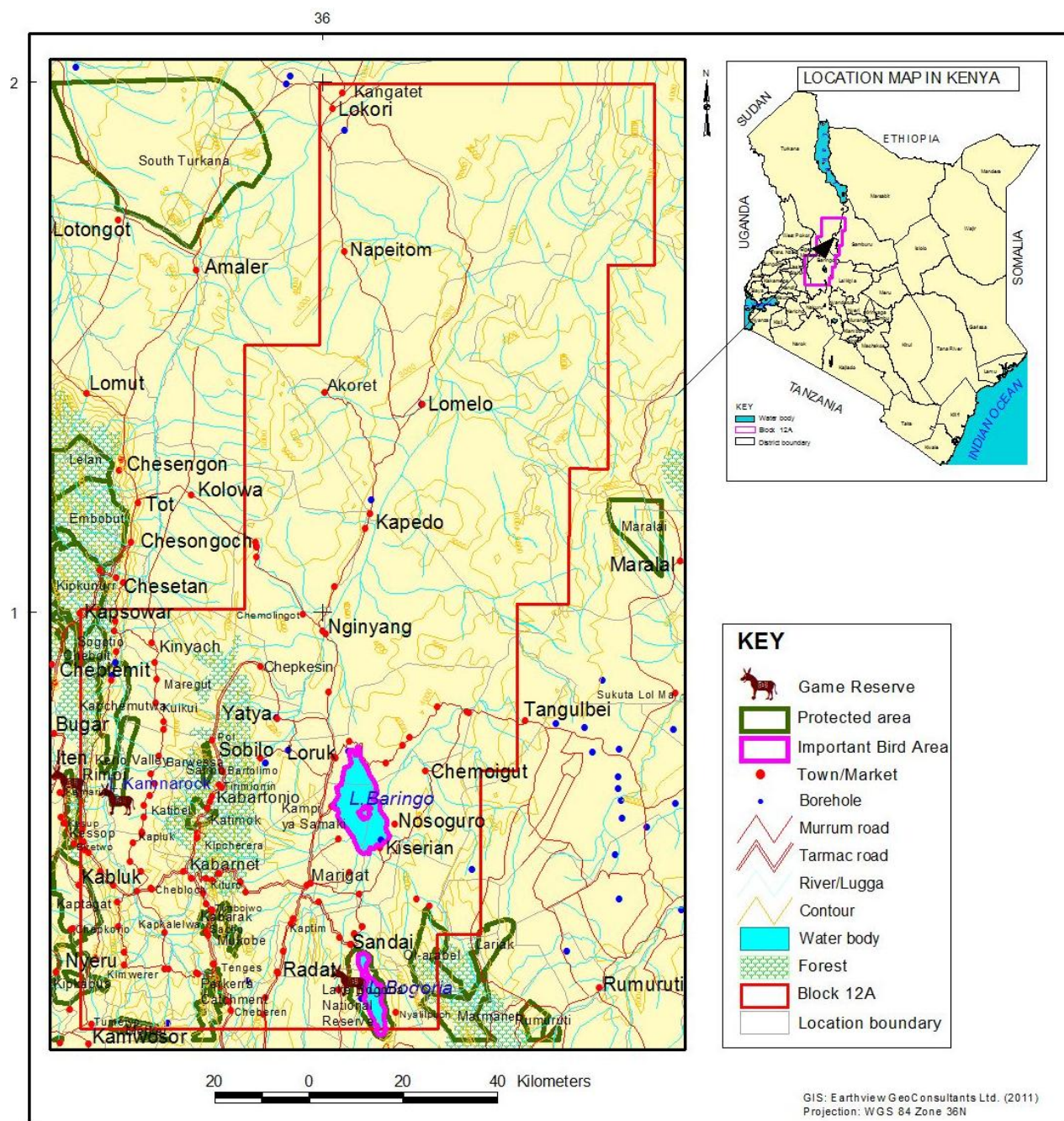


Figure 5.10: Locations of protected areas within the Block.

## 5.2.10 Archaeological, Historical and Cultural Sites

### 5.2.10.1 Archaeological and Historical Sites

The Tugen Hills sedimentary succession has yielded abundant and diverse faunal assemblages including a number of hominid specimens (e.g., Bishop et al., 1971; Hill, 1985, 1995, Hill et al., 1992, 2002; Senut et al., 2001). Indeed, fossiliferous sediments in the Baringo Basin comprise the most complete late Neogene section known from the African rift (Chapman et al., 1978). The Upper Chemeron Formation (~3.2–2.4Ma) has about 100 fossil vertebrate localities, including three hominin sites, which have been stratigraphically situated in it.

There are also several historical and cultural sites revered by the local communities. One of such is found near Lokori Town at Arror which is a cultural site. There is a historical site in Koriema centre in Marigat district where elders used to meet. In fact the word *Koriema* in Tugen dialect means ‘a meeting place’.

### 5.2.11 Visual Aesthetics

The area has pristine and rugged scenic beauty with valleys, hills, extensive plains, as well as several sand rivers (luggas) to the north. The varied landscape is aesthetically beautiful, and there are a number of potential tourist attraction spots, such as the Kapedo Hot Springs and the flamingos at Lake Bogoria (Plate 5.50). Mitigation for seismic surveys close to such sites are presented in Chapter 7.



Plate 5.50: The Kapedo Hot Springs (left) and flamingos on Lake Bogoria (right).

### 5.2.12 Noise and Vibrations

Ambient noise in the project area is generally low level due to its largely rural setting particularly in the central to northern parts. In the southern section, there are more developed and populated towns and industries, as well as agricultural activities. Nevertheless, these generate transient noise that is within the bounds of acceptable noise exposure limits.

### 5.2.13 Solid and Liquid Wastes

The generation of solid wastes and waste fluids are limited to areas where there are human settlements and larger towns. Wastes include paper, plastics, sewage, and organic matter (food waste). More such waste is generated in the southern part of the project area which is more populated and developed, as compared to the central and northern areas. However, there were no indications that poor waste management is occurring on a scale large enough to elicit widespread environmental concerns, including the bigger towns such as Marigat, Kerio, and Kabarnet.

The area produces low volumes of solid and liquid wastes on account of its low population and rural nature, and there is no public or private waste management service available in most of the project area, save for the southern border of the block. No recycling facilities exist, and the landfills in which municipal (town) wastes are disposed of are not well designed or managed and tend to be under-utilised due to lack of waste transport services. Wastes are normally disposed of in pits that are dug on individual or communal basis.



### 5.3 SOCIO-ECONOMIC BASELINE

This section provides information on key social-economic issues and activities relevant to the project. It includes an overview of social characteristics, economic settings, health, education, and demography. While the team tried to exhaust all available information, it should be noted that detailed information on some of the issues are not available and where available, they date back several years.

The population census for example, which was undertaken in 2009, was cancelled in some of the areas due to ambiguity in the data collected. More updated census data will be available when the ambiguity is resolved.

#### 5.3.1 Social Characteristics

##### 5.3.1.1 Demography

The project area has varied demographic distribution. Whereas the northern part of the block is sparsely populated with a very low population density, the converse is true of the southern part. This can be attributed to the climatic conditions as well as the communities' way of living (pastoralist in the relatively drier north, agricultural in the relatively more humid south).

According to the Kenya population census of 2009 that was carried out by the Central Bureau of Statistics, Turkana South District had 226,379 people, Pokot East had 133,189 people, Baringo and Baringo North had 162,351 and 93,789 people respectively. These data were documented on the earlier existing administrative units, rather than those that were recently created in the past five years.

##### 5.3.1.2 Education

Several educational institutions are found within the project area (Plate 5.51) and as is the case with other sectors and facilities development, the southern part is more developed as compared to other parts of the block. Institutions available include nursery schools, primary, secondary schools and some Tertiary institutions.



Plate 5.51: Part of the educational infrastructure within the project area.

##### 5.3.1.3 Housing

Housing is a major economic pillar in any given region, and can be used to measure the economic strength of a particular area. Within the project area, housing is widely determined by the cultures and land tenure systems. It is also influenced by the government especially



through the Constituency Development Fund (CDF). The northern part of the project area is mainly occupied by pastoralists, whose nomadic way of life dictates that they construct temporary structures that are commonly known as *Manyattas* (Plate 5.52). Within this area, permanent structures can be found in small towns and centres, or as dispersed public utilities that are funded mainly by the CDF.

The southern part of the block has permanent structures as the people are engaged in different economic activities and own land privately.



**Plate 5.52: Some manyattas in Morlem and CDF funded toilets respectively.**

#### **5.3.1.4 Energy Sources**

The area meets most of its energy demands from the national grid although other sources are utilized, especially in rural areas (Plate 5.53). These include diesel generators, kerosene and charcoal.



**Plate 5.53: Power lines in Chepkum, Marakwet East and a power transformer in Loruk Town, East Pokot respectively.**

#### **5.3.1.5 Land Tenure System**

Block 12A has two land tenure systems. The northern part of the block has a communal land tenure system, whereby land is collectively owned by the residents and managed on their behalf by the respective County Councils, while to the southern parts of the block, individuals have title deeds and thus own the lands.

### 5.3.2 Economic Setting

#### 5.3.2.1 Labour Force

There exists a readily available pool of unskilled labour force in the project area, especially to the north, due to lack of major economic activities except for livestock rearing. Many of the young unemployed school leavers are available for any type of work, since there are limited job opportunities at the few urban centres in the area.

#### 5.3.2.2 Livestock

This is a major economic activity especially in the northern and eastern parts of the project area. The area is mainly occupied by the Turkana, Pokot, Njemps, Tugen and Samburu who are traditionally pastoralists. They keep mainly cattle, goats, sheep and donkeys. In the southern parts of the block, especially Baringo Central and North Districts, people do not practice grazing due to the high population and the restrictions associated with the land tenure system, which allows for private ownership of land, resulting in small, discrete and fenced parcels with access allowed only by the land holder (Plate 5.54).



**Plate 5.54: Cattle at a selling yard in Nginyang, East Pokot.**

#### 5.3.2.3 Crop production

Crop farming is mostly done in the central and southern parts of the project area. This is because the rain here is reliable and the climate more favorable. Small-scale subsistence farming is carried out within Baringo Central and North Districts. Large-scale farming is undertaken in the mainly horticultural Pekerra Irrigation Scheme near Marigat Town. The main crops grown include: maize, beans, pawpaws, bananas, potatoes, kales, tomatoes, French beans, watermelons, among others (Plates 5.55 and 5.56). Near Marigat town and the area towards Lake Bogoria, *Aloe vera* is grown commercially (Plate 5.57).





**Plate 5.55: Kales and bananas in a farm in Chepkum, Marakwet East District.**



**Plate 5.56: Tomatoes growing in Pekerra Irrigation Scheme.**



**Plate 5.57: Aloe Vera being grown near Marigat town.**



### 5.3.2.4 Industry

Several industrial activities are undertaken within the project area, mainly in the central to southern parts. They include geothermal power production in Silale area, saw milling in Karbarnet and Kabartonjo areas (Plate 5.58), and fluorspar mining in Kimwarer (Plate 5.59), honey processing, seed production within Pekerra Irrigation by Kenya Seed Company, among others.



**Plate 5.58: Saw milling being undertaken in Kabartonjo.**



**Plate 5.59: A safety notice within Fluorspar mines in Kimwarer; Source: Fieldwork 2011**

### 5.3.2.5 Trade and commerce

Within the centers and towns there are small or large-scale business enterprises. The northern part of the project area has less commercial activities as compared to the south. This is largely due to the nature of the people's lifestyles whereby majority in the northern part are pastoralists and mainly engage in sale of livestock (Plate 5.60). The southern part of the block are involved in agricultural activities and hence engage in trade of various agricultural products (Plate 5.61). Security issues and poor infrastructure also hinder development in these areas.





**Plate 5.60: Lorries wait to transport livestock from Nginyang Selling Yard.**



**Plate 5.61: A trader selling honey and watermelons near Marigat town, Marigat District.**

### **5.3.2.6 Tourism**

The tourism sector is well developed in the southern part of the project area. This is largely because there are several and unique attractions such as the hot springs in Lake Bogoria, and rare wild animals like the Greater *Kudu* found within Lake Bogoria National Reserve. The Great Rift Valley offers an attractive scenic view coupled with camping sites, conservancies, cultural centers and parks among other attractions (Plate 5.62).



**Plate 5.62: Some of the tourist attractions within the project area.**

### **5.3.3 Health Setting**

The project area has a huge disparity in relation to health facilities. Whereas the southern part of the block has adequate facilities, the northern part, especially Turkana East and East Pokot, have insufficient facilities. Several towns host fully fledged district hospitals but in the north, the residents rely on Catholic missions or NGO-operated dispensaries, which are rare and are both ill-equipped and poorly staffed.

### **5.3.4 Security and Public Safety**

Security concerns arise particularly where two pastoralist communities border. Conflicts tend to occur between the Ichamus and Pokots, Tugens and Pokots, Pokots and Turkanas, and Pokots and Samburus, among others. The sometimes deadly conflicts are related to competition for the scarce resources, including pasture and water for their animals, and livestock re-stocking. These security hotspots are found on the northern, central and eastern parts of the project area. The southern part experiences calm since the residents are engaged in farming, bee keeping and other non-pastoral activities.

### **5.3.5 Community Views**

The EIA team made extensive field visits in the project area, held public meetings with the local people and administered questionnaires to households as well. While the community members are aware that Tullow Oil cannot shoulder all their needs, they requested the company to consider the following projects as part of the CSR:

- Fresh water supply projects such as drilling of boreholes to needy areas - this was a major issue especially in areas to the north where water supply is a major problem unlike the southern side of the block where water is available;
- Assistance to schools and dispensaries such as building of new classrooms and dispensary blocks where there are none;
- Provision of education bursaries, particularly to needy students who excel in their examinations;
- The northern part of the block is under-developed, with poor road and communication infrastructure. The communities hope that the presence of the company in that area may lead to improved communication. They also proposed that some of the cut lines, if linking two centers and are useful to the communities, could be retained as roads;
- Some parts of the block are insecure, especially the area between Lokori and Lomelo. The communities feel that the presence of the company in that area may help reduce the security incidents that occur often in that area.

### 5.3.5.1 Concerns

- The proposed project may disrupt grazing patterns as the seismic lines may go through the grazing areas and watering points
- The company may be coming to dump some waste and if government and the public are not vigilant, the proponent and his crew may dump hazardous and harmful chemicals in the area
- The proponent should not source locally available labour from other parts of the country as this may be a source of potential conflict
- The project may strain the already scarce fresh water resources in the area.
- The project will temporarily attract an influx of people into the area and may lead to an increase in social decadence like prostitution, drug abuse and the mushrooming of settlements.
- The project area especially to the south has individuals with title deeds. The communities in that area would like to be informed on how the company intends to work with them on their lands.
- Some individuals may scuttle the proposed project by giving misleading information to the public if the proponent and his consultants do not enhance public awareness about the project in the area.

These community concerns are related to past experience with other projects that are not necessarily (but may have been in the north where seismic survey has previously been undertaken) similar to the current project, and on their understanding of the project components as explained during the public consultations. While in most cases these views are valid, seismic surveys in recent years have been able to address these issues, thereby minimizing or eradicating the concerns. For example, labour is sourced locally as far as is practicable, disruptions to grazing have not been experienced, and hazardous dumping of wastes has not occurred.

### 5.3.6 Housing and Recreational Facilities for TKBV Staff

The team involved in the seismic survey will put up camp(s) away from populated areas, but position them in such a manner as to effectively and efficiently traverse the project area. Such camps should be located in areas that are fairly secure. Other key considerations when siting the base camp(s) will be availability of easy access, water, and a source of fresh farm produce for use by employees at the base camp. The company may therefore consider drilling a borehole of their own to avoid conflict with the local population on sharing the scarce water resources.

### **5.3.7 Corporate Social Responsibility**

The EIA team made extensive field visits in the project area, held public meetings with the local people and administered questionnaires to households. While the community members are aware that TKBV cannot provide all their needs, they requested the company to consider a number of projects, which will be beneficial to the communities as part of their CSR.



## **CHAPTER 6:**

### **ANALYSIS OF PROJECT ALTERNATIVES**

#### **6.1 INTRODUCTION**

Alternatives to the project are defined as functionally different ways of achieving the same end (CEA Agency, 1997). Currently, seismic testing, both on land and in marine settings, is a critical and proven technology for refining knowledge about geological formations with a relatively high potential for containing petroleum hydrocarbons in commercial quantities. There are no functionally different alternatives for defining potential for hydrocarbon resources that are not cost prohibitive.

Under the “no-go” or “no-action” alternative, the project does not go ahead, thus the status quo remains. Oil and gas production, however, cannot occur in the absence of exploration activities. It should be noted that this project is a data acquisition project that will enable evaluation of the newly acquired data to identify potential oil and gas prospects. If no oil and gas prospects can be delineated based on the data acquired, then the project will end at that point. If, however, the data indicates that potential oil and gas prospects are likely, then the project would move on (with a time interval of several months during which the seismic data will be processed and analysed, and likely prospects delineated) to an exploratory drilling phase to determine actual presence and amounts of oil and/or gas. In this case, a new EIA would have to be carried out. As a precursor to the drilling of petroleum exploration wells, seismic acquisition is an accepted and well-developed method of petroleum reservoir delineation. While surface mapping, gravity, magnetics, and other forms of geophysical exploration are commonly employed to further understand the geological character of a sedimentary basin, they are generally considered complimentary techniques rather than stand-alone methods of data collection and interpretation. It is, therefore, considered that the proposed seismic acquisition activity is the only viable means to assess the hydrocarbon prospectivity of the 12A license area. If the project does not go on at this stage, then the potential benefits that have been outlined in Chapter 1, section 1.5.3, will stand foregone.

#### **6.2 PROJECT SITE ALTERNATIVES**

One alternative to the project is to leave the assigned project area. The Kenyan Government through previous exploration work by various companies has identified a number of ‘blocks’ with potential for oil and gas. These blocks are found in the Coast, Eastern, North-Eastern, Nyanza (Nyanza Trough) and Rift Valley Provinces (including their inland waters) and Kenya’s territorial waters and exclusive economic zones in the Indian Ocean. TKBV has been granted the exploration licence for Block 12A in the Kenya Rift Valley; therefore, the concept of ‘alternative site’ does not apply as each block within the country is agreed upon by the Government of Kenya and the interested party and subsequently licensed. Other blocks have been licensed to other companies under the terms of the PSC, and some of these have already been approved and licensed by NEMA to carry out onshore (land-based) and offshore (marine) seismic surveys. A number of companies have recently completed onshore and offshore seismic surveys with no reported adverse environmental impacts.

#### **6.3 SURVEY DESIGN ALTERNATIVE TECHNOLOGIES AND RECOMMENDATIONS**

The technology to be employed for the seismic survey is the latest state-of-the-art for activities of this nature, and has been outlined in Chapter 2. Around 500 line kilometres of seismic data acquisition will be carried out in the project area. The company will construct a number of seismic survey lines (track lines) along which seismic data will be collected. The seismic survey operations and related activities will be constrained to the seismic survey

lines once they are confirmed, and to the base camp, fly camps and access roads to these areas within the block 12A. On an area-wide survey such as this, there is considerable scope to adjust line placements and program size to bypass habitations or areas of particular sensitivity. A detailed evaluation of each line will be carried out as work progresses and line placements will be adjusted to achieve the survey objectives (see section 2.4.1) with minimum disruption and impact to the environment and resident communities. Thus, the actual coordinates of the proposed survey lines on land shall be based on analysis of pre-existing data and the information acquired on the area through this EIA study, and will be subject to adjustments based on specific issues or conditions encountered when the operation is ongoing. Two methods will be used to generate the seismic waves (1) Truck mounted Vibroseis units, and (2) dynamite charged shot-holes for land-based seismic data acquisition.

The following equipment which will be dedicated solely to the proposed seismic survey activity that will be carried out in Block 12A:

- Seismic source generators (Vibroseis and dynamite charges for land-based data acquisition);
- Data recording truck;
- Transport equipment: e.g. trucks, pick-ups, 4WD vehicles;
- Communication equipment including handheld satellite phones, and vehicle-mounted VHF radio, and will also establish a communication base station at the main camp site;
- Mulchers, bulldozers, and light-cutting hand-held equipment for clearing of seismic lines;
- Surveying equipment;
- GPS equipment;
- Small drill-rigs;
- Uphole drill rig;
- LVL shallow seismic refraction kit;
- Associated electronics, data processing and printing equipment, and;
- Ambulance.

Additional equipment and facilities that will be available will include:

- Fully serviced and self-contained base camp for all personnel and equipment;
- Adequate fire-fighting equipment, and first-aid kits;
- Fully equipped clinic for medical care of the personnel, and;
- Emergency trained paramedic(s).

### **6.3.1 Acoustic Source Technologies**

#### **6.3.1.1 Vibroseis**

In this case, truck-mounted “vibrators” provide the primary source.

##### **(a) Alternative Technologies**

The Vibroseis technology (see section 2.3) is a state-of-the-art technology that is widely used to carry out seismic surveys around the world. The only other alternative to Vibroseis is using a dynamite shot-hole (discussed in section 6.3.1.2 below). The commonly used vibrators generate a peak force of 282 kN (63,500 lbs). Vibroseis is generally preferred over dynamite shot-holes for the following reasons: lower cost than dynamite operations; vibrator settings can be adjusted in the field and hence can greatly improve the results of a survey;

and Vibroseis source points can easily be recorded again if for some reason the reflected signals are not of the required quality.

### **(b) Recommendations**

Vibroseis units have the advantage of not requiring shot-hole drilling crews or detonation materials. However, in wooded areas these large vehicles require much wider lines to be cut or mulched and in water-logged soil the tyres may cause surface damage. Vibroseis will accordingly be restricted to dry, sparsely vegetated areas. Given the semi-arid to vegetative conditions of the project area, and the fact that, there are many river floodplains which support dense riverine vegetation, and most of the areas are hilly with steep scarps, Vibroseis is the preferred option for seismic survey in the flat-lying, less vegetative or gently undulating areas, while dynamite shot-holes would be preferred in the more rugged, steep hilly ridge and scarp areas.

#### **6.3.1.2 Dynamite Shot-holes**

In this case, a small charge of explosive is placed in a narrow-diameter hole drilled five to fifteen metres into the ground, before being detonated remotely. Depth of hole, charge size, and type of explosives can affect the final quality of seismic data. These will be determined through parameter testing which will be undertaken during project start-up phase.

### **(a) Alternative Technologies**

The only other alternative to dynamite shot-holes is Vibroseis (discussed in Section 6.3.1.1 above). Dynamite shot-holes are normally used in cases where Vibroseis method cannot be utilized, such as areas with steep slopes or rough terrain.

This method has some constraints. As earlier mentioned, shot-hole depth, charge size, and type of explosive must be predetermined prior to the actual survey: none of these variables can be easily adjusted to improve data recovery, while Vibroseis field testing is easily conducted to determine optimum sweep frequencies and sweep lengths.

### **(b) Recommendations**

This technique will be useful and effective in hilly, rugged and steep terrain, in dry or water-logged terrain, as well as in sensitive areas such as cultural and archaeological sites and highly vegetative areas. However, given the strong winds particularly in the northern section of the project area (Lokori area), geophones may have to be buried (not pinned in at the ground surface), and thus may cause considerable delay in acquisition of the seismic data along the line.

Both hand-powered and machine-powered drill units will be used according to the hardness of the ground and depth of hole. There will be man-portable units in areas where access is very limited and a low-impact technique is required. In most areas, however, drill units will be mounted on wheeled or tracked vehicles as the terrain requires. The drilled “shot” holes are usually destroyed by the detonations and will be backfilled on the surface after use. With this form of acquisition, seismic lines need only to be around two to three metres wide and can be meandered to avoid mature vegetation.

A flexible approach will be taken in the technique employed for shot-hole drilling. Either a tractor or man-portable rotary type rig capable of drilling up to 20m deep holes will be employed. A small tractor would be able to traverse the reasonably dry sections of line cleared by the mulcher. In wetter areas (such as in river flood plains or water-logged areas), a low impact man-portable shallow shot-hole drill rig, which could either be rotary or of a

flush nature, could be used providing that the underlying rock is not close to the surface and a source of water is close by. In wet areas, flush drill must be used and the depth of the achievable hole will depend on logistics and subsurface geology.

In some areas, the near surface geology consists of a thin soil cover over hard rocks that may in turn overlie loose unconsolidated materials beneath. To ensure that majority of the energy from the shot is focused downwards it will be necessary to employ a drilling technique capable of penetrating the overlying hard layer of rock and passing through the unconsolidated layers beneath to place the charge at a suitable depth. In such drilling conditions, a sonic drill would be ideal: however, it may well be possible to achieve the desired depth by using a drill with a combination hammer bit and rotary head, with a compressed air-lift or pumped water-lift technique.

### **6.3.2 Line Cutting Technologies**

#### **(a) Alternative Technologies**

A few decades back, the lines used to be cut using bulldozers: this was not considered environmentally friendly because they removed vegetation entirely, as well as scraped off surface soils. The current state-of-the-art technology is the use of mulchers. The mulching units are self-powered vehicles mounted on low ground pressure tracks or wheels exerting only 3-3.75 psi pressure on the surface. These machines cut low-lying vegetation and leave behind fine, rapidly bio-degradable nutrient-rich mulch in their wake with seeds intact. Soil structures and root systems are also left intact. Regeneration of mulched vegetation is rapid and even in arid areas vegetation returns to its pre-cut state in one to two years.

#### **(b) Recommendations**

Line cutting will not be necessary in some parts of the project area on account of the bare or sparsely vegetated surface with thin soil cover overlying hard rock beneath. In areas where line cutting will be necessary, the method used will range from bulldozers, to the use of mulchers to clear areas with relatively dense vegetation. The mulchers will cut a track of 2.5 metres in width without disturbing the top mat of soil. Use of mulchers completely removes the need to have bulldozers and chainsaws on the crew and therefore eliminates significant safety hazards.

### **6.3.3 Access Road Technologies**

As far as is practicable, existing routes will be used to reach the seismic line acquisition areas. Where this is not possible, access roads may have to be constructed. These are typically done using a bulldozer (e.g. Caterpillar D8R or equivalent) and light hand-cutting of vegetation using machetes. Some lines may have to be bulldozed to allow access for the Vibroseis vehicles. Such routes should also be planned in liaison with the area authorities and community leaders, and there should be a win-win approach to this so that such access roads can benefit the local communities once the project is over.

### **6.3.4 Seismic Data Recording Equipment**

This will include a recorder and computer workstation mounted in a truck, cables with attached geophones (cables can be several kilometres long), and geophone testers.





**Plate 6.1: Typical seismic recording truck.**

### **6.3.5 Communications Equipment**

The area has an unreliable, low coverage and patchy communications network particularly the northern section of the project area. Communications equipment that would be used would include VSAT, hand-held satellite phones, vehicle mounted VHF radios, and mobile phones. Communications will be coordinated through a central communications base station that will be set up at the base camp. There are several technological options offered by communications equipment supplies companies. The option selected should be based on assessment of the peculiar requirements in the project area.

### **6.3.6 Surveying Equipment**

Once the seismic line coordinates have been determined, it will be necessary to carry out a survey before line cutting commences. Typical survey instruments would include, for example, the survey instrument itself (e.g. RTK), hand-held GPS, and plotters to print out the survey line maps. There are several state-of-the-art technological options that TKBV can choose from.

### **6.3.7 Transport Equipment**

This will include the following: normal saloon/station wagon 4WD cars, pickups, water tanker, fuel tanker, personnel carrier, Vibroseis service truck, recording truck, line-layout truck, food transport truck, drill rig trucks and ambulances. Selection of the appropriate make and type of this equipment will be done later by the seismic contractor, based on a consideration of the environmental setting and challenges posed to vehicles. Crew changes will usually take place via small aircraft.

Seismic surveys are a specialised technical area, and alternative methods and technologies are limited. The survey technique and equipment specifications for the proposed seismic programme are considered to be necessary for the acquisition of quality data to allow geological evaluation and the safe and optimal development of the Block.

## CHAPTER 7:

### ENVIRONMENTAL IMPACT ASSESSMENT

#### 7.1 INTRODUCTION

The baseline biophysical and social environmental parameters established in Chapter 3 are critically examined in this section in relation to the potential environmental and socio-economic impacts of the proposed onshore and offshore seismic survey. In addition to adhering to the mitigations below, the proponent needs to comply with the requisite national legislation and regulations that are outlined in Chapter 4 of this report.

It should be noted that seismic surveys are of short duration, typically less than three months, and are generally considered to be a low impact activity that generally permits the immediate return of the operational sites to its previous land use. This is indirectly supported by the fact that a suite of seismic surveys have already been conducted in the onshore and offshore (marine) areas of Kenya, and no adverse or long-lasting impacts have been reported from these activities. All such seismic survey EIA project reports that have previously been submitted have been approved by NEMA.

This Chapter identifies the potential environmental and social impacts of the proposed project, based on the components of the proposed survey (Chapter 2), and in the context of the baseline conditions that have been established in Chapter 5, and with due regard to applicable legislation described in Chapter 4. The predicted impacts are then assessed using the methodology outlined in Chapter 3, section 3.2, and appropriate mitigation measures are determined.

#### 7.2 ENVIRONMENTAL AND SOCIAL ASPECTS IDENTIFICATION FOR THE ONSHORE (LAND) SURVEY

The components of the seismic survey and survey-related activities that have been outlined in Chapter 2 and that could result in environmental and social impacts are indicated in Table 7.1 below.

**Table 7.1: Project impact sources, prediction of impacts on environmental and social structure and characteristics of the project land area.**

	Environmental or Social Parameter	Impact Source	Predicted Impacts
1.	• Physiography and Geology	• Vibroseis and associated equipment • Bulldozer • Dynamite shots	• Cut lines leave long-lasting residual impacts (tracks on landscapes) • Vibrators/bulldozers and dynamite use near steep slopes may lead to minor landslips and rock topples
2.	• Soils	• Vibroseis and associated equipment • Bulldozer • Transport Vehicles • Oil or chemical leaks from vehicles and machinery, garage and storage areas	• Compaction of soils along cut lines • Disturbance of soil along cut lines • Cut lines may enhance gulley formation and erosion (wind and water) • Rutting in loose soils • Contamination of soils
3.	• Air Quality	• Vehicles and machinery • Sanitary systems • Waste disposal points • Camp cooking facilities	• Pollution from exhaust and other gaseous emissions • Fugitive dust generation from traffic • Offensive odours • Health risks
4.	• Surface and Groundwater Resources	• Water supply source for the camp	• Conflict with neighbouring communities if water source is shared

		<ul style="list-style-type: none"> <li>• Heavy vehicles and machinery</li> <li>• Drilling of shot holes</li> </ul>	<ul style="list-style-type: none"> <li>• Compaction of near-surface aquifers such as springs, reducing yield</li> <li>• Downward draining of groundwater through drill holes, reducing yield at springs</li> </ul>
5.	• Water Quality	<ul style="list-style-type: none"> <li>• Liquid effluent discharges from sanitation systems at the campsite</li> <li>• Oil or chemical leaks from garage and storage areas, vehicles and machinery</li> <li>• Subsurface detonation of dynamite charges</li> </ul>	<ul style="list-style-type: none"> <li>• Contamination of water supply source for the camp</li> <li>• Contamination of underlying aquifers</li> </ul>
6.	• Terrestrial Environment (Habitats, Flora, and Fauna)	<ul style="list-style-type: none"> <li>• Vibroseis and associated equipment</li> <li>• Mulchers</li> <li>• Bulldozer</li> <li>• Transport vehicles</li> </ul>	<ul style="list-style-type: none"> <li>• Cutting of vegetation along cut lines</li> <li>• Disturbance of wildlife (physical presence and noise)</li> <li>• Introduced weeds and pests</li> <li>• Trampling of meso and micro fauna</li> </ul>
7.	• Aquatic Environment (Habitats, Flora, and Fauna)	<ul style="list-style-type: none"> <li>• Vibroseis and associated equipment</li> <li>• Mulchers</li> <li>• Transport vehicles</li> </ul>	<ul style="list-style-type: none"> <li>• Cutting of shoreline and riverine vegetation along cut lines</li> <li>• Disturbance of coastal and riverine aquatic animals (physical presence and noise)</li> <li>• Introduced weeds and pests</li> <li>• Trampling of meso and micro fauna</li> </ul>
8.	• Land Resources and National Parks	<ul style="list-style-type: none"> <li>• Vibroseis, mulchers and associated equipment</li> <li>• Dynamite shots</li> <li>• Vehicles</li> <li>• Presence of humans</li> </ul>	<ul style="list-style-type: none"> <li>• Cut lines affect pastoral resources</li> <li>• Disturbance of animals and resources in National Parks</li> </ul>
9.	• Archaeological, Historical and Cultural Sites	<ul style="list-style-type: none"> <li>• Vibroseis and associated equipment</li> <li>• Vehicles</li> <li>• Dynamite shots</li> </ul>	<ul style="list-style-type: none"> <li>• Compaction by heavy vehicles and machinery may damage soils and rocks on cultural sites</li> <li>• Compaction by heavy vehicles and machinery may damage soft sediment deposits on archaeological sites near Lokori/Kangatet</li> <li>• Seismic operation vehicle access may disturb graveyards, cultural sites and soft sediments in archaeological sites</li> <li>• Friction between local communities and seismic crew workers</li> </ul>
10.	• Visual Aesthetics	<ul style="list-style-type: none"> <li>• Campsite design</li> <li>• Cut lines</li> </ul>	<ul style="list-style-type: none"> <li>• Incongruent campsite design does not blend in with the environment</li> <li>• Landscape aesthetic value diminished by cut line footprints and vegetal cover removal</li> </ul>
11.	• Noise and Vibrations	<ul style="list-style-type: none"> <li>• Vibroseis and associated equipment</li> <li>• Dynamite charges and associated equipment</li> <li>• Vehicles traversing the area</li> </ul>	<ul style="list-style-type: none"> <li>• Disturbance to humans, animals and livestock</li> <li>• Disturbance to workers</li> <li>• Health risks</li> </ul>
12.	• Solid and Liquid Wastes	<ul style="list-style-type: none"> <li>• Campsite</li> <li>• Workplaces in the field</li> </ul>	<ul style="list-style-type: none"> <li>• Pollution of surface soils, water and groundwater</li> <li>• Offensive odours</li> <li>• Health risks</li> </ul>
13.	• Social Characteristics	<ul style="list-style-type: none"> <li>• Workforce influx</li> <li>• Activities along the seismic survey lines</li> </ul>	<ul style="list-style-type: none"> <li>• Possible increase in crime and promiscuity</li> <li>• Possible increase in number of students dropping out of school in search of jobs</li> <li>• Erosion of culture and social values as a result of intercultural association.</li> <li>• May interfere with grazing lands and</li> </ul>

			watering points • Friction between local communities and migrant workers • Increase in communicable diseases and STDs
14.	• Economic Characteristics	• Employment opportunities • Tenders and supplies	• Improved livelihood • Improved short-term business opportunities for the locals • Potential CSR project benefits Influx of cash into low-cash rural economies
15.	• Occupational Health and Safety	• Campsite and fieldwork environment	• Injuries to workers, visitors and area residents arising from project operations • Fire hazard • Other health risks
16.	• Security and Public Safety	• Workforce security needs	• Improvement in security due to security enhancement for project activities

### 7.3 IMPACTS ASSESSMENT AND MITIGATION FOR THE ONSHORE (LAND) SURVEY

#### 7.3.1 Physiography and Geology

Given that most of the project area is highly vegetated and hilly with steep scarps except on the northern section of block where the vegetation density is sparse, impacts identified (Table 7.1) will be adverse if the mitigation measures mentioned in chapter 8 are not observed. The area, although in an active tectonic setting, has low earthquake and landslide risk. However, the two basins (Baringo and Kerio) are flanked by steep hills and escarpments and the floors of the basins are characterized by step-faulted scarps – such areas might be sensitive to minor landslip or rockfalls triggered by induced vibrations during the seismic survey. Minor landslips may occur due to Vibroseis/dynamite use in the steep slopes of the western, Central and Eastern margin hill ranges and scarps, or in the extensive relic and active alluvial fan network along the major rivers and colluvium sediments of the two basins. Some cut lines will touch on the east or facing scarps and slopes of the craggy hills and ranges marking the western Escarpment (e.g. Elgeyo Escarpment and Tugen ranges) and eastern borders of the project area (Tangulbei step-faulted scarps and Laikipia Escarpment), raising the potential of rock scarring. The risk of subsidence due to passage of heavy vehicles is lower still in larger part of the block, except in few cases such as in the Lorusio Hot Spring area where there exist underground fault lines (sinkholes) that may result in subsidence when heavy vehicles and machines pass over the area (Chapter 5, Section 5.2.5.2), and also localised compaction of surface soils may occur in some places.

There are few existing road networks in the area, especially in the northern region (Lokori), and the eastern side in Kamuge and Suguta Valley. The road network is poorly developed in these areas with accessibility by road currently being almost impossible in some parts. Accessing the eastern side of Lake Baringo and Lake Bogoria by road is not possible because of lack of access roads. Thus, access roads of only a few kilometres in length may need to be constructed to allow for the seismic survey. The southern region of the block has a relatively good road network of both tarmac and earth roads that run both north-south and east-west, and which will abet access to the proposed survey lines. Most of the perennial rivers, except the Kerio and Suguta, are found only in the southern part of the project area. These can only be crossed at the existing road crossings. The highly dissected, incised and rugged topography particularly in upland and foot slope areas might impede easy movement during the seismic survey.



**Mitigation:**

- Use existing access roads to the extent possible;
- Pre-survey possible access routes, and use the selected routes rather than accessing work sites through free-ranging driving across the open country;
- Explosives (dynamites) should be used as source of acoustic energy instead of Vibroseis in areas with highly dissected and incised surface (section 4.3.3 and 4.3.4);
- When laying cut lines, off-road driving should be discouraged to avoid creating unnecessary tracks and trampling of pasture;
- Minimise to the extent possible, the use of bulldozers to open up cut lines and access roads to minimise landscape scarring;
- Avoid cut lines on slopes steeper than 40° to minimise risk of landslips and rock topples;
- Optimise source energy to achieve the survey objectives to minimise risk of landslips and rock topples;
- Buffer zones should be maintained from areas posing landslide and topple hazards.

The potential residual impacts would be related to scarring, and displaced sediments and boulders that may arise from landslips and rock topples related to use of the Vibroseis and dynamite shots.

**7.3.2 Soils**

There are a number of different types of soils in the project area, each with its unique geological, chemical and physical properties, as well as anthropogenic footprints such as compaction by grazing animals, that are relevant to a number of issues that would need to be considered when executing the project. These issues include: ecosystem services, e.g. the role of soil in support of vegetation and higher food chain members; flooding and ponding potential, as well as erosion via surface runoff, and their resultant geomorphologic features, soils nutrients mining and deposition; wind deflation, transportation and deposition of soil-derived particulates; organic matter content, surface sealing and capping; agricultural potential, etc.

In the areas where the soils have high sand content and/or have shallow to moderately deep loamy or sandy soils, particularly the hills, step-faulted scarps of the Rift Valley, foot slopes, plateaus/high level structural plains and lava flows, the effect of compaction by vehicles and machinery will be slight. However it would be prudent to stick to designated routes to minimize the effect as much as is practicable. Soils of the floodplains, piedmont plains, step-faulted floor of the Rift Valley and uplands are more susceptible to compaction. This is due to the degrading conditions of the soils, a result of human interference (vegetation removal for settlement/irrigation practice causing soil exposure and overgrazing by livestock), sodium content of surface soils, shallow depth and their higher clay contents. These soils therefore, would likely be compacted to a significant extent. However, if these soils are adequately dry (soil moisture content below the plastic limit) when activities occur, and vehicles minimize the number of times they drive across them, compaction should be minimal and soil productivity (as measured by a plant's ability to grow) should not be noticeably affected. Designated routes should be adhered to as much as practicable during vehicular and machinery movement.

**Mitigation:**

- Machinery and equipment should use existing routes as much as is practicable to avoid compaction of the surface soil (section 4.4.5);

- Any excessive damage to drainage channels caused by seismic activities should be repaired;
- Luggas should be crossed at road crossings, where such crossings exist, or in areas where the bank heights are less than 1m – banks at the lugga crossings should be mechanically restored;
- Vehicles should steer away from natural drains and waterways as is practicable, but a buffer zone or dog-leg should be maintained except at crossing points;
- Minimize vegetation and grassland clearance as much as possible when cutting the survey line transects (section 4.4.5);
- Seismic survey should be carried out only during the dry periods and vehicle movements should be minimised during wet periods;
- Use only essential and low pressure/impact tyres on vehicles in areas with wet soils or that are susceptible to flooding and/or ponding;
- Ensure that all vehicles and machinery operating in the field (and in the campsite) do not have any oil leaks that could contaminate the soils (section 4.3.7).

The potential residual impacts would be enhanced gulleying and erosion due to altered runoff and drainage patterns at local scales.

### 7.3.3 Air Quality

Dust emanating from preparation of seismic cut lines, base camps and access ways as well as that generated by moving trucks and equipment, is likely to contribute to transient air pollution. Further, the disturbed surface could be susceptible to wind erosion. In addition, burning of litter generated at the camp (e.g. paper, cartons), exhaust fumes from the fleet of seismic survey trucks, service vehicles and any other machinery used during the proposed seismic survey are likely to contribute to air pollution. The effects of these particulate/aerosol pollutants on air quality will be transient and localized.

#### ***Mitigation:***

- Limit traffic speed and restrict movement of vehicles as is reasonable to minimize sand and dust generation. Field vehicles, trucks and any other machinery should be switched off when not in use as appropriate. Vehicle speeds to be monitored using Vehicle Tracking Systems (VTS);
- Employees working under dusty conditions should be provided with dust (face) masks;
- Minimize vegetation and grassland clearance as much as possible;
- If camp waste material is to be burned, this should be done at a time of low wind movement, preferably in areas shielded by vegetation;
- Regular servicing of all trucks, service vehicles, and any other machinery should be undertaken to ensure optimal energy use efficiency;
- Periodic watering of ground surface in the camp areas is recommended to reduce dust levels especially during dry periods/seasons.

### 7.3.4 Surface and Ground Water Resources

The project area, being rural and undeveloped, lacks a mains water supply. Water is sourced from shallow wells, shallow to deep boreholes, springs, rivers and luggas, and the lake (Baringo). The water's patchy distribution, and the low, erratic and unpredictable rainfall, particularly to the northern section of project area means that water is generally scarce in most of the area and especially to those who are living far away from the perennial rivers. This scarcity has led to human-human and human-wildlife conflicts. The seismic crew will also need to access safe potable water. Effluents generated at the campsite(s) will also need

to be managed so as not to contaminate any underlying shallow, unconfined aquifers or rivers and luggas because the livelihood of the locals depends on these water sources.

Shallow groundwater aquifers occur in the volcanic rocks throughout the project area, and could potentially be compacted by Vibroseis and other equipment, thereby reducing yields. Drill holes can potentially affect the shallow groundwater flow near springs. They may, for example, penetrate underlying confining strata, which would allow groundwater to drain downward, rather than flow laterally to a spring. It is highly improbable that the drill holes could penetrate artesian aquifers as these are unknown in the area, and the shot holes will be very shallow.

**Mitigation:**

- A water supply borehole should be drilled to provide the water required for the project; this could be donated to the community on completion of the seismic survey;
- It is recommended that an efficient and monitored water use policy be adopted by the project proponent at the camp site and other work areas (section 4.4.3);
- An efficient sanitation system should be put in place in the campsite(s) to handle effluents (section.4.3.8);
- Hazardous and toxic waste material should be managed according to OGP practices and in compliance with Kenyan legislation, specifically the Environment Management and Coordination (Waste Management) Regulations;
- Buffer zones will be maintained between cut lines and water sources such as wells and springs (sections 4.3.10, 4.4.3);
- When water is encountered when drilling shot holes, bentonite could, in conjunction with a concrete insert, be used to plug the hole up to 3m above the static water level or to a depth of 1m from the ground surface;
- Ensure that any in-field refuelling or maintenance is performed while using a drip tray with a spill-kit available;
- Ensure that all drivers and technicians are familiar with drip-tray and spill-kit use through daily tool-box talks.

Residual impacts on surface and groundwater resources are not expected if the mitigations outlined above are implemented.

### **7.3.5 Water Quality**

Liquid effluent discharges and oil or chemical leaks at the campsite, if not properly managed, can potentially lead to pollution of underlying shallow groundwater and storm run-off. Along the cut lines, subsurface detonation of charges would leave localized small residuals of gases and solids (i.e., water/stream, carbon-dioxide gas, nitrogen gas, calcium carbonate solid, and sodium carbonate gas). The shot-hole method could also lead to clouding of spring waters for up to several weeks. Oil leaks from vehicles operating in the field and parked at the campsite can also potentially pollute underlying groundwater. Water quality and quantity monitoring programs should reflect the possible impacts of the project/activities undertaken. In addition, the program should reflect the possible seasonal and impact changes in volumes, chemical, physical and biological characteristics of the water courses, water bodies and aquifers in the project area. The removal of the vegetative cover and the associated vehicular movement along the access roads could provide pathways for the increased transportation of eroded sediments towards the rivers.

**Mitigation:**

- Campsite should be located in an area with a deep water table and overlain with clayey soils;
- Pits for disposal of domestic and sanitary effluents should be sited with knowledge of the geological and soil characteristics of the area;
- Buffer zones will be maintained between cut lines and water sources such as wells and springs (section 4.3.10);
- When water is encountered when drilling shot holes, bentonite may be used to plug the hole up to 3m above the static water level or to a depth of 1m from the ground surface;
- Ensure that all vehicles and machinery operating in the field (and in the campsite) do not have any oil leaks that could contaminate the soils (section 4.3.7) through daily vehicle checks;
- Refuelling areas should be underlain with spill-proof hard standing or bund, with spill-kits readily available and operatives trained in their use;
- Hazardous and toxic waste material should be managed according to Kenyan national protocols and practices.

Residual impacts on water quality are not expected if the mitigations outlined above are effected.

**7.3.6 Terrestrial Environment (Habitats, Flora, and Fauna)**

The environment has various habitat characteristics that include near barren landscapes, moderately dense grassed bushland, scattered bushland, wooded bushlands, thicket, forest and riverine forests. These habitats are constantly evolving in line with the major erosive influences and geological setting, most notably the Great Rift Valley. The most significant erosive devices are wind and water and the impacts of these on the various ecosystems vary from habitat to habitat. However, in the southern tip of the block the available ecosystems have been disturbed following the high level of anthropological interference, namely; settlement, deforestation, and agricultural activity. Agricultural activities in the block were supported by major groundwater and surface water systems. These systems included: Elmololo, Waseges, Pekerra, Lobo and Kerio.

All the same, the region exhibits a great capacity for regeneration. If not significantly altered it will revert back to its original self.

Anticipated impacts to the terrestrial environment include:

- Clearance of lines for the purpose of seismic survey. This may leave the land bare and susceptible to agents of erosion. However, the extent of the exploration is not anticipated to lead to significant habitat loss and/or biodiversity decline since the typical area necessary for 2D seismic survey is limited in extent;
- Noise and vibrations from the vehicular movement and transport of machinery is anticipated to cause some disturbance especially amongst the wildlife;
- Possible emergence of human-wildlife conflict if seismic activity is to be conducted in areas with high wildlife concentration like Lake Kamnarok National Reserve and Lake Bogoria National Reserve;
- Disruption of the traditional systems of grazing, small-scale and sustainable agriculture and fishing industry;
- There will likely be an increase in human population associated with the anticipated workforce influx, ultimately leading to an increase in exploitation of the natural resources;



- It is also likely that there will be an increased in anthropogenic solid and liquid wastes produced in plastic water bottles and bags, hazardous waste as well as general solid waste will increase as a result of the said activity;
- Due to the dense nature of the vegetation and rugged terrain in some areas of the block, TKBV will have to carefully plan the routes in which they lay seismic lines to avoid excessive vegetation clearance. TKBV should avoid forested areas, dense bushes and felling mature trees.

**Mitigation:**

- Mitigations to soils (7.3.2), noise and vibrations (7.3.11) and wastes (7.3.12) apply;
- Trees with trunk diameter greater than 20cm should not be cut;
- The risk of introduction of weed and pest species to the region via contaminated vehicles and equipment will be mitigated by the wash-down of all vehicles and ancillary equipment at a designated location;
- For areas with dense vegetation, seismic lines should be well planned to minimise to the extent possible the clearing of vegetation and mulchers should be used;
- Seismic survey activities to be undertaken during daylight hours only;
- Ensure that equipment are in perfect working order and cause minimal noise/air pollution nuisance to fauna;
- Wildlife shall have the right of way when they are of such a size that can be readily seen from vehicles;
- Foraging, hunting, feeding and trapping of wildlife by workers, when on and off duty, should be strictly prohibited. This prohibition should extend to the purchase of these items from the indigenous population by workers;
- Involve the KWS to ensure that wildlife disturbance and danger to seismic team is mitigated when work is being undertaken in parks.

### **7.3.7 Aquatic Environment (Habitats, Flora, and Fauna)**

The aquatic environments of the rivers in the region have not been well studied and its components are not documented (see section 5.2.6.2). Lakes Baringo and Bogoria are both found at the south of the block and do not cover a significant area of the block. However, these two lake ecosystems are ecologically sensitive and have been designated as Ramsar sites and are listed as Important Bird Areas (IBAs). The key anticipated impacts are expected to be clearance of riverine vegetation, and to a much lesser extent, noise and vibration impacts on aquatic wildlife. Necessary measures should be put in place i.e. survey of the area prior to line clearance to ensure that aquatic birds' nests on the banks of the Kerio and Suguta Rivers are not disturbed, and, in the southern sector of the block, that nesting and roosting sites of birds around Lake Bogoria and Lake Baringo are not disturbed.

**Mitigation:**

- Mitigation for soils (section 7.3.2) vegetation (section 7.3.6) and noise and vibrations (section 7.3.11) apply;
- Carry out vehicle and ancillary equipment cleaning to remove biofouling prior to departure from areas with known or potentially invasive species.

### **7.3.8 Land Resources and National Heritage Sites**

The area has numerous and varied land resources. However, the activities of the seismic operation are expected to have a minimal impact on the general well-being of the project area. Impacts are expected to be: clearing of vegetation to create cut lines, displacement of some individuals especially where seismic activity will be concentrated, an increase in noise

and vibration as a result of movement of vehicles, machinery and equipment and conflicting land use if the seismic activities coincide with national heritage sites.

**Mitigation:**

- As for sections 7.3.1 (Physiography and Geology), 7.3.2 (Soils), 7.3.6(Terrestrial Environment) and 7.3.7 (Aquatic Environment) above.

### **7.3.9 Archaeological, Historical and Cultural Sites**

Several sites recognised by the National Museums of Kenya (NMK) as well as the local communities were noted. Some of these sites are found around Lomelo, Katilia, Majimoto and Kabarnet. These sites have been documented and there is need to preserve them. The National Museums, under the National Museums and Heritage Act (2009) has jurisdiction over archaeological and cultural sites upon which it bestows recognition.

**Mitigation:**

- Consultations should be undertaken with NMK and local elders to help in identifying and avoiding any sensitive cultural sites during the survey in order to prevent conflict with the community;
- Use of shot points rather than Vibroseis is recommended for such areas;
- Seismic survey lines will not be planned to go through known cultural sites (section 4.4.4);
- Access routes and cut lines will be selected to provide sufficient offset to known cultural sites to avoid disturbing them: these offsets shall be determined in consultation with area leaders;
- All such sites will be flagged for avoidance (sections 4.3.2; 4.4.4);
- If archaeological materials are found during the operations, they should be left undisturbed marked with GPS, and the National Museums of Kenya personnel should be contacted to advise further on how to proceed;
- All project field workers must be informed, before commencement of operations, that any disturbance to, defacement of, or removal of archaeological, historical, or sacred material will not be permitted.

No residual impacts are expected.

### **7.3.10 Visual Aesthetics**

Limited disruption of the aesthetics of the pristine environment which is characterised by moderately dense bushland and grassland can be envisaged. Interferences will result from constructions within the base camp, geophysical survey traverse lines and access ways and the requisite infrastructure

**Mitigation:**

- Use of modern line cutting technology, preferably *mulchers* for clearing of the geophysical survey transects will ensure that natural re-vegetation will occur in a much shorter period since the seeds and branches will be left along the traverses and this will promote re-growth when it rains;
- Backfilling any excavated and remediation of degraded areas (e.g. lugga crossings) should be considered;
- Access tracks to lines will be 'dog-legged' at road intersections to prevent road users from seeing the lines;

- Minimize use of bulldozers on sensitive landscape.

### 7.3.11 Noise and Vibrations

The use of heavy and light vehicles, Vibroseis machinery and dynamite charging, and power augers for shallow drilling is likely to be a source of noise and vibrations. The base camp site can also be a source of noise pollution especially if generators are used to generate electricity for use in the camps.

Some noise-sensitive areas (e.g. National Reserves, schools, hospitals and residences) are found in the project area. However, no significant impact is anticipated due to the localized and temporal nature of this project and its expected noise levels. The length of time the seismic crew spends in any one location is short, with up to 10 km per day of acquisition possible in good weather conditions. This will reduce the overall noise impacts on localised residential receptors to less than one day of actual disturbance.

#### ***Mitigation:***

- To reduce the expected transient impacts on wildlife, noise levels will need to be minimized to the extent possible, correct strength of dynamite charging and Vibroseis use applied to achieve the survey objectives, and human contact with wildlife should also be minimized in line with the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, and the Wildlife Conservation and Management Act;
- All seismic operations will be carried out only during daylight hours;
- Limit the energy generated from Vibroseis trucks and dynamite charging by generating only the required level of acoustic signal strength to achieve the survey objectives. Personal protective equipment should be used by seismic crews in such cases;
- Provision of full protective gear for workers, like helmets and earplugs, is recommended. Workers should also be sensitized on hazards likely to be encountered in such work environment;
- The suggested restriction for seismic source detonation close to wells, springs, buildings and/or settlements will be based on International Association of Geophysical Contractors (IAGC) Guidelines;
- Community Liaison Officers (CLOs) will meet with local leaders to sensitize the communities in the vicinity of the seismic operation areas about the project and its possible noise and vibration impacts. The communities should be informed in advance when a seismic survey operation is to be executed along a given seismic transect/location;
- Monitor noise levels during the survey start-up phase so that the noise and vibration levels do not exceed the internationally acceptable levels and that appropriate personal protective equipment such as ear defenders are used by seismic when detonating the dynamite charges and/or when working near the Vibroseis or other loud machinery;
- To reduce the expected transient impacts on wildlife, noise levels will need to be minimized to the extent possible, including the appropriate dynamite charge size selection and Vibroseis use applied to achieve the survey objectives;
- Human contact with wildlife should also be minimized in line with the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, and the Wildlife (Conservation and Management) Act;
- The affected communities should be informed in advance when a seismic survey operation is to be executed along a given seismic transect/location;

- Use generators with minimal noise production at camp sites and effect a noise mitigation policy for all operations in accordance with the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations.

### 7.3.12 Solid and Liquid Wastes

As a result of the proposed project, it is expected that waste will be generated by the survey crew e.g. cans, wrappings, paper, plastics. Plastic waste is of particular concern especially if ingested by livestock, and for its environmental pollution effect. Waste oils and petroleum used in vehicles and exploration machinery may spill or leak on/into the ground, hence polluting the soil or water system within the project area. This may degrade water quality and affect livestock and domestic water users in the project area.

#### **Mitigation:**

- Waste materials (at the camp and in the field working areas) should be segregated into non-hazardous and hazardous waste, and consideration given to re-use, recycling, or disposal (sections 4.4.1, and 4.4.9) as appropriate;
- A waste management plan documenting the waste strategy, storage (including facilities and locations), handling procedures and means of disposal, should be developed and should include a clear waste-tracking mechanism to track waste consignments from the originating location to the final waste treatment and disposal location in compliance with the Environmental Management and Coordination (Waste Management) Regulations;
- Hygienic sanitation and disposal of grey and black water will be covered in the waste management plan in order to protect the general health of the workers and the general public;
- Ensure that all waste generated along seismic lines during operations is returned to the base camp for segregation and disposal as appropriate;
- No smoking will be permitted on the seismic line;
- Ensure that solid waste is removed from site for recycling/disposal only by an authorised (by County Council) waste handler;
- Fuel and other non-aqueous liquid storage areas should be banded;
- Servicing of equipment should be carried out in a designated and lined garage area which has readily available spill-kits. Workers in this area will be regularly briefed on spill prevention.

### 7.3.13 Social Characteristics

The local communities are very conservative especially to the Northern parts of Block 12A, with respect to their culture. Due to influx of many people in the area, these cultures may be compromised or some communities may feel unease with the employees from the other neighbouring communities and may be considered as spies for their communities since the area is known for intercommunity cattle rustling. Owing to poverty levels in the area, school drop-out rates may also increase.

#### **Mitigation:**

- Employ Community Liaison Officers to keep communities informed prior to project mobilisation and on an ongoing, continual basis to ensure sensitization of the community and stakeholders *vis à vis* the project objectives, activities and scheduling, potential impacts;

- The communities should be informed well in advance of the start of the seismic survey operation and prior to execution along a specific seismic transect/location using appropriate wide-penetration communication media;
- Awareness campaigns can be undertaken to inform/educate both the local communities and project employees;
- During the seismic operations, disruption of livelihood activities in the area (section 4.4.6) should be avoided where possible, otherwise minimized.
- Provision to be made to compensate local property and landowners for any loss or damage caused by seismic operations. Compensation rates to be agreed with Government department before operations commence.

### **7.3.14 Economic Characteristics**

The infrastructure, especially roads within the project area to the north is very poor, insecure and not passable during wet seasons hence some cut lines may be useful to the local communities as access roads after seismic survey is done. The proposed project will offer limited, short-term, unskilled and semi-skilled employment opportunities to the locals. This may result in influx of people from other areas since the block encompasses several districts and several different tribes, and could lead to recruitment-related conflicts if not properly handled.

#### ***Mitigation:***

- Liaise with local community leaders during the recruitment process;
- Employment policies to be strategically managed to avoid inter-community conflict and similar problems caused by migrant labourers;
- Unskilled and semi-skilled manpower to be sourced locally as far as possible;
- Gender should be factored into the employment criteria;
- Sustained public awareness and sensitization about the proposed project should be continued throughout the project lifespan;
- Consideration to be made to educate local populace on cash management in a low-cash culture.

The residual impacts in this instance would mostly be positive, including short-term employment opportunities and infrastructure improvements if access roads are designed in such a manner that they would be useful to the communities post-project.

### **7.3.15 Occupational Health and Safety**

During the seismic survey, the workers, visitors and the local community may be exposed to occupational and health hazards. Accidents between vehicles or vehicles and humans or wildlife may occur. Workers could also be exposed to other risks in the field, such as landslips, rock falls and topples, fires, and attacks from criminal elements.

#### ***Mitigation:***

- All operations will be conducted in compliance with Tullow's EHS policy, international best practices and Kenya Government requirements (as set out in the Occupational Health and Safety Act and the Public Health Act (see also section 4.2.6 of this report);
- Appropriate and well-stocked first aid kits and fire-fighting equipment should be available to all crew, and specific crew members should be trained on first aid administration and handling of fire-fighting equipment (section 4.3.7);



- Job-specific personal protective equipment to be provided to the workers, training should be given, and their use made mandatory in designated areas (section 4.3.7);
- Environmental safety and health regulations and policies/plans must be adhered to (see sections 4.2.6 (Health Policy), 4.3.5 (Energy Act), 4.3.6 (Public Health Act), 4.3.10 (Local Government Act), 4.3.11 (Physical Planning Act), and 4.4 – NEMA Regulations);
- A Base Camp Clinic is to be provided, manned by suitably qualified field medical staff, licensed as appropriate to operate in-country, equipped with equipment and medication as appropriate, including ambulance vehicle(s);
- Adequate warning or cautionary signage will be posted as required;
- All electrical equipment shall be properly installed, earthed and regularly inspected, and where practicable will comply with IEE 17<sup>th</sup> edition regulations;
- Only properly trained and authorised employees shall operate equipment or machinery;
- Tullow driving policy and all other project-specific driving policies and journey management plans to be strictly adhered to and enforced;
- Provision of an Emergency Response Plan, Evacuation Plan, Medevac Plan, Malaria Management Plan and a communicable diseases education programme to be put in place.

No residual impacts are expected in this case.

### **7.3.16 Security and Public Safety**

Due to influx of outsiders in the project area, the locals, especially in the northern part of the block, feel insecurity may escalate. One of the reasons they indicated was that people from neighbouring communities may be able to spy on their herding habits then organise cattle raids. It should also be noted that the boundaries of different communities is not very clear in most parts of the area and often conflicts between the communities erupt in such areas. The increase in human activities, including vehicle and seismic exploration activities, could increase the potential for human anti-social behaviours including firearms use.

#### ***Mitigation:***

- Ensure that all workers can be identified by staff uniform and badges where applicable;
- Adequate security measures should be provided, e.g. perimeter fencing, safe havens and security manning at the campsites and whilst on line utilising Administration Police (APs) and Kenya Police Reservists (KPRs);
- The company should liaise with the Provincial Administration, the Kenya Police, KWS, Kenya Police Reservists and other agencies to provide adequate security during the seismic survey operation;
- Barriers (camp perimeter fence and gate) and guards will be installed as necessary to protect employees and visitors from physical hazards and criminal activity;
- Camp population will be forbidden from interacting with the local populace;
- Camp will be located at a significant distance from any local communities;
- Journey management policy and monitoring to be enforced.

A positive residual impact is the possibility that the involvement of government agencies during the project operations may enhance long-term security initiatives from the concerned parties, hence improving the security situation in the area.

### 7.3.17 Construction of the Campsite and Associated Facilities

The campsite will be constructed by the Seismic Contractor. Such campsites typically comprise of housing (accommodation, kitchen, mess, offices, clinic) and working / storage facilities (e.g. workshop, parking bay, generator house, fuelling station) that could be tented (with concrete base) and/or moveable steel container dwelling units. Other associated facilities include bathrooms, lavatories, refrigeration unit, water storage and processing unit, fuel storage areas.

***Mitigation:***

- Construction work should be carried out only during daytime hours;
- Minimize vegetation and grassland clearance as much as possible during construction (section 4.4.5);
- Construction workers to be provided with Personal Protective Equipment (PPE);
- All vehicles and equipment used should be in proper working conditions, with no fuel or oil leaks, and should be regularly serviced;
- Limit traffic speeds to 40km to reduce dust levels;
- Solid and liquid wastes should be managed as outlined in section 7.3.12;
- Occupational health and safety mitigations outlined in section 7.3.15 apply;
- Other more specific mitigations for: campsite construction, fuelling stations, camp clinic, and water borehole drilling are outlined in the EMP in detail in sections 8.9.17, 8.9.18, 8.9.19 and 8.9.20.

**Table 7.2: Existing environmental pressures and potential impacts of onshore (land) project operations on environmental and social factors in the project area (see Chapter 3, section 3.2 for impact assessment criteria and rating).**

Parameter assessed	Project Phase	Pressures/Impacts	Intensity High (H) Medium (M) Low (L)	Extent	Duration	Probability	Status	Degree of confidence	Significance of Potential Impacts without mitigation	Significance of Potential Impacts with mitigation
Physiography, Drainage and Geology	Baseline (Pre-project)	<ul style="list-style-type: none"> <li>- Reduced river flows as a result of drought encroachment</li> <li>- Increased sedimentation in lakes Baringo, Kamnarok and Bogoria from land degradation and soil translocation</li> <li>- Landslips on steep slopes related to deforestation and high rainfall</li> </ul>	Medium	Local to Regional	Long-term	Definite	Negative	High	N/A	N/A
	Project Operations	<ul style="list-style-type: none"> <li>- Cut lines leave long-lasting residual impacts (tracks, and/or scarring on surface rocks)</li> <li>- Vibrators/bulldozers and dynamite use near steep slopes may lead to minor landslips and rock topples</li> </ul>	Low	Site-specific	Short to Long-term	Highly probable	Negative	High	Medium	Low
Soils	Baseline (Pre-project)	<ul style="list-style-type: none"> <li>- Livestock and wildlife grazing and soil compaction</li> <li>- Wind and water erosion</li> </ul>	Medium	Local to Regional	Short to Long-term	Highly probable	Negative	High	N/A	N/A
	Project Operations	<ul style="list-style-type: none"> <li>- Compaction of soft sediments in water-logged areas along cut lines</li> <li>- Disturbance and exposure of soil along cut lines</li> <li>- Cut lines may enhance gulleying and erosion (wind and water)</li> <li>- Rutting in loose soils</li> <li>- Contamination of soils</li> </ul>	Low	Site-specific	Short to Long-term	Highly Probable	Negative	High	Medium	Low

Parameter assessed	Project Phase	Pressures/Impacts	Intensity High (H) Medium (M) Low (L)	Extent	Duration	Probability	Status	Degree of confidence	Significance of Potential Impacts without mitigation	Significance of Potential Impacts with mitigation
Air quality	Baseline (Pre-project)	<ul style="list-style-type: none"> <li>- Dust generated by wind and enhanced by low vegetation cover</li> <li>- Offensive odours from point sources e.g. pit latrines and garbage dumps</li> </ul>	Low	Site-specific to Regional	Short-term	Definite	Neutral	High	N/A	N/A
	Project Operations	<ul style="list-style-type: none"> <li>- Pollution from exhaust emissions</li> <li>- Fugitive dust generation from traffic</li> <li>- Offensive odours</li> </ul>	Low	Site-specific to Local	Short-term	Definite	Negative	High	Low	Low
Terrestrial environment	Baseline (Pre-project)	<ul style="list-style-type: none"> <li>- Land degradation from overgrazing and deforestation</li> <li>- Desertification</li> <li>- Local reduction in biodiversity due to land degradation and deforestation</li> </ul>	Medium	Local to Regional	Permanent	Probable	Negative	Medium	N/A	N/A
	Project Operations	<ul style="list-style-type: none"> <li>- Clearing vegetation for access roads and cut lines</li> <li>- Disturbance to fauna due to physical presence and intermittent noise from acoustic sources, vehicles and machinery</li> <li>- Introduced weeds/pests from equipment imports</li> </ul>	Medium	Site-specific to Local	Short to Long-term	Probable	Negative	High	Medium	Low
Aquatic environment	Baseline (Pre-project)	<ul style="list-style-type: none"> <li>- Decreasing water quantity and quality (increased turbidity and salinity)</li> <li>- Disappearance of aquatic birds due to pressure of excessive extraction of water levels</li> </ul>	Medium	Local	Long-term	Probable	Negative	Medium	N/A	N/A

Parameter assessed	Project Phase	Pressures/Impacts	Intensity High (H) Medium (M) Low (L)	Extent	Duration	Probability	Status	Degree of confidence	Significance of Potential Impacts without mitigation	Significance of Potential Impacts with mitigation
	Project Operations	<ul style="list-style-type: none"> <li>- Disturbance to coastal (shoreline) and riverine aquatic fauna</li> <li>- Clearance of shoreline and riverine vegetation</li> </ul>	Low	Site-specific	Short-term	Probable	Negative	Medium	Low	Low
Surface and groundwater	Baseline (Pre-project)	<ul style="list-style-type: none"> <li>- Freshwater shortage</li> <li>- Damming of rivers</li> <li>- Uneven distribution of the resource</li> <li>- High demand for water resources</li> </ul>	High	Local to Regional	Permanent	Highly probable	Negative	Medium	N/A	N/A
	Project Operations	<ul style="list-style-type: none"> <li>- Conflict with neighbouring communities if water source is shared</li> <li>- Compaction of near-surface aquifers such as springs, reducing yield</li> <li>- Downward draining of groundwater through drill holes, potentially reducing yield at springs</li> </ul>	Low	Site-specific to Local	Short-term	Probable	Negative	Medium	Low	Low
Water Quality	Baseline (Pre-project)	<ul style="list-style-type: none"> <li>- High sediment loads in rivers</li> <li>- Point-source pollution of springs and wells by humans and livestock</li> </ul>	Medium	Site-specific to local	Permanent	Probable	Negative	Medium	N/A	N/A
	Project Operations	<ul style="list-style-type: none"> <li>- Contamination of water supply source for the camp</li> <li>- Contamination of underlying shallow aquifers by e.g, fuel spills</li> </ul>	Low	Site-specific to local	Short-term	Probable	Negative	Medium	Medium	Low
Land resources and natural heritage sites	Baseline (Pre-project)	<ul style="list-style-type: none"> <li>- Overgrazing</li> <li>- Land degradation and deforestation</li> </ul>	Medium	Regional/ Local	Long-term	Probable	Negative	Medium	N/A	N/A



Parameter assessed	Project Phase	Pressures/Impacts	Intensity High (H) Medium (M) Low (L)	Extent	Duration	Probability	Status	Degree of confidence	Significance of Potential Impacts without mitigation	Significance of Potential Impacts with mitigation
	Project Operations	- Cut lines affect pastoral activities - Disturbance of animals in National Parks	Low	Site-specific to Local	Short-term	Probable	Negative	Medium	Medium	Low
Archaeological, Historical and Cultural Sites	Baseline (Pre-project)	- Water erosion - Overgrazing	Low	Site-specific to Local	Long-term to Permanent	Probable	Negative	Medium	N/A	N/A
	Project Operations	- Compaction by heavy vehicles and machinery may damage fossils/artefacts buried in shallow soils - Vibrations and drilling of shot holes may disturb/break up near-surface archaeological materials - Vibrations may disturb/break up graves and cultural related (Namorutunga) rocks	Low	Site-specific	Permanent	Probable	Negative	Medium	High	Low
Visual aesthetics	Baseline (Pre-project)	- Land degradation - Deforestation	Low	Local	Long-term	Probable	Negative	Medium	N/A	N/A
	Project Operations	- Poor campsite design does not blend in with the environment - Cut line footprints and vegetation cover removal lower aesthetic value of landscape	Low Low	Site-specific	Short to Long-term	Probable	Negative	High	Medium	Low
Noise and vibrations	Baseline (Pre-project)	- Noise from strong winds - Anthropogenic (but not excessive) noise localised in small towns and centres	Low	Local	Permanent	Definite	Neutral	High	N/A	N/A

Parameter assessed	Project Phase	Pressures/Impacts	Intensity High (H) Medium (M) Low (L)	Extent	Duration	Probability	Status	Degree of confidence	Significance of Potential Impacts without mitigation	Significance of Potential Impacts with mitigation
	Project Operations	<ul style="list-style-type: none"> <li>- Disturbance to resident community, animals and livestock during operations from acoustic source, vehicles and machinery</li> <li>- Disturbance to workers</li> <li>- Health risks</li> </ul>	Low	Local	Short-term	Definite	Negative	High	Medium	Low
Liquid and Solid Wastes	Baseline (Pre-project)	<ul style="list-style-type: none"> <li>- Poor liquid and solid waste management in major centres, e.g. Lokori</li> </ul>	Low	Local	Short to long-term	Probable	Negative	High	N/A	N/A
	Project Operations	<ul style="list-style-type: none"> <li>- Pollution of surface soils, surface waters and ground waters from e.g. fuel spills</li> <li>- Offensive odours</li> <li>- Health risks</li> </ul>	Low	Site-specific to Local	Short-term	Probable	Negative	Medium	Medium	Low
Social Characteristics	Baseline (Pre-project)	<ul style="list-style-type: none"> <li>- Low education levels</li> <li>- Low literacy levels</li> <li>- Few health facilities (inadequate, understaffed and under-equipped)</li> </ul>	High	Regional	Long-term	Definite	Negative	High	N/A	N/A
	Project Operations	<ul style="list-style-type: none"> <li>- Possible increase in crime and promiscuity</li> <li>- Possible increase in number of students dropping out of school in search of jobs</li> <li>- Erosion of culture and social values as a result of intercultural association</li> <li>- May interfere with grazing lands and watering points</li> </ul>	Low	Local	Short-term	Probable	Negative	Medium	Medium	Low
Economic factors	Baseline (Pre-project)	<ul style="list-style-type: none"> <li>- Few job opportunities</li> <li>- Poor access to markets</li> <li>- Slow economic growth rate</li> </ul>	High	Regional	Long-term	Definite	Negative	High	N/A	N/A

Parameter assessed	Project Phase	Pressures/Impacts	Intensity High (H) Medium (M) Low (L)	Extent	Duration	Probability	Status	Degree of confidence	Significance of Potential Impacts without mitigation	Significance of Potential Impacts with mitigation
	Project Operations	<ul style="list-style-type: none"> <li>- Improved livelihood</li> <li>- Improved short-term business opportunities for the locals</li> <li>- Potential CSR project benefits</li> </ul>	Medium	Regional	Short-term	Probable	Positive	High	Medium	Low
Occupational Health and Safety	Baseline (Pre-project)	<ul style="list-style-type: none"> <li>- Cattle-rustling amongst the pastoral communities</li> <li>- Large numbers of guns held illegally</li> <li>- High ambient (but transient) dust levels</li> <li>- Wildfires</li> </ul>	Medium	Local to Regional	Short to Long-term	Probable	Negative	High	N/A	N/A
	Project Operations	<ul style="list-style-type: none"> <li>- Injuries to workers, visitors and area residents arising from project operations</li> <li>- Fire hazard</li> <li>- Other health risks</li> </ul>	Low	Site-specific	Short-term	Improbable	Negative	High	High	Low
Security and public safety	Baseline (Pre-project)	<ul style="list-style-type: none"> <li>- Frequent cattle rustling</li> <li>- Illegal guns</li> <li>- Resource conflicts</li> </ul>	High	Regional	Long-term	Highly probable	Negative	High	N/A	N/A
	Project Operations	<ul style="list-style-type: none"> <li>- Improvement in security due to security enhancement for project activities (has been reported from previous seismic surveys)</li> </ul>	Medium	Local	Short-term	Probable	Positive	Medium	Low	Low

## 7.4 CUMULATIVE IMPACTS IN THE PROJECT AREA

The cumulative impacts on the surface and groundwater are considered to be minimal during the seismic operation, particularly when the operation is carried out during the dry season. The cumulative impacts are those impacts which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions.

The impact on soil resources can be accurately characterised and for the most part mitigated through the proposed line preparation activity using mulchers, which help to preserve their stability, and significantly raise the probability of regenerating the indigenous vegetation *in situ* from the existing seed base.

The cumulative impacts on the biodiversity of the area are considered insignificant. The temporary modification of vegetation to permit the seismic survey is considered a minor impact due to the commonality and widespread nature of the vegetation across the region. The vegetation is recognized as being sensitive to disturbance due to the harsh climatic setting and poor soils. The direct impact of the activity on threatened species of fauna is considered small: the fish species identified are found in the protected ranges - Lake Baringo National Reserve and the Kerio River. Biodiversity in the area have their ranges at the protected ranges of Lake Bogoria National reserve and Lake Baringo where they are protected. Consequently, potential or actual habitat impacts that are deleterious to the localised biodiversity are adequately managed for posterity by the Kenya Wildlife Service in conjunction with the Baringo County Council.

The scope for cumulative impacts on archaeological and cultural sites from the proposed activity are low, this again being due to the linear (rather than area) nature of the programme, and also because such sites can be avoided once identified, and flagged so as not to be disturbed. The scale of fugitive particulate material generation and their impacts on the surrounding environment is generally negligible, particularly because the naturally strong winds have a much greater impact in this regard. Adequate mitigation measures are, however, available during the operations phase to limit the generation of dust in the localised area and where the activity creates greater than normal levels of traffic.

Positive cumulative benefits for the local business community are an expected result of the proposed activity with the planning and construction phases utilising a range of local professional service providers. UN-skilled and semi-skilled workers who may be employed in the project will likely acquire new and lifelong skills that may prove useful in other sectors of the Kenyan economy.

## 7.5 SIGNIFICANCE OF IMPACTS

The seismic survey will utilise state-of-the-art equipment and experienced personnel to carry out the work. They will also adhere to the international best practices regulations of OGP and IAGC and the applicable national legislation and regulations. As mentioned earlier, seismic survey operations are regarded, from an industry standpoint, as being of a small scale in both effort and duration. In addition the majority of operations will be conducted a long distance away from any habitation, town or workplace so that the inhabitants will be largely insulated from survey-related disturbances. The short-term duration (3 months) of seismic survey activity and of impacts will result in negligible cumulative impacts for most environmental and social factors, and no long-term cumulative impacts following cessation of the proposed seismic survey project.

## **CHAPTER 8:**

### **ENVIRONMENTAL MANAGEMENT PLAN**

#### **8.1 INTRODUCTION**

The environmental and social aspects identified in this impact study concerns in the EIA must be properly managed. The tool for achieving this is the incorporation of an Environmental Management Plan (EMP) into the EIA to ensure adherence and future compliance with legislation, good environmental performance, and integration of environmental issues into the project decision. The EMP provides the means of assessing the accuracy of the predicted project impacts and the monitoring of the effectiveness of the proposed mitigation measures contained in the EIA study report. The EMP should therefore indicate how the environmental concerns highlighted in the EIA would be managed. TKBV will monitor the implementation of key contractor parties and assess compliance with the provisions of the EMP through its contractual mechanisms and management.

TKBV is committed to provide resources essential to the implementation of the EMP. The EMP outlined below provides all the details of project activities, impacts, mitigation measures, time schedules, responsibilities and commitments proposed to minimize environmental and social impacts of the project, and includes monitoring and evaluation for the implementation, operational and decommissioning phases of the project.

TKBV is also committed to identifying and mitigating against any environmental and/or social aspects which may arise during the project implementation which may have not been identified during the study.

#### **8.2 OBJECTIVES OF THE EMP**

The objectives of the EMP are to:

- Adhere and address necessary legal frameworks and other requirements;
- Promote environmental management and communicate the aims and goals of the project EMP to all stakeholders;
- Incorporate environmental management into project design and operating procedures;
- Ensure all workers, contractors, sub-contractors and others involved in the project meet all legal and institutional requirements with regard to environmental management and adhere to the EMP developed for this project;
- Address issues and concerns raised in the EIA stakeholders' consultation process;
- Serve as an action plan for environmental management
- Provide a framework for implementing commitments of the project (i.e. mitigation measures identified in the EIA);
- Prepare and maintain records of project environmental performance (i.e. monitoring, audits and compliance tracking); and
- Prepare an environmental monitoring plan whose aim is to ensure that the negative environmental impacts identified in this Chapter 7 of this EIA are effectively mitigated against in design, construction, operational and decommissioning stages of the project.



### 8.3 PROJECT DESCRIPTION

As per the PSC requirements, approximately 500km of 2D data will be acquired over a time period of eight to twelve weeks, commencing in Quarter Two of 2012. Line clearance along the pre-determined and pre-surveyed transects on land will be done by use of mulchers and light hand-cutting tools, and where access roads are required, by bulldozers. Support vehicles such as for personnel movement, carrying of data recording equipment, etc., will be available. The workforce, who will reside in a fully equipped base camp, will be between 100 and 150 in number. The health and safety of the crew and the general public at large will be ensured by the company complying both with the relevant national legislation, its own in-house environmental health and safety (EHS) policies which embrace the international best practices for such activities, and this EMP. A close working relationship will be fostered with the local communities, and as far as is practicable, unskilled and semi-skilled workers shall be recruited locally.

### 8.4 APPLICABLE LEGISLATION AND REGULATIONS

The spectrum of legislation and regulations that apply to the seismic survey project has been detailed in Chapter 4. Some of the key legislation that relate to the activity are the:

- Environmental Management and Co-ordination Act, 1999 and associated regulations and guidelines;
- Petroleum (Exploration and Production) Act, Cap. 308;
- Energy Act, No. 12 of 2006;
- Explosives Act, Cap. 115;
- Wildlife (Conservation and Management) Act, Cap. 376;
- National Museums and Heritage Act, Cap. 216;
- Water Act, Cap. 372;
- Fisheries Act, Cap. 378; and
- Occupational Safety and Health Act, No. 15 of 2007.

### 8.5 TULLOW POLICIES AND PROCEDURES

Tullow has two key policies that relate to this activity, namely, the Environmental, Health and Safety Policy, and the Corporate Social Responsibility Policy. These policies aim to: preserve biodiversity and promote sustainable development by protecting people, minimising harm to the environment and reducing disruption to its neighbouring communities, and; conduct all business operations to best industry standards and to behave in a socially responsible manner (i.e. behave ethically and with integrity in the communities where it works, and to respect cultural, national and religious diversity). Further details on these policies are in Chapter 4, section 4.6).

### 8.6 ROLES, RESPONSIBILITIES AND TRAINING

TKBV will be responsible for the overall implementation, monitoring and quality assurance/quality control of this EMP. It will be responsible for ensuring that the policies, management plans and actions to be implemented to avoid, reduce, mitigate, or compensate for adverse environmental and social impacts are adhered to. TKBV shall develop a clear command chain framework for employee responsibilities, reporting and incident management, and shall ensure that all employees understand it.

TKBV will sub-contract the project to a seismic survey company to undertake the survey. In this case, the contractor will be responsible for the implementation and monitoring of the EMP in their related work contract activity (and this condition should be built into the terms of

reference for tendered work and the contract document. The contractor will also be responsible for the occupational health and safety of the workers and others who may be carrying out both related and un-related activities within and around the work sites. TKBV will be responsible for periodic environmental inspections of the work and camp sites in general. The contractors will also be responsible for implementing corrective actions that may be required by TKBV as a result of these inspections.

TKBV will train its employees in order to equip them to carry out their duties under the scope of the EMP. Contractors will likewise be required to do the same for their employees and in relation to the work component that they have been given to carry out (see the EMP below). The workers shall be regularly informed on, and assessed for, their understanding of the various policies and plans that relate to their work environment. TKBV will constitute a competent and effective workforce, taking into account the skills required for each work component, and giving priority to local workers for employment opportunities in the semi-skilled and unskilled work categories. Suitable training and skill transfer will be provided, where required.

Specific training requirements are mentioned under the relevant sections of the EMP below.

## **8.7 COMMUNICATION WITH STAKEHOLDERS AND GRIEVANCE MECHANISM**

TKBV will develop and maintain a formal procedure for communication with various stakeholders to inform on the various stages of project activities, as well as to receive their views and concerns, if any. TKBV should maintain a written register of its interactions and discussions with the various stakeholders so that issues that require to be followed up are clear and well-understood, and the outputs can be assessed.

TKBV will also establish a grievance mechanism to handle complaints from the stakeholders/residents of the area, as well as for its own and contracted workers. This mechanism will also include procedures for assessing any project-related damages to persons and properties and levels of compensation. Such a mechanism will be best established in consultation with officials from Government (Ministry of Energy, Ministry of Fisheries, Community Leaders, and Stakeholder Group Representatives).

## **8.8 AUDITING**

It is a requirement by law that any project activity being undertaken be audited after every year. The seismic survey is, however, of a much shorter duration. Auditing will, therefore, be done upon completion of the project activities. The auditing to be undertaken at the end of the project is to ensure that the project adhered to the EMP as outline in this project report and that corrective measures were put in place in cases where impacts were identified. If the audit findings indicate that there are impacts that were not corrected, then the proponent will be required by NEMA to undertake such corrective measures before the Authority signs off the project.

Besides the regulatory framework, TKBV will conduct regular internal audits covering all aspects of the EMP during the course of the project operations. The audits shall be performed by a qualified consultant and communicated to TKBV's relevant departments and NEMA.

'Qualified consultant' would be a local or foreign EIA individual or firm of experts registered as such with the National Environment Management Authority under Regulation 14 of the Environmental (Impact Assessment and Audit) Regulations, 2003. However, under Regulation 34, if the project proponent's EIA report has been approved by the Authority, or after an initial audit of an ongoing project has been done, that proponent may thereafter self-

audit regularly, ensuring that the criteria used to audit is based on the EMP developed during the EIA process or after the initial audit. The audit report is submitted to the Authority. The Authority is responsible for carrying out environmental audits and monitoring of these activities through an environmental inspector appointed under the Act (EMCA, section 68)

## **8.9 THE ENVIRONMENTAL (AND SOCIAL) MANAGEMENT PLAN (EMP) FOR THE ONSHORE SEISMIC SURVEY**

The EMP for the onshore survey addresses the following components that relate to the seismic survey:

- Physiography and Geology
- Soils
- Air Quality
- Surface and Groundwater Resources
- Water Quality
- Terrestrial Environment (Habitats, Flora, and Fauna)
- Land Resources and National Parks
- Archaeological, Historical and Cultural Sites
- Visual Aesthetics
- Noise and Vibrations
- Solid and Liquid Wastes
- Social Characteristics
- Economic Characteristics
- Occupational Health and Safety
- Security and Public Safety

The structure of the Environmental Management Plan adopted for each of the environmental and social components addressed in it (below) is as follows:

1. Potential Impacts and Mitigations – These outline the impacts and mitigations that have been identified and that are peculiar to the project area (see Chapter 7);
2. Identification of Desired Outcomes, Objective Indicators, and Monitoring – The Desired Outcomes reflect what the project proponent and stakeholders would like to see once the operation has been completed. The Objective Indicators indicate how the Desired Outcomes can be measured, and their success determined (either qualitatively, quantitatively, or both). The Monitoring aspect is based on assessment of project operations *vis à vis* the Objective Indicators and the Desired Outcome;
3. Responsibilities and Management.

In each and every component of the EMP, the Tullow EHS and CSR policies that are outlined in Chapter 4 apply. Other additional relevant plans (whose frameworks are outlined in later sections of this EMP and that TKBV will need to tailor to fit into its work ethic and culture) are indicated under the applicable EMP component(s).

### **8.9.1 Physiography and Geology**

The impact sources from the project operations will include the Vibroseis and associated equipment, bulldozers, survey support vehicles and dynamite charges.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> <li>▪ Cut lines leave long-lasting residual impacts (tracks, and/or scarring on surface rocks)</li> <li>▪ Vibrators/bulldozers and dynamite use near steep slopes may lead to minor landslips and rock topples</li> </ul>	<ul style="list-style-type: none"> <li>▪ Vibrators/bulldozers and dynamite use near steep slopes may lead to minor landslips and rock topples;</li> <li>▪ Pre-survey possible access routes, and use the selected routes rather than accessing work sites through free-ranging driving across the open country;</li> <li>▪ Explosives (dynamite) should be used as source instead of Vibroseis in areas with highly dissected and incised surfaces (sections 4.3.3 and 4.3.4);</li> <li>▪ When laying cut lines, off-road driving should be discouraged to avoid creating unnecessary tracks and trampling of pasture;</li> <li>▪ Minimise, to the extent possible, the use of bulldozers to open up cut lines and access roads to minimise rock scarring;</li> <li>▪ Avoid cut lines on slopes steeper than 40° to minimise risk of landslips and rock topples.</li> </ul>

<i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, Risk and cost</i>					
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)	E.g Cost (Ksh.)
<ul style="list-style-type: none"> <li>▪ Residual impacts of cut lines minimized to the extent possible</li> <li>▪ Landslips and rock topples do not occur</li> </ul>	<ul style="list-style-type: none"> <li>▪ 100% of seismic cut lines pre-surveyed on the ground</li> <li>▪ Actions taken to minimise cut line impacts are recorded</li> <li>▪ No project-related landslips or rock topples recorded</li> </ul>	<ul style="list-style-type: none"> <li>▪ Continuous, daily: pre-survey and actual line cutting</li> <li>▪ On site</li> </ul>	<ul style="list-style-type: none"> <li>▪ The Seismic EHS QC will be responsible for the day-to-day monitoring and management, and will report to the Explorations Manager on a weekly basis, or immediately in case of an incident occurring.</li> </ul>	Low	50,000

### 8.9.2 Soils

The impact sources from the project operations will include Vibroseis and associated equipment, bulldozer, transport vehicles, oil or chemical leaks from vehicles and machinery, garage and storage areas.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> <li>Compaction of soils in the working area and access ways</li> <li>Compaction of degraded soils along cut lines</li> <li>Disturbance of soil along cut lines</li> <li>Cut lines, may enhance gulley formation and erosion (wind and water)</li> <li>Rutting in loose soils</li> </ul>	<ul style="list-style-type: none"> <li>Machinery and equipment should use existing routes as much as is practicable to avoid compaction of the surface soil (section 4.4.5);</li> <li>Construct drainage channels on access ways where natural drainage may be affected;</li> <li>Vehicles should steer away from natural drains and waterways as is practicable, but a buffer zone or dog-leg should be maintained except at crossing points;</li> <li>Minimize vegetation clearance as much as possible when clearing area for campsite allocation or use area with extensive bare patches</li> <li>Seismic survey should be carried out only during the dry periods and vehicle movements should be minimised during wet periods;</li> <li>Use only essential and low pressure/impact tyres on vehicles in areas with wet soils or that are susceptible to ponding;</li> <li>Ensure that all vehicles and machinery operating in the field (and in the campsite) do not have any oil leaks that could contaminate the soils.</li> </ul>

<b><i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i></b>					
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)	E.g Cost (Ksh.)
<ul style="list-style-type: none"> <li>Minimal, (if any) , compaction of soils where applicable</li> <li>Minimal disturbance of soils especially on waterways and natural drains</li> <li>Protection of artefacts/archaeological material in shallow soils from compaction in localized area</li> <li>Zero spillage of chemicals and hazardous material on soils</li> </ul>	<ul style="list-style-type: none"> <li>100% of existing routes and possible alternatives pre-surveyed on the ground</li> <li>Soils characterized and pre-surveyed on the ground.</li> <li>Appropriate campsites surveyed and selected</li> </ul>	<ul style="list-style-type: none"> <li>Continuous, duration of pre-survey route checking adjusting and opening bypasses where appropriate</li> <li>One time assessment and site selection of base-camp and archaeological/cultural sites</li> <li>Continuous monitoring and safeguard mechanisms</li> </ul>	<ul style="list-style-type: none"> <li>The TKBV EHS Representative will be responsible for the day-to-day monitoring and management, and will report to the Tullow Oil Seismic Operations Supervisor and the TKBV EHS Manager on a daily and weekly basis, or immediately in case of an incident occurring.</li> </ul>	Low	50,000

### 8.9.3 Air Quality

The impact sources from the project operations will include vehicles and machinery, sanitary systems and waste disposal points.



Potential Impacts	Mitigation
<ul style="list-style-type: none"> <li>▪ Pollution from exhaust emissions;</li> <li>▪ Fugitive dust-generation from traffic;</li> <li>▪ Offensive odours;</li> <li>▪ Air pollution health risks.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Limit traffic speed and restrict movement of vehicles as is reasonable to minimize sand and dust generation. Field vehicles, trucks and any other machinery should be switched off when not in use as appropriate. Vehicle speeds to be monitored using Vehicle Tracking Systems (VTS);</li> <li>▪ Field vehicles, trucks and any other machinery should be switched off when not in use;</li> <li>▪ Regular servicing of all trucks, service vehicles, and any other machinery powered using fossil fuels to ensure efficient combustion and minimisation of exhaust emissions (section 4.4.8);</li> <li>▪ Use low sulphur fuels if available and where suitable;</li> <li>▪ Employees working in dusty conditions must use appropriate PPE;</li> <li>▪ If camp waste material is to be burned, it should be done at a time of low wind movement, and preferably in areas shielded from wind by vegetation;</li> <li>▪ Installation and proper management of camp sanitation facilities.</li> </ul>

<b><i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i></b>					
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)	E.g Cost (Ksh.)
<ul style="list-style-type: none"> <li>▪ Minimal pollution from exhaust emissions</li> <li>▪ Minimal dust generation from traffic</li> <li>▪ No offensive odours</li> <li>▪ No health risks</li> </ul>	<ul style="list-style-type: none"> <li>▪ Use of low sulphur versus other fuels wherever possible</li> <li>▪ Adherence to equipment maintenance schedule</li> <li>▪ Set speed limits are not exceeded (record incidents of limits exceeded)</li> <li>▪ No offensive odours recorded</li> <li>▪ No violation of OHS requirements for dust impact mitigation (violations recorded).</li> </ul>	<ul style="list-style-type: none"> <li>▪ Malfunctioning equipment removed immediately from operations for repair</li> <li>▪ Speed limit violations based on speed-tracking devices in vehicles, monitored at base camp</li> <li>▪ Regular inspection of sanitary facilities and waste disposal points</li> <li>▪ Regular checks on use of PPE</li> </ul>	<ul style="list-style-type: none"> <li>▪ The TKBV EHS Representative will be responsible for the day-to-day monitoring and management of air quality issues in the field, and around the campsite. The EHS representative will liaise with the Seismic QC representative on site on any issues arising and will report to the Tullow Oil Seismic Operations Supervisor and the TKBV EHS Manager on a daily and weekly basis, and will immediately report on health risk incidents.</li> </ul>	Low	60,000

#### 8.9.4 Surface and Groundwater Resources

The impact sources from the project operations will include water supply source for the camp, heavy vehicles and machinery, and drilling of shot holes.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> <li>Conflict with neighbouring communities if water source is shared</li> <li>Compaction of near-surface aquifers such as springs, reducing yield</li> <li>Downward draining of groundwater through drill holes, reducing yield at springs</li> </ul>	<ul style="list-style-type: none"> <li>The company should consider drilling its own water supply borehole and hand this over to the community once the seismic survey exercise is completed</li> <li>It is recommended that an efficient water-use policy be adopted by the project proponent at the camp site and other work areas (section 4.4.3)</li> <li>An efficient sanitation system should be put in place in the campsite(s) to handle effluents (section.4.3.8)</li> <li>Buffer zones will be maintained between cut lines and water sources such as wells and springs (sections 4.3.10, 4.4.3)</li> <li>When water is encountered when drilling shot holes, bentonite could, in conjunction with a concrete insert, be used to plug the hole up to 3m above the static water level or to a depth of 1m from the ground surface.</li> </ul>

<b>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</b>					
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)	E.g Cost (Ksh.)
<ul style="list-style-type: none"> <li>No conflict over water use with neighbouring communities</li> <li>No compaction of near surface aquifers</li> <li>No downward draining of groundwater through drill holes</li> </ul>	<ul style="list-style-type: none"> <li>TKBV has its own water borehole or other independent water source</li> <li>Identification of nearby springs and wells along cut lines during line survey exercise</li> <li>No violation of buffer zone limits around groundwater sources</li> <li>Water yields do not decrease</li> <li>Identification of nearby springs and wells along cut lines during line survey exercise</li> <li>Inventory of drill hole plugging maintained</li> <li>Water yields do not decrease</li> </ul>	<ul style="list-style-type: none"> <li>Compliance with buffer zone requirements</li> <li>Aquifer zones encountered during drilling are sealed off</li> </ul>	<ul style="list-style-type: none"> <li>The field operations supervisor will be responsible for the day-to-day monitoring and management of surface and groundwater resources in the field, while the camp supervisor will be responsible for water monitoring at and around the campsite. The field operations supervisor and the camp supervisor will report to the explorations manager on a weekly basis, and will immediately report on incidents of concern.</li> </ul>	Low	150,000

Site selection for the borehole will be done with inputs from a registered hydrogeologist and in consultation with stakeholders. The hydrogeological report will be done in accordance with the legislation and regulations that relate to the Water Act 2002, and will also require a site-specific EIA as per EMCA 1999 legislation and regulations. Mitigations for water borehole drilling which will be undertaken by the seismic contractor have been outlined in section 8.9.20.

### 8.9.5 Water Quality

The impact sources from the project operations will include: liquid effluent discharges from sanitation systems at the campsite; oil or chemical leaks from garage and storage areas,

vehicles and machinery operating in the camp and field; and subsurface detonation of dynamite charges during the field survey.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> <li>Contamination of water supply source for the camp</li> <li>Contamination of underlying aquifers</li> </ul>	<ul style="list-style-type: none"> <li>Campsite should be sited in an area with a deep water table and overlain with clayey soils;</li> <li>Pits for disposal of domestic and sanitary effluents should be sited with knowledge of the geological and soil characteristics of the area;</li> <li>Buffer zones will be maintained between cut lines and water sources such as wells and springs (sections 4.4.3. 4.3.8);</li> <li>When water is encountered when drilling shot holes, bentonite may be used to plug the hole up to 3m above the static water level or to a depth of 1m from the ground surface;</li> <li>Ensure that all vehicles and machinery operating in the field (and in the campsite) do not have any oil leaks that could contaminate the soils (section 4.4.8) through daily vehicle checks;</li> <li>Refuelling areas should be underlain with spill-proof hard standing or bund, with spill-kits readily available and operatives trained in their use;</li> <li>Hazardous and toxic waste material should be managed according to Kenyan national protocols and practices.</li> </ul>

<b><i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i></b>					
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)	E.g Cost (Ksh.)
<ul style="list-style-type: none"> <li>No contamination of water supply source for the camp</li> <li>No contamination of underlying aquifers in the project area</li> </ul>	<ul style="list-style-type: none"> <li>Camp water supply source is fit for human consumption</li> <li>Camp water supply source is protected</li> <li>Zero spillage of chemicals and hazardous material on soils that may lead to surface/ groundwater pollution</li> <li>Waste pits and landfills are carefully sited</li> <li>Buffer zones are observed</li> </ul>	<ul style="list-style-type: none"> <li>Regular physico-chemical and microbiological testing,</li> <li>Casing and cementing of borehole and wellhead area</li> <li>Protocols for and conditions of oils and chemicals storage at the camp are adhered to</li> <li>Compliance with buffer zone requirements</li> </ul>	<ul style="list-style-type: none"> <li>The field operations supervisor will be responsible for the day-to-day monitoring and management of actions to protect water quality in the field, while the camp supervisor will be responsible for such actions at and around the campsite. The field operations supervisor and the camp supervisor will report to the explorations manager on a weekly basis, and will immediately report on incidents of concern.</li> </ul>	Low	100,000

#### **8.9.6 Terrestrial Environment (Habitats, Flora, and Fauna)**

The impact sources from the project operations will include: Vibroseis and associated equipment, mulchers, bulldozers, transport vehicles, and physical presence of the workforce. Kenya is currently facing a severe drought which is likely to contribute to flora and fauna depletion in the project area.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> <li>▪ Cutting of vegetation along cut lines.</li> <li>▪ Disturbance of wildlife (physical presence)</li> <li>▪ Introduced weeds and pests</li> <li>▪ Contamination of the environment (solid and liquid wastes)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Mitigations to soils (7.3.2), noise and vibrations (7.3.11) and wastes (7.3.12) apply;</li> <li>▪ Trees with trunk diameter greater than 20cm should not be cut;</li> <li>▪ The risk of introduction of weed and pest species to the region via contaminated vehicles and equipment will be mitigated by the wash-down of all vehicles and ancillary equipment at a designated location;</li> <li>▪ For areas with dense vegetation, seismic lines should be well planned to minimise to the extent possible the clearing of vegetation and mulchers should be used;</li> <li>▪ Seismic survey activities to be undertaken during daylight hours only;</li> <li>▪ Ensure that equipment are in perfect working order and cause minimal noise/air pollution nuisance to fauna;</li> <li>▪ Wildlife shall have the right of way when they are of such a size that can be readily seen from vehicles;</li> <li>▪ Foraging, hunting, feeding and trapping of wildlife by workers, when on and off duty, should be strictly prohibited. This prohibition should extend to the purchase of these items from the indigenous population by workers;</li> <li>▪ Involve the KWS to ensure that wildlife disturbance and danger to seismic team is mitigated when work is being undertaken in parks.</li> </ul>

<b><i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i></b>					
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)	E.g Cost (Ksh.)
<ul style="list-style-type: none"> <li>▪ Minimal cutting of vegetation along cut lines</li> <li>▪ Minimal disturbance of wildlife</li> <li>▪ No weeds or pests introduced into the area</li> <li>▪ Minimal contamination of the environment</li> </ul>	<ul style="list-style-type: none"> <li>▪ Length of line where no cutting is required versus length of line where mulcher is used</li> <li>▪ Number of wildlife encounters and actions taken recorded</li> <li>▪ All equipment (Vehicles and ancillary equipment) are washed down and biofouling removed before being taken to the project area</li> <li>▪ A safety data sheet should be maintained for all potentially hazardous materials, as well as supporting documentation for the transport, use and disposal of such materials</li> </ul>	<ul style="list-style-type: none"> <li>▪ Continuous monitoring of vegetation clearance during line preparation</li> <li>▪ Continuous monitoring of wildlife movement</li> <li>▪ Inspection and certification of the equipment cleaning action</li> </ul>	<ul style="list-style-type: none"> <li>▪ The seismic QC Representative will ensure that workers adhere to the mitigations and will also maintain close liaison with KWS on a needs basis. Permissions will have to be sought from Park Authorities in order to gain access to carry out survey work within the parks.</li> </ul>	Low	80,000

### 8.9.7 Aquatic Environment (Habitats, Flora, and Fauna)

The impact sources from the project operations will include Vibroseis and associated equipment, bulldozer, and transport vehicles, particularly at lake, river/lugga crossings and work taking place on these ecosystems. Other sources will be oil or chemical leaks from vehicles, machinery, garage and storage areas, and use of non-sanitised vehicles and equipment that have previously been used in a different environment.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> <li>• Cutting of shoreline and riverine vegetation along cut lines</li> <li>• Disturbance of coastal and riverine aquatic animals (physical presence, noise and pollution)</li> <li>• Introduced weeds and pests               <ul style="list-style-type: none"> <li>▪ Trampling of meso and micro fauna</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ Mitigation for soils (section 7.3.2) vegetation (section 7.3.6), and noise and vibrations (section 7.3.11) apply;</li> <li>▪ Carry out vehicle and ancillary equipment cleaning to remove biofouling prior to departure from areas with known or potential invasive species.</li> </ul>

<i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i>					
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)	E.g Cost (Ksh.)
<ul style="list-style-type: none"> <li>▪ No disturbance of aquatic animals and benthic habitats</li> <li>▪ No interference with breeding sites and birds' nests</li> <li>▪ No pollution of habitats</li> <li>▪ No exotic aquatic species introduced</li> </ul>	<ul style="list-style-type: none"> <li>▪ Noise and vibration levels moderated</li> <li>▪ Lakes, rivers/luggas crossed at designated points</li> <li>▪ No breeding sites and birds nests are interfered with</li> <li>▪ Vehicles and equipment are cleaned prior to commencement of operations as indicated in mitigations above</li> </ul>	<ul style="list-style-type: none"> <li>▪ Monitoring to minimise disturbance</li> <li>▪ Inspections during work, continuous monitoring</li> <li>▪ Monitoring to ensure that such sites are avoided</li> <li>▪ Ensure that vehicles/equipment are in proper working condition</li> <li>▪ Inspection to certify that vehicles and equipment are properly cleaned</li> </ul>	<ul style="list-style-type: none"> <li>▪ The seismic QC representative shall be responsible for ensuring that the aquatic environment is not, or only minimally, disturbed. He/she shall be responsible for ensuring that all the mitigation measures specified are implemented. An EHS officer shall be responsible for ensuring that occupational health and safety protocols are strictly implemented.</li> </ul>	Low	50,000

### 8.9.8 Land Resources and National Parks

The impact sources from the project operations will include: Vibroseis, mulchers and associated equipment, dynamite shots, vehicles and presence of humans.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> <li>▪ Cut lines and access road may affect pastoral resources</li> <li>▪ Disturbance of animals in National Parks and game reserves</li> </ul>	<ul style="list-style-type: none"> <li>▪ As for sections 8.9.1 (Physiography and Geology), 8.9.2 (Soils), 8.9.6 (Terrestrial Environment) and 8.9.8 (Aquatic Environment).</li> </ul>



<b>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</b>					
<b>Desired Outcomes</b>	<b>Objective Indicators</b>	<b>Monitoring</b>	<b>Responsibility and Management</b>	<b>Risk with mitigation (High, Medium or Low)</b>	<b>E.g Cost (Ksh.)</b>
<ul style="list-style-type: none"> <li>Animal encounters minimised</li> <li>Pastoralist activities are only minimally disrupted</li> <li>Other desired outcomes relate to the following sections: Soils (8.9.2), Terrestrial Environment (8.9.6)</li> </ul>	<ul style="list-style-type: none"> <li>No animal encounters recorded</li> <li>No complaints from pastoralists</li> <li>Objective indicators for Soils and Terrestrial Environment are met</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring of animal presence along survey routes</li> <li>Information outflow to the affected communities on seismic line survey schedules and exclusion time periods</li> <li>Adhering to the use of existing routes and road network</li> <li>Maintaining a complaints register</li> <li>Enforcing policy against poaching through regular tool-box talks supervision</li> </ul>	<ul style="list-style-type: none"> <li>The Seismic QC Representative shall ensure that the requisite monitoring and reporting are undertaken. He/she shall also be responsible for establishing an effective liaison with the Kenya Wildlife Service field staff, and will involve KWS personnel in the areas within the jurisdiction of the institution, but can extend the collaboration outside this scope. The Seismic QC Representative will also establish liaison with the communities to avoid disruption of their activities during the survey. All workers will be regularly briefed on the expected behaviour during the survey.</li> </ul>	Low	120,000

### 8.9.9 Archaeological, Historical and Cultural Sites

The impact sources from the project operations will include: Vibroseis and associated equipment, vehicles and dynamite shots.

<b>Potential Impacts</b>	<b>Mitigation</b>
<ul style="list-style-type: none"> <li>Vehicles and machinery may intrude on cultural sites</li> <li>Vibrations and drilling of shot holes may disturb/break up rocks and material at sacred/burial sites</li> </ul>	<ul style="list-style-type: none"> <li>Consultations should be undertaken with NMK and local elders to help in identifying and avoiding any sensitive cultural sites during the survey in order to prevent conflict with the community;</li> <li>Use of shot points rather than Vibroseis is recommended for such areas;</li> <li>Seismic survey lines will not be planned to go through known cultural sites (section 4.4.4);</li> <li>Access routes and cut lines will be selected to provide sufficient offset to known cultural sites to avoid disturbing them: these offsets shall be determined in consultation with area leaders;</li> <li>All such sites will be flagged for avoidance (sections 4.3.2; 4.4.4);</li> <li>If archaeological materials are found during the operations, they should be left undisturbed marked with GPS, and the National Museums of Kenya personnel should be contacted to advise further on how to proceed;</li> <li>All project field workers must be informed, before commencement of operations, that any disturbance to, defacement of, or removal of archaeological, historical, or sacred material will not be permitted.</li> </ul>

<b>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</b>					
<b>Desired Outcomes</b>	<b>Objective Indicators</b>	<b>Monitoring</b>	<b>Responsibility and Management</b>	<b>Risk with mitigation (High, Medium or Low)</b>	<b>E.g Cost (Ksh.)</b>
<ul style="list-style-type: none"> <li>Negligible interference, if any, with the archaeological, historical and cultural sites</li> <li>Desired Outcomes for Soils (section 8.9.2) apply</li> </ul>	<ul style="list-style-type: none"> <li>No violations of buffer zone restrictions</li> <li>The sites are flagged for avoidance</li> <li>Archaeologist from National Museums of Kenya (NMK) on site with the field team when carrying out work in those sensitive areas starting from the line survey phase.</li> <li>Objective indicators for section 8.9.2 are met</li> </ul>	<ul style="list-style-type: none"> <li>Buffer zones are adhered to</li> <li>Sites are clearly flagged</li> <li>Cultural/Historical sites are not interfered with</li> </ul>	<ul style="list-style-type: none"> <li>The Seismic QC Representative shall liaise with community leaders through a team of Community Liaison Officers on the identification and flagging of culturally sensitive areas. Such persons with good knowledge of the sites may need to accompany the seismic team to identify the various sites. The Seismic QC Representative shall be responsible for ensuring that such sites are not disturbed, and that all the workers are aware of the locations of the site. The Seismic QC Representative shall also liaise with the National Museums of Kenya on matters of archaeological significance.</li> <li>An internal awareness education and training programme will be conducted to provide personnel and contractors with knowledge and an understanding of the importance of archaeological, historical and cultural resources.</li> </ul>	Low	150,000

### 8.9.10 Visual Aesthetics

The impact sources from the project operations will include campsite design and cut lines.

<b>Potential Impacts</b>	<b>Mitigation</b>
<ul style="list-style-type: none"> <li>Poor campsite design does not blend in with the environment</li> <li>Cut line footprints and vegetation cover removal lower aesthetic value of landscape</li> </ul>	<ul style="list-style-type: none"> <li>Use of modern line cutting technology, preferably <i>mulchers</i> for clearing of the geophysical survey transects will ensure that natural re-vegetation will occur in a much shorter period since the seeds and branches will be left along the traverses and this will promote re-growth when it rains;</li> <li>Backfilling any excavated and remediation of degraded areas (e.g. lugga crossings) should be considered;</li> <li>Access tracks to lines will be 'dog-legged' at road intersections to prevent road users from seeing the lines;</li> <li>Minimize use of bulldozers on sensitive landscape.</li> </ul>

<b>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</b>					
<b>Desired Outcomes</b>	<b>Objective Indicators</b>	<b>Monitoring</b>	<b>Responsibility and Management</b>	<b>Risk with mitigation (High, Medium or Low)</b>	<b>E.g Cost (Ksh.)</b>
<ul style="list-style-type: none"> <li>▪ Campsite blends well with environment</li> <li>▪ Visual aesthetics maintained by minimising cut line footprints and vegetation removal</li> </ul>	<ul style="list-style-type: none"> <li>▪ Camp design is aesthetic and good housekeeping practices are maintained</li> <li>▪ Residual impacts of cut lines minimized in extent (sections 8.9.1, 8.9.2 and 8.9.6 apply)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Camp constructed according to design</li> <li>▪ Physiography and Geology, Soils and Vegetation sections apply (sections 8.9.1, 8.9.2 and 8.9.6)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Maintenance of visual aesthetics will be the responsibility of the Seismic QC Representative</li> </ul>	Low	50,000

### 8.9.11 Noise and Vibrations

The impact sources from the project operations will include: Vibroseis and associated equipment, dynamite charges, and associated equipment and vehicles traversing the area.

<b>Potential Impacts</b>	<b>Mitigation</b>
<ul style="list-style-type: none"> <li>▪ Disturbance to humans, animals and livestock</li> <li>▪ Disturbance to workers</li> <li>▪ Health risks</li> </ul>	<ul style="list-style-type: none"> <li>▪ To reduce the expected transient impacts on wildlife, noise levels will need to be minimized to the extent possible, correct strength of dynamite charging and Vibroseis use applied to achieve the survey objectives, and human contact with wildlife should also be minimized in line with the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, and the Wildlife Conservation and Management Act;</li> <li>▪ All seismic operations will be carried out only during daylight hours;</li> <li>▪ Limit the energy generated from Vibroseis trucks and dynamite charging by generating only the required level of acoustic signal strength to achieve the survey objectives. Personal protective equipment should be used by seismic crews in such cases;</li> <li>▪ Provision of full protective gear for workers, like helmets and earplugs, is recommended. Workers should also be sensitized on hazards likely to be encountered in such work environment;</li> <li>▪ The suggested restriction for seismic source detonation close to wells, springs, buildings and/or settlements will be based on International Association of Geophysical Contractors (IAGC) Guidelines;</li> <li>▪ Community Liaison Officers (CLOs) will meet with local leaders to sensitize the communities in the vicinity of the seismic operation areas about the project and its possible noise and vibration impacts. The communities should be informed in advance when a seismic survey operation is to be executed along a given seismic transect/location;</li> <li>▪ Monitor noise levels during the survey start-up phase so that the noise and vibration levels do not exceed the internationally acceptable levels and that appropriate personal protective equipment such as ear defenders are used by seismic when detonating the dynamite charges and/or when working near the Vibroseis or other loud machinery;</li> <li>▪ To reduce the expected transient impacts on wildlife, noise levels will need to be minimized to the extent possible, including the appropriate</li> </ul>

	<p>dynamite charge size selection and Vibroseis use applied to achieve the survey objectives;</p> <ul style="list-style-type: none"> <li>Human contact with wildlife should also be minimized in line with the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, and the Wildlife (Conservation and Management) Act;</li> <li>The affected communities should be informed in advance when a seismic survey operation is to be executed along a given seismic transect/location;</li> <li>Use generators with minimal noise production at camp sites and effect a noise mitigation policy for all operations in accordance with the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations.</li> </ul>
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<b><i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i></b>					
<b>Desired Outcomes</b>	<b>Objective Indicators</b>	<b>Monitoring</b>	<b>Responsibility and Management</b>	<b>Risk with mitigation (High, Medium or Low)</b>	<b>E.g Cost (Ksh.)</b>
<ul style="list-style-type: none"> <li>Ambient noise and vibration levels maintained</li> </ul>	<ul style="list-style-type: none"> <li>Seismic data acquisition design plans optimised for reduction of noise and vibrations from Vibroseis and dynamite charges</li> <li>Regularly serviced and efficient vehicle engines</li> <li>"Quiet" machinery e.g. generators, utilise</li> <li>Requirement for "quiet" equipment purchase/use embedded in tendering of equipment documents,</li> </ul>	<ul style="list-style-type: none"> <li>Review of design parameters, as needed</li> <li>Monitor ground and noise vibration during parameter testing phase</li> <li>Monitor installed equipment</li> <li>Servicing work and schedules</li> <li>Inspect equipment as needed</li> </ul>	<ul style="list-style-type: none"> <li>The TKBV EHS Representative will be responsible for ensuring the monitoring and mitigation of noise and vibrations. During camp construction, noisy activities should be undertaken during normal working hours. The OHS policy regarding use of PPE should be adhered to by the workers. Trucking operations should be avoided at night.</li> </ul>	Low	50,000

### 8.9.12 Solid and Liquid Wastes

The impact sources from the project operations will include: campsite and workplaces in the field.

<b>Potential Impacts</b>	<b>Mitigation</b>
<ul style="list-style-type: none"> <li>Pollution of surface soils, water and groundwater</li> <li>Offensive odours</li> <li>Health risks</li> </ul>	<ul style="list-style-type: none"> <li>Waste materials (at the camp and in the field working areas) should be segregated into non-hazardous and hazardous waste, and consideration given to re-use, recycling, or disposal (sections 4.4.1, and 4.4.9) as appropriate;</li> <li>A waste management plan documenting the waste strategy, storage (including facilities and locations), handling procedures and means of disposal, should be developed and should include a clear waste-tracking mechanism to track waste consignments from the originating location to the final waste treatment and disposal location in</li> </ul>

	<p>compliance with the Environmental Management and Coordination (Waste Management) Regulations;</p> <ul style="list-style-type: none"> <li>Hygienic sanitation and disposal of grey and black water will be covered in the waste management plan in order to protect the general health of the workers and the general public;</li> <li>Ensure that all waste generated along seismic lines during operations is returned to the base camp for segregation and disposal as appropriate;</li> <li>No smoking will be permitted on the seismic line;</li> <li>Ensure that solid waste is removed from site for recycling/disposal only by an authorised (by County Council) waste handler;</li> <li>Fuel and other non-aqueous liquid storage areas should be banded;</li> <li>Servicing of equipment should be carried out in a designated and lined garage area which has readily available spill-kits. Workers in this area will be regularly briefed on spill prevention.</li> </ul>
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<b><i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i></b>					
<b>Desired Outcomes</b>	<b>Objective Indicators</b>	<b>Monitoring</b>	<b>Responsibility and Management</b>	<b>Risk with mitigation (High, Medium or Low)</b>	<b>E.g Cost (Ksh.)</b>
<ul style="list-style-type: none"> <li>No pollution of surface soils, water and groundwater</li> <li>No offensive odours</li> <li>No health risks</li> </ul>	<ul style="list-style-type: none"> <li>No leakages of oils, chemicals or sewage and other domestic effluents reported</li> <li>Sanitary systems are working and no breakdowns reported</li> <li>Hazardous wastes (e.g. medical and chemical wastes) are properly disposed of</li> <li>Appropriate use of personal protective equipment when and where mandatory</li> </ul>	<ul style="list-style-type: none"> <li>Materials storage rooms are secure and accessed only by authorised personnel, daily</li> <li>Work areas are secure and accessed only by authorised personnel, daily</li> <li>Material storage containers checked for leaks daily</li> <li>Daily visual checks on sanitary systems</li> <li>Adherence to OHS policy and use of PPEs</li> </ul>	<p>Seismic QC representative will be responsible for management of solid and liquid waste at the camp sites and field working areas. Systems for treating solid and liquid wastes generated in the course of rolling out the project should be properly selected, installed, managed and decommissioned according to national legislation, regulations, and international best practices in order to minimise or eliminate their potential environmental impacts. Safety of the workers and the surrounding communities will be taken into account for all stages of materials handling during all project phases. The EHS officer shall consult with the local authorities in Lodwar to determine location and capacity of landfills, if any.</p>	Low	200,000

### 8.9.13 Social Characteristics

The impact sources from the project operations will include: workforce influx and activities along the seismic survey lines and camp area.



Potential Impacts	Mitigation
<ul style="list-style-type: none"> <li>▪ Possible increase in social vices, crime rate and prostitution</li> <li>▪ Possible increase in school drop-out by individuals searching for jobs</li> <li>▪ Erosion of culture and social values as a result of intermingling with workers</li> <li>▪ May interfere with grazing lands and watering points</li> <li>▪ May interfere with farmlands especially on the southern side of the block in farming communities</li> </ul>	<ul style="list-style-type: none"> <li>▪ Employ Community Liaison Officers (CLOs) to keep communities informed prior to project mobilisation and on an ongoing, continual basis to ensure sensitization of the community and stakeholders <i>vis a vis</i> the project objectives, activities and scheduling, potential impacts;</li> <li>▪ The communities should be informed well in advance of the start of the seismic survey operation and prior to execution along a specific seismic transect/location using appropriate wide-penetration communication media;</li> <li>▪ Awareness campaigns can be undertaken to inform/educate both the local communities and project employees;</li> <li>▪ During the seismic operations, disruption of livelihood activities in the area (section 4.4.6) should be avoided where possible otherwise minimized.</li> <li>▪ Provision to be made to compensate local property and landowners for any loss or damage caused by seismic operations. Compensation rates to be agreed with Government department before operations commence.</li> <li>▪ Camps to be established at distances from local communities to minimise interactions between local people and seismic workers</li> </ul>

<i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i>					
Desired Outcomes	Desired Outcomes	Desired Outcomes	Responsibility and Management	Risk with mitigation (High, Medium or Low)	E.g Cost (Ksh.)
<ul style="list-style-type: none"> <li>▪ Decrease in crime rates and no school drop-outs</li> <li>▪ Preservation of cultural and social values</li> <li>▪ Protection of grazing lands and watering points</li> <li>▪ Protection of agricultural land</li> </ul>	<ul style="list-style-type: none"> <li>▪ Decrease in crime rates and no school drop-outs</li> <li>▪ Preservation of cultural and social values</li> <li>▪ Protection of grazing lands and watering points</li> <li>▪ Protection of agricultural land</li> </ul>	<ul style="list-style-type: none"> <li>▪ Decrease in crime rates and no school drop-outs</li> <li>▪ Preservation of cultural and social values</li> <li>▪ Protection of grazing lands and watering points</li> <li>▪ Protection of agricultural land</li> </ul>	<ul style="list-style-type: none"> <li>▪ The TKBV Community Liaison Team should ensure community involvement in establishment of recruitment and tender committees to check on recruitment procedures, gender balance and potential conflict areas. One officer should be selected to coordinate the implementation of the grievance mechanism.</li> </ul>	Low	50,000

#### 8.9.14 Economic Characteristics

The impact sources from the project operations will include: employment opportunities, tenders, and supplies.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> <li>Improved livelihood</li> <li>Improved short-term business opportunities for the locals</li> <li>CSR project benefits</li> </ul>	<ul style="list-style-type: none"> <li>Liaise with local community leaders during the recruitment process;</li> <li>Employment policies to be strategically managed to avoid inter-community conflict and similar problems caused by migrant labourers;</li> <li>Unskilled and semi-skilled manpower to be sourced locally as far as possible;</li> <li>Gender should be factored into the employment criteria;</li> <li>Sustained public awareness and sensitization about the proposed project should be continued throughout the project lifespan.</li> </ul>

<i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i>					
Desired Outcomes	Desired Outcomes	Desired Outcomes	Responsibility and Management	Risk with mitigation (High, Medium or Low)	E.g Cost (Ksh.)
<ul style="list-style-type: none"> <li>Improved economy and living standards</li> </ul>	<ul style="list-style-type: none"> <li>Number of locals recruited</li> <li>Number and type of CSR projects that TKBV commits to</li> </ul>	<ul style="list-style-type: none"> <li>As needed</li> </ul>	<ul style="list-style-type: none"> <li>The TKBV Community Liaison Team should ensure community involvement in establishment of recruitment and tender committees to check on recruitment procedures, gender balance and potential conflict areas. CLO team should coordinate the implementation of the grievance mechanism, which would be set up and managed by TKBV. TKBV would also determine fair levels of compensation (if the need arises) in consultation with relevant Government agencies (e.g. Ministry of Energy, and KWS).</li> </ul>	Low	160,000

### 8.9.15 Occupational Health and Safety

The impact sources from the project operations will include the campsite and fieldwork environments and management of waste generated during the operations.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> <li>▪ Injuries to workers, visitors and area residents arising from project operations</li> <li>▪ Fire hazard</li> <li>▪ Other health risks</li> </ul>	<ul style="list-style-type: none"> <li>▪ All operations will be conducted in compliance with Tullow's EHS policy, international best practices and Kenya Government requirements (as set out in the Occupational Health and Safety Act and the Public Health Act; see also section 4.2.6 of this report);</li> <li>▪ Appropriate and well-stocked first aid kits and fire fighting equipment should be available to all crew, and specific crew members should be trained on first aid administration and handling of fire fighting equipment (section 4.3.7);</li> <li>▪ Job-specific personal protective equipment to be provided to the workers, training should be given, and their use made mandatory in designated areas (section 4.3.7);</li> <li>▪ Environmental safety and health regulations and policies/plans must be adhered to (see sections 4.2.6 (Health Policy), 4.3.5 (Energy Act), 4.3.6 (Public Health Act), 4.3.10 (Local Government Act), 4.3.11 (Physical Planning Act), and 4.4 – NEMA Regulations);</li> <li>▪ A Base Camp Clinic is to be provided, manned by suitably qualified field medical staff, licensed as appropriate to operate in-country, equipped with equipment and medication as appropriate, including ambulance vehicle(s);</li> <li>▪ Adequate warning or cautionary signage will be posted as required;</li> <li>▪ All electrical equipment shall be properly installed, earthed and regularly inspected and where practicable will comply with IEE 17<sup>th</sup> edition regulations;</li> <li>▪ Only properly trained and authorised employees shall operate equipment or machinery;</li> <li>▪ Tullow driving policy and all other project-specific driving policies and journey management plans to be strictly adhered to and enforced.</li> </ul>

<b><i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i></b>					
Desired Outcomes	Desired Outcomes	Desired Outcomes	Responsibility and Management	Risk with mitigation (High, Medium or Low)	E.g Cost (Ksh.)
<ul style="list-style-type: none"> <li>▪ Prevent workers and/or visitors from possible injuries/harm and health-related risks</li> </ul>	<ul style="list-style-type: none"> <li>▪ 100% use of personal protective equipment (PPE) when and where required</li> <li>▪ Caution signage placed visibly in required places</li> <li>▪ Training and drills on health and safety in the workplace, including fire-fighting</li> </ul>	<ul style="list-style-type: none"> <li>▪ Continuous monitoring and recording of incidences under each work component section</li> </ul>	<ul style="list-style-type: none"> <li>▪ The TKBV EHS Representative should ensure all the protocols relating to environmental health and safety, and occupational health and safety policies are adhered to. Frequent training programs on first aid, fire-drills and other related health issues should be a prerequisite. The field team will be self-contained and will carry its own water to the work sites to minimise health risks relating to water consumption.</li> </ul>	Low	120,0000

### 8.9.16 Security and Public Safety

The impact sources from the project operations will be related to the workforce security needs and the security of the environment in which they are operating.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> <li>Improvement in security due to security enhancement for project activities</li> <li>Cessation of work due to third party armed attack</li> </ul>	<ul style="list-style-type: none"> <li>Ensure that all workers can be identified by staff uniform and badges where applicable;</li> <li>Adequate security measures should be provided, e.g. perimeter fencing, safe havens and security manning at the campsites and whilst on line utilising Administration Police (APs) and Kenya Police Reservists (KPRs);</li> <li>The company should liaise with the Provincial Administration, the Kenya Police, KWS, Kenya Police Reservists and other agencies to provide adequate security during the seismic survey operation;</li> <li>Barriers (camp perimeter fence and gate) and guards will be installed as necessary to protect employees and visitors from physical hazards and criminal activity;</li> <li>Camp population will be forbidden from interacting with local populace;</li> <li>Journey management policy and monitoring to be enforced.</li> </ul>

<i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i>					
Desired Outcomes	Desired Outcomes	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)	E.g Cost (Ksh.)
<ul style="list-style-type: none"> <li>No security-related incidents</li> <li>Adequate security for the workforce</li> </ul>	<ul style="list-style-type: none"> <li>Reduced number of security-related incidents recorded</li> </ul>	<ul style="list-style-type: none"> <li>Continuous monitoring and recording of incidences</li> </ul>	<ul style="list-style-type: none"> <li>Security issues shall be presided over by the Chief Security Officer, who shall report to the Country Manager. The involvement of government agencies such as the Kenya Police (KP), Administration Police (AP), and Kenya Police Reservists (KPRs) during the project operations may enhance long-term security initiatives from the concerned parties, hence improving the security situation in the area.</li> </ul>	Low	150,000

### 8.9.17 Construction of the Campsite

The workforce will reside in a base camp that will be constructed by a professional civil and building contractor with experience in setting up such camps. Issues such as camp security, provision of basic services (e.g. accommodation, water, sanitation, lighting, and health care), waste management, materials storage areas, etc., shall be incorporated in the camp design.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> <li>▪ Disturbance to soils and vegetation during construction</li> <li>▪ Reduced landscape aesthetics due to stockpiling of excavated soils</li> <li>▪ Health and safety hazard due to poor campsite construction</li>   <li>▪ Spillage of oils and fuels from construction equipment and vehicles</li> <li>▪ Disturbance to communities</li>   <li>▪ Insecurity</li>   <li>▪ Health and safety hazard during campsite occupation</li>   <li>▪ Fuel and chemicals leaks</li> </ul>	<ul style="list-style-type: none"> <li>▪ Minimise soil disturbance (excavation) and vegetation clearance as is practicable based on good construction practice;</li> <li>▪ Excavated soil should be used in landscape design of the campsite rather than stockpiling;</li> <li>▪ Campsite will be erected by a qualified and licenced civil and building contractor;</li> <li>▪ Construction workers shall be qualified to carry out assigned tasks;</li> <li>▪ Construction workers shall use appropriate Personal Protective Equipment;</li> <li>▪ Adequate temporary housing and sanitation facilities shall be provided for the construction workers;</li> <li>▪ Construction equipment and vehicles shall be well maintained to minimise gaseous emissions;</li> <li>▪ All equipment shall be well maintained, checked and promptly repaired to ensure no spillage of oils and fuels;</li>   <li>▪ Construction of the campsite shall be undertaken during daylight hours only;</li> <li>▪ Construction equipment shall be fitted with silencers to minimise noise emissions;</li> <li>▪ The campsite will be set up away from populated areas;</li> <li>▪ Camp population will be forbidden from interacting with local populace;</li> <li>▪ Camp location shall be determined in consultation with the local community leaders;</li> <li>▪ Company employees shall comply both with the relevant national legislation, and its own in-house environmental health and safety (EHS) policies</li> <li>▪ Journey management policy and monitoring to be enforced;</li> <li>▪ Adequate security measures should be provided, e.g. perimeter fencing, safe havens and security manning at the campsites utilising AP's and KPR's;</li> <li>▪ Barriers and guards will be installed as necessary to protect employees and visitors from physical hazards and criminal activity;</li> <li>▪ Security fortresses will be erected within the camp, and will have sand-sack perimeter walls and adequate space to accommodate all staff in case of a bandit or militia attack;</li> <li>▪ Facilities will include fully equipped and staffed medical unit and radio control and communications room (with radio, internet and satellite phone facilities) that will be manned on a 24-hour basis;</li> <li>▪ Safety equipment such as fire extinguishers will be placed strategically within the camp site.</li> <li>▪ Workshop/garage areas will have a concrete floor suitably lined in order to contain oil/fuel spillage;</li> <li>▪ The generator housing unit should be secured, and only authorised personnel allowed to enter in;</li> <li>▪ Adequate warning signs and fire extinguisher equipment will be visibly and appropriately posted;</li> <li>▪ the power distribution network and shall have junction points where the power can be isolated or cut-off for repair or emergency purposes;</li> <li>▪ Water for general use will be stored in a bladder placed in a bunded area (with the bunded containment being able to capture the entire capacity of water stored in case of leakage);</li> <li>▪ A water processing plant will be set up to ensure potable water supplies;</li> <li>▪ Charging of the water (for general use and drinking) will be done using water bowsers;</li> <li>▪ Adequate and well maintained sanitary facilities and waste management system will be constructed;</li> </ul>



	<ul style="list-style-type: none"> <li>The generator, fuel and chemical storage areas will be bunded to prevent accidental leakages and spills.</li> </ul>
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<b><i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i></b>					
<b>Desired Outcomes</b>	<b>Objective Indicators</b>	<b>Monitoring</b>	<b>Responsibility and Management</b>	<b>Risk with mitigation (High, Medium or Low)</b>	<b>E.g Cost (Ksh.)</b>
<ul style="list-style-type: none"> <li>Minimal disturbance to environment during construction</li> <li>Reduced potential for environmental pollution due to oil and fuel leaks and noise and gaseous emissions</li> <li>Communities are not disturbed</li> <li>No security-related incidents</li> <li>No safety and health-related incidents</li> </ul>	<ul style="list-style-type: none"> <li>Soil and vegetation are not unnecessarily cleared</li> <li>Maintenance schedule for equipment and vehicles adhered to and no pollution incidents reported</li> <li>Number of community disturbance incidents reported</li> <li>Number of security-related incidents recorded</li> <li>Number of safety and health-related incidents recorded</li> </ul>	<ul style="list-style-type: none"> <li>Continuous monitoring and recording of incidences</li> </ul>	<ul style="list-style-type: none"> <li>The construction of the campsite shall be supervised by the chosen contractor and overseen by TKBV. Camp operations shall be supervised and coordinated by the Camp Manager.</li> </ul>	Low	200,000

### 8.9.18 Fuelling Station

A parking bay for vehicles will be demarcated within the campsite area, and it will have a fuelling station.

<b>Potential Impacts</b>	<b>Mitigation</b>
<ul style="list-style-type: none"> <li>Fuel spills</li> <li>Fire hazard</li> </ul>	<ul style="list-style-type: none"> <li>Fuelling station will be underlain with a spill-containing liner;</li> <li>The fuel storage area will be set at one end of the parking bay area, and will be bunded. The bunds should have the capacity to contain all the fuel stored inside the fuel bladder in case of leakage;</li> <li>The fuel storage floor shall be concrete-based, and canvas-lined to capture minor spillages, with a structure measuring at least 12m x 8m x 0.05m;</li> <li>The bladder will be charged with fuel ferried by tankers, and will be conveyed to the pump via an outlet hose;</li> <li>Clearly marked spill kits will be placed adjacent to the refuelling area, and all staff involved in vehicle maintenance and refuelling will be trained in their use;</li> <li>Clear 'no smoking' signage shall be posted in this area;</li> <li>Fire-fighting equipment will be placed at strategic places within the fuelling station and in other areas of the campsite;</li> <li>All workers will be trained in the use of the installed fire-fighting equipment;</li> </ul>

<ul style="list-style-type: none"> <li>Fuel contamination</li> </ul>	<ul style="list-style-type: none"> <li>The fuel storage area will have a tarpaulin covering to protect it from the weather, but should be well aerated.</li> </ul>
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<b><i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i></b>					
<b>Desired Outcomes</b>	<b>Objective Indicators</b>	<b>Monitoring</b>	<b>Responsibility and Management</b>	<b>Risk with mitigation (High, Medium or Low)</b>	<b>E.g Cost (Ksh.)</b>
<ul style="list-style-type: none"> <li>No fuel spills</li> <li>No fires</li> <li>No fuel contamination</li> </ul>	<ul style="list-style-type: none"> <li>Number of incidents recorded</li> </ul>	<ul style="list-style-type: none"> <li>Continuous monitoring and recording of incidences</li> </ul>	<ul style="list-style-type: none"> <li>Proper operations in the fuel filling station shall be supervised and coordinated by the Camp Manager.</li> </ul>	Low	50,000

### 8.9.19 Camp Clinic

A fully equipped and staffed ambulance will be on standby in case of accidents or emergencies, and will be supported by a fully equipped and staffed clinic that will be located in the base camp. There will also be an on-call helicopter for crew movement and emergency evacuations.

<b>Potential Impacts</b>	<b>Mitigation</b>
<ul style="list-style-type: none"> <li>Pollution due to poor handling of biomedical and pharmaceutical wastes</li> </ul>	<ul style="list-style-type: none"> <li>Such wastes will be handled as per NEMA Waste Management Regulations 2006;</li> <li>The wastes will be segregated, and disposed of in the waste disposal facility as provided for by the relevant Local Authority (Turkana County Council in the western part of the project area, and Marsabit County Council in the eastern part of the project area);</li> <li>Biomedical waste will not be stored above 0°C for more than seven days without the written approval of the relevant lead agency, provided that untreated pathological waste shall be disposed of within 48 hours.</li> </ul>

<b><i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i></b>					
<b>Desired Outcomes</b>	<b>Objective Indicators</b>	<b>Monitoring</b>	<b>Responsibility and Management</b>	<b>Risk with mitigation (High, Medium or Low)</b>	<b>E.g Cost (Ksh.)</b>
<ul style="list-style-type: none"> <li>No pollution from medical and pharmaceutical wastes</li> </ul>	<ul style="list-style-type: none"> <li>Number of incidents of improper disposal recorded</li> </ul>	<ul style="list-style-type: none"> <li>Continuous monitoring and recording of incidences</li> </ul>	<ul style="list-style-type: none"> <li>The operation of the medical clinic will be under the direct management of the Camp Doctor, and shall be overseen by the Camp Manager.</li> </ul>	Low	50,000

### 8.9.20 Water Borehole Drilling

The groundwater in the project area is exploited mainly through boreholes and shallow wells excavated in luggas, and tends to have widely variable quality, from human-potable through livestock-potable to saline and non-potable. The borehole water quality is generally good for use as drinking water, and is the cleanest source of potable water in the area, but in some existing water the sulphates and/or fluoride levels may be high. TKBV will drill a water borehole to meet its water needs. Borehole water drilling is a very low impact activity, with the key impacts being vegetation and soil disturbance in an area that is typically less than 50x50m, and disposal of low volume rock cuttings from the drill hole.

Before the borehole drilling, an hydrogeological survey will need to be carried out by a hydrogeologist registered with the Ministry of Water and Irrigation and the Geologists Registration Board. The hydrogeological survey will include: study of the geology of the area (no environmental impact), and resistivity sounding and profiling using a Terrameter with connecting cables, stainless steel non-polarising current electrodes and copper potential electrodes (minimal clearing of low-level vegetation along a transect about 30cm wide and a maximum of 800m long) to identify the water-bearing stratum. The resistivity sounding is a passive technique with no environmental impact. The hydrogeological report will be submitted to the Water Resources Management Authority as a pre-condition for obtaining a drilling permit.

Boreholes may be drilled with either percussion (cable-tool) or rotary plant: the former have the advantage of lower cost, but the disadvantages of longer time at site, less flexibility in borehole development, and the greater possibility that temporary casing will be needed to hold back heaving or unstable formations. Rotary plant is more expensive to use, but it is considerably faster. Rigs with a compressor and mudpump allow efficient development (i.e. jetting and air lifting), which percussion rigs cannot emulate. In addition, approximate yields may be estimated during drilling, from the air-blown volume of water and cuttings (when air rotary techniques are used).

Potential Impacts	Mitigation
<ul style="list-style-type: none"> <li>Disturbance to soils and vegetation during data acquisition and borehole drilling</li> <li>Contamination during well development</li> <li>Drill cuttings from borehole</li> <li>Pollution/contamination of</li> </ul>	<ul style="list-style-type: none"> <li>Minimise soil disturbance and vegetation clearance as is practicable (no unnecessary vegetation clearance);</li> <li>Well development must be done with the Airlift method for at least 30 minutes or until the water is clear of drilling cuttings;</li> <li>Great care should be taken that the water quality of the different aquifers is accurately determined. Upon the first strike, drilling fluids should be effectively flushed, and after sufficient time, a water sample should be taken of the air-blown (rotary) or bailed (percussion) yield;</li> <li>On-site analysis using an EC meter, and preferably a portable laboratory, is recommended;</li> <li>Screen-off non-targeted aquifer(s);</li> <li>The Drilling Contractor should engage the services of an experienced hydrogeologist during the drilling, design, installation, and testing of the borehole;</li> <li>Drill cuttings from the borehole should be buried in clay or other suitably lined pit in the event that the borehole is successful;</li> <li>If the borehole is not successful, the drill hole can be refilled with the drill cuttings;</li> <li>Drilling should be carried out at a diameter of not less than 6", using</li> </ul>

borehole/aquifer water	<p>either a rotary type or percussion machine, to allow to allow for casing, gravel packing and pump installation.</p> <ul style="list-style-type: none"> <li>▪ The borehole should be cased to the bottom using suitable non-polluting material, with screens at the aquifer position and plain casings at non-aquifer position;</li> <li>▪ The borehole should be bottom plugged in loose formations;</li> <li>▪ The annular space must be gravel packed at the screen and aquifer position with durable and suitably sized material with respect to the size of the aquifer materials;</li> <li>▪ Grouting should be done by placing a concrete mixture up to 6m depth from ground surface;</li> <li>▪ Any drilling additives to be used (e.g. foam or polymer) must be non-toxic and bio-degradable. Bentonite additives should not be acceptable, as they may plug the aquifer zones and are extremely difficult to remove during development.</li> </ul>
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<b><i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i></b>					
<b>Desired Outcomes</b>	<b>Objective Indicators</b>	<b>Monitoring</b>	<b>Responsibility and Management</b>	<b>Risk with mitigation (High, Medium or Low)</b>	<b>E.g Cost (Ksh.)</b>
<ul style="list-style-type: none"> <li>▪ No disturbance to soil and vegetation</li> <li>▪ No contamination of the aquifer during well development and post-development</li> <li>▪ Non-target aquifer strata are protected</li> <li>▪ Drilling cuttings are safely disposed of</li> </ul>	<ul style="list-style-type: none"> <li>▪ No unnecessary clearing of vegetation and soil disturbance</li> <li>▪ No contamination of aquifers</li> <li>▪ Aquifers, borehole and well-head are protected based on good construction practice</li> <li>▪ Drill cuttings are safely disposed</li> </ul>	<ul style="list-style-type: none"> <li>▪ Monitoring during the drilling and well-head construction phases</li> </ul>	<ul style="list-style-type: none"> <li>▪ The TKBV EHS Representative should ensure all the protocols relating to environmental health and safety, and occupational health and safety policies are adhered to by the Drilling Contractor. Overall supervision will be the responsibility of the Camp Manager, who should also ensure that a qualified and registered hydrogeologist is available on site to supervise the drilling and well protection works.</li> </ul>	Low	150,000

## **8.10 OTHER GENERAL REQUIREMENTS AND TRAINING ISSUES**

### **8.10.1 Occupational Health and Safety Plan**

TKBV in conjunction with the Seismic Contractor will develop an Occupational Health and Safety Plan (OHSP), based on Tullow's EHS and CSR policies, prior to commencement of the project operations. The OHSP will uphold TKBV's commitment to a safe environment for employees, contractors and visitors. The plan will also address all applicable legal requirements relating to health and safety. The OHSP will set out the framework under which health and safety on the project site, and to and from the site, will be managed. The roles and responsibilities of the company, manager, supervisors and workers will be set out under this plan.

A health and safety training program will also be implemented at the site. The objectives of this training program will be to:

- provide appropriate orientation and support to all employees, contractors and visitors on site so that they can act in an appropriately safe manner;
- provide ongoing training to workers;
- Inform at-risk workers to help attain a positive and safe work environment.

#### **8.10.2 Vehicle Traffic Management**

All vehicular movement and driving will be undertaken as per Tullow Oil's Driving Policy for Land Transportation (See attached policy). Priority will be given to careful Journey Management Planning.



# Driving policy – Land transportation

As part of its commitment to high standards of Environment, Health and Safety, Tullow has stipulated the following minimum requirements for vehicle use and general Land Transportation.

These minimum requirements are applicable to all company vehicles, employees and contractors of Tullow Oil while on company business and may be exceeded by detailed local procedures.

- Safe/Defensive driver training is to be provided for drivers (those employed as drivers) of Tullow vehicles;
- Speed limits and all applicable local laws are to be adhered to;
- The use of hand held mobile phones/Blackberries while driving is prohibited;
- Smoking is prohibited in all Tullow vehicles;
- All 4 x 4 and other heavy vehicles should be fitted with reverse alarms/warning lights;
- Travelling in rear freight compartments (open or enclosed without seating or seat belts) of 4 x 4 field vehicles is not allowed;
- Driving hours should be aligned with the OGP publication "Land transportation safety recommended practice – Journey Management";

Requirement	Recommended practice
Maximum driving time between breaks and minimum break time	4.5 hours followed by a 30 minute break. However it is strongly recommended to have a 15 minute break every two (2) hours, or more frequent breaks during periods of circadian lows.
Maximum duty hours within a rolling 24 hour period	16 hours (i.e. employee cannot drive after 16 duty hours). This shall include driving, loading, unloading, waiting, rest breaks, and any other work (including air travel)
Maximum driving hours within a rolling 24 hour period	Ten (10) hours total excluding commuting time. Eleven (11) hours including any commuting time
Maximum duty hours in a rolling 7 day and 14 day period	14 day period: 120 hours, subject to an 80 hour/7 day maximum, and an average of 60 hours per week over an extended period
Off duty period in a rolling 7 day period	Minimum of a continuous 24 hour break prior to driving again

- Regular breaks are to be taken on long journeys, recommend a 15 minute break every 2 hours;
- Tullow vehicles should contain as a minimum the following equipment: First aid kit, Communication devices, Fire extinguisher, Drinking water, Warning triangle (for breakdowns), Torch, Basic Tool Kit (to include spare bulbs/fuses), (Extra fuel for remote locations).
- Three point seat belts are to be installed for all driver and passenger seats in Tullow vehicles and must be worn at all times;
- Drivers must be appropriately licensed, approved, and be fit to drive;
- Drivers must not drive under the influence of drugs, alcohol or medication that could affect their ability to drive.
- Vehicles should be fit for purpose and maintained in a safe working order in line with the manufacturers' specifications and local legal requirements.

#### Further requirements for developing countries:

- People intending to drive in developing countries should liaise with the Country Manager and/or EHS Advisor as in each case there will be specific requirements and hazards that they should be aware of;
- No night driving outside of city limits is allowed unless in an emergency or with prior approval by Country Manager or their nominated Incident Responsible Person;
- In-Vehicle Monitoring Systems (such as "Drive Rights units") and/or GPS tracking systems should be fitted where possible;
- Journey Management procedures reflecting local driving conditions and identified risks shall be in place that complies with the OGP publication "Land transportation safety recommended practice – Journey Management";

Any incidents in which a breach of the local procedures or this policy has occurred should be reported as near misses in investigated accordance with the Accident and Incident Investigation and Reporting Procedure. Violation of the policy will be investigated and may result in disciplinary action.



TOP-EHS-POL-002-Rev2

### 8.10.3 Waste Management Plan

A Waste Management Plan (WMP) will be developed for the project. It will identify all waste streams, including potentially hazardous materials to be used and provide a system for monitoring them. Transportation, storage, use and ultimate disposal will be considered. Safety of the workers and the surrounding communities will be taken into account for all stages of materials handling during all project phases.

Hazardous materials and wastes require special handling and training procedures. All employees will be provided with basic training so that, at a minimum, they can: identify hazardous materials; know how to obtain appropriate information on special handling procedures required; know what precautions and protective equipment are required; know how to label and package hazardous materials and wastes; know where and how hazardous wastes are to be stored; and know how wastes are to be disposed of. Employees who are tasked with receiving, off-loading and storing potentially hazardous materials or involved in the storage and shipment off-site of hazardous wastes should receive hazardous materials handling training.

### 8.10.4 Spills Prevention and Response Plan

Before the project commences, a Spill Prevention and Response Plan (SPRP) will be developed for use by TKBV and contracted personnel in the event of a deleterious material spill. The objective of the spill response measures will be to ensure that where accidental spills occur, all available resources are used appropriately to minimize the extent and severity of effect on the environment. All spills occurring on the project site will be responded to in a way that will uphold the following priorities: protection of human life and health; protection of the environment; protection of property; and minimized disruption to operational activities. At all times, applicable regulations will be used to guide response and cleanup activities.

At locations where the potential for spillage of hazardous material is highest, such as at fuelling points, spill control and containment means will be incorporated into the infrastructure during construction. The storage of materials will be tied in with the HMMP.

Spill response kits appropriate to the types and volumes of materials that will be used during the project operations will be specified, including the types of equipment that will handle or transport contaminant materials (including fuel). Spill response kits will be located at appropriate material handling and storage locations. The contents of the kits will be based on the potential risk associated with the material, volume of material, and environmental sensitivity of the area. General kit contents could include: absorbent socks; granular absorbents; and protective equipment such as gloves, goggles and protective suits. All kits will be stored in a visible location, and in appropriate weather-resistant containers. Regular inspections of the kits will be performed to ensure that kits are complete and all materials remain functional.

All TKBV employees and contractors will undergo, as part of their orientation to the site, a training program on spill-prevention and hazard-identification, as well as spill-response, containment and reporting procedures. Other aspects of the training will include education on the:

- SPRP
- Applicable legislation
- Potentially affected environmental receptors (e.g. soil, surface and groundwater)
- Field application of appropriate spill-response techniques

### 8.10.5 Emergency Response Plan (ERP)

A more general plan that will deal with emergencies such as those related to accidents and personal injury, medical evacuations, fires, and escalating insecurity shall be put in place before the commencement of project operations. A copy of the ERP is included in the appendices. Issues to be addressed include the capacity for response and management, and the support agencies that can be called in to assist (e.g. Kenya Police, Hospital staff, KWS, etc). Specific issues will be developed in conjunction with the Seismic Contractor.

### 8.10.6 Environmental Awareness Plan

On appointment, all contracting companies and employees will receive a copy of the EMP and will be trained in the relevant categories of the EMP that are outlined in sections 8.9 and 8.10 above. TKBV will also undertake to address the following items:

- Basic workforce environmental awareness;
- Sensitivity of the site
- Personnel environmental training needs; and
- Resources available for use in personnel environmental awareness training
- Daily toolbox talks will be held to sensitize the workforce on environmental issues of concern.

Ongoing training through tool-box talks will also assist in continually improving the environmental awareness of the project team. TKBV will also target the community leaders and government administrators for sensitization and awareness-building on the project components. These leaders and administrators would, thereafter, be able to explain the project components, the environmental issues, and mitigation measures that are being undertaken, to the community at large.

### 8.10.7 Campsite Decommissioning Plan

The campsite decommissioning plan will follow the same sequence of project decommissioning as activities as described in chapter 2:

- Workers lay-off and compensation;
- Equipment demobilization (such as containers, vehicles, accommodation facilities)
- Dismantling of camp facilities;
- Cleaning the camps and disposal of solid, liquid and hazardous waste;
- Restoration of waste pits, cesspools and the whole camp site;
- Restoration of cut lines, shot hole repairs, removal of any debris and recovery and destruction of dead charges within the project area; and
- Audit and sign off.

The decommissioning will cover the base camp and any fly camps or any other facility that shall be erected. The decommissioning will lay emphasis on:

- Examining the conformity to the EMP's developed during the EIA for the seismic survey project;
- Preparation of a decommissioning plan before decommissioning begins;
- Conforming to national legislation and regulatory requirements and international best practices.

The decommission will be carried out as soon as is practicable after the end of the seismic survey, hence the specifics of it, which will depend largely on what was actually constructed on the ground, will need to be formulated well in advance.

### **8.11 COST OF THE PROJECT, EMP AND TIMEFRAME FOR THE ACTIVITY**

It is estimated that the entire project will cost USD 8.2 million. The cost of implementing the EMP is Kenya Shillings 2,040,000. The EMP will largely be implemented by salaried employees who will be tasked to carry out the various EMP monitoring and evaluation activities, therefore the EMP will not incur significant additional costs, over and above those already budgeted for in the project.

It is anticipated that the seismic survey will commence in mid-November.

## **CHAPTER 9:**

### **CONCLUSIONS AND RECOMMENDATIONS**

#### **9.1 SUMMARY OF THE PROJECT COMPONENTS**

Tullow Oil is an International Oil and Gas exploration company with interests in many parts of the African continent including Kenya, Uganda and Ghana. The company signed a Production Sharing Contract (PSC) with the Government of Kenya in 2011 and obtained an Exclusive Prospecting Right (EPR) for Block 12A (surface area of 15389.39 km<sup>2</sup>), which covers parts of Turkana East, East Pokot, Marakwet West, Baringo Central, Marigat, Keiyo South, Baringo North, and Mogotio Districts. The company now intends to undertake a seismic survey for the purpose of evaluating the hydrocarbons prospects safely, evaluate the prospects without adverse impact to the environment, and determine the hydrocarbon potential of the designated prospect.

The proposed seismic survey will use environmentally friendly state-of-the-art technology, and comply with the Environmental Management Plan detailed herein, as well as national legislation and regulations and industry international best practices. There are possible impacts from the proposed seismic operation that have been identified through this EIA study, and appropriate mitigation measures instituted to protect the biophysical and socio-economic environments. Tullow Oil is cognizant of the need for a proactive environmental and social approach. Members of the public interviewed had a positive view of the proposed project.

Positive cumulative benefits for the local business community are an expected result of the proposed activity with the planning and construction phases utilising a range of local professional service providers. Semi-skilled workers who may be employed in the project will likely acquire new and lifelong skills that may prove useful in other sectors of the Kenyan economy.

Overall, the impacts of the proposed project are classified as “low” (see section 3.5). The relationship between the significance rating and decision-making is also classified as “low” (see section 3.5), provided that the recommended measures to mitigate the impacts are implemented. The mitigation measures suggested in this report and the environment management plan developed will ensure that the project is technically, environmentally, and socially sound and acceptable.

#### **9.2 RECOMMENDATIONS**

From an environmental point of view, it can be concluded that the project is viable and will not adversely affect the environment if the EMP outlined in this document is strictly adhered to. Some of the key recommendations are summarized here-below:

- To reduce the expected transient impacts on wildlife, noise levels will need to be minimized to the extent possible, correct strength of dynamite charging and Vibroseis use applied to achieve the survey objectives, and human contact with wildlife should also be minimized in line with the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, and the Wildlife (Conservation and Management) Act;
- Liaise with the Kenya Wildlife Service (KWS) to ensure that wildlife disturbance and danger to the seismic team is mitigated in and around the National Reserves in the south;



- Minimize vegetation and grassland clearance as much as possible when cutting the survey line transects;
- Trees with trunk diameter greater than 20cm should not be cut unless absolutely unavoidable;
- Use of modern line cutting technology, preferably *mulchers* for clearing of the geophysical survey transects will ensure that minimal vegetation is removed, hence ensuring that re-vegetation will occur in a much shorter period since the seeds and branches will be left along the traverses and this will promote faster re-growth;
- Use existing access roads to the extent possible, limit traffic speed, and restrict movement of vehicles as is reasonable to minimize dust generation;
- Rivers/luggas should be crossed at road crossings, where such crossings exist, or in areas where the bank heights are less than 1m – banks at the lugga crossings should be mechanically restored;
- Access routes and cut lines will be selected to provide sufficient offset to known cultural sites to avoid disturbing them: these offsets shall be determined in consultation with area leaders;
- Seismic survey activities to be undertaken during daylight hours only;
- A waste management plan documenting the waste strategy, storage (including facilities and locations), handling procedures and means of disposal should be developed and should include a clear waste-tracking mechanism to track waste consignments from the originating location to the final waste treatment and disposal location in compliance with the Environmental Management and Coordination (Waste Management) Regulations;
- The company should consider drilling its own water supply borehole for the camp to avoid water resource conflicts with the communities;
- Employees should be provided with and use personal protective equipment at all times;
- Employ Community Liaison Officers to keep communities informed prior to project mobilisation and on an ongoing, continual basis to ensure sensitization of the community and stakeholders *vis a vis* the project objectives, activities and scheduling, potential impacts;
- Liaise with local community leaders during the recruitment process;
- All operations will be conducted in compliance with Tullow's EHS policy, international best practices and Kenya Government requirements (as set out in the Occupational Health and Safety Act and the Public Health Act); and
- The company should liaise with the Provincial Administration, the Kenya Police, KWS, Kenya Police Reservists and other agencies to provide adequate security during the seismic survey operation.

## REFERENCES:

- Andrews, P. and Banham, P. (eds.) (1999) Late Cenozoic Environments and Hominid Evolution: a tribute to Bill Bishop, Geological Society, London.
- Baker, B.H., 1963. Geology of the Baragoi area. Geological Survey of Kenya, Nairobi 53, 1-74.
- Baker, B.H., Mitchell, J.G. and Williams, L.A.J. (1988) Stratigraphy, geochronology and volcano-tectonic evolution of the Kedong-Naivasha-Kinangop region, Gregory Rift Valley, Kenya, *J. Geological Society, London* 145, 107-116.
- Baker, B.H. 1965: The Rift System in Kenya. Report on UMC/UNESCO seminar on the East African Rift System, 82.84.
- Bosworth, W., Morley, C.K., 1994. Structural and stratigraphic evolution of the Anza rift, Kenya. *Tectonophysics*, 236, 93 – 115.
- Birdlife International, 2001. Lake Baringo. Site Fact Sheet No. KE044. Retrieved from: <http://www.birdlife.org/datazone/sitefactsheet.php?id=6434>
- Bishop, W.W., Chapman, G.R., Hill, A., Miller, J.A. 1971. Succession of Cainozoic vertebrate assemblages from the northern Kenya Rift Valley. *Nature* 233:389-394.
- Bishop, W.W., 1975. Geological reconnaissance of the lower Suguta Valley and its eastern flank, north Kenya rift Valley, In: Grove, A.T. (Ed.), Cambridge Meeting on Desertification, 62-63.
- Bosworth, W. (1992) Mesozoic and early Tertiary rift tectonics in East Africa, *Tectonophysics* **209**, 115-137.
- Bosworth, W. and Maurin, A., 1993. Structure, Geochronology and Tectonic Significance of the Northern Suguta Valley (Gregory Rift), Kenya. *J. Geol. Soc. London* 150, 751-762.
- Casanova, J., Hillaire-Marcel, C., Page, N., Taieb, M. and Vincens, A., 1988. Palaeohydrology and Late Quaternary Stratigraphy of Lacustrine Deposits in the Suguta Rift (Kenya). *C. R. Acad. Sci. Paris Sér. II* 307, 1251-1258.
- Castanier, S., Bernetrolle, M.C., Maurin, A. and Perthuisot, J.P., 1993. Effects of Microbial Activity on the Hydrochemistry and Sedimentology of Lake Logipi, Kenya. *Hydrobiologia* 267, 99-112.
- Chapman, G.R. and Brook, M. (1978) Chronostratigraphy of the Baringo Basin, Kenya Rift Valley, in W.W. Bishop (ed.), *Geological Background to Fossil Man*, Geological Society, London, Scottish Academic, 207-223.
- Carney, J.N. 1972. The geology of the area to the east of Lake Baringo, Rift Valley Province, Kenya. PHD thesis, University of London. (Unpublished), 201pp.
- Chapman, G.R., Lippard, S.J. and Martyn, J.E. (1978) The stratigraphy and structure of the Kamasia Range, Kenya Rift Valley, *J. Geological Society, London* 135, 265-281.
- Cornelissen, E., Boven, A., Dabi, A., Hus, J., Ju Yong, K., Keppens, E., Langohr, R., Moeyersons, J., Pasteels, P., Pieters, M., Uytterschaut, H., Van Noten, F., Workineh, H. (1990) The Kapthurin Formation revisited, *Afr. Arch. Review* 8, 23-75.
- Dindi, E.W., 1994. Crustal structure of the Anza-graben from gravity and magnetic investigations. *Tectonophysics*, 236, 359-371.
- Dodson R. G. 1971. Geology of the area south of Lodwar, degree sheet 18, N.E. quarter, Geological survey of Kenya, 1971
- Dodson R. G. 1991. Geology of the Barchuma-Kom Area. Report No. 93. Mines and Geological Department, 39 pp.
- Dodson, R.G., 1963. Geology of the South Horr area. Geological Survey of Kenya, Nairobi, 1-53.
- Drill Rig. (2009, May 14). In *Wikipedia, the free encyclopedia*. Retrieved May 27, 2009 from [http://en.wikipedia.org/wiki/Drilling\\_rig](http://en.wikipedia.org/wiki/Drilling_rig)

- Dunkley, P.N., Smith, M., Allen, D.J. and Darling, W.G. (1993) The geothermal activity and geology of the northern sector of the Kenya Rift Valley, British Geological Survey Research Report SC/93/1, 185 pp.
- Dunkley, P.N., Smith, M., Allen, D.J. and Darling, W.G., 1993. The geothermal activity and geology of the northern sector of the Kenya Rift Valley. British Geological Survey Research Report SC/93/1, NERC, Nottingham, pp. 185.
- Dunkelman, T.J., Karson, J.A., Rosendahl, B.R. 1988. Structural style of the Turkana Rift, Kenya. *Geology* 16, 258 – 261.
- Dunkelman, T.J., Rosendahl, B.R., and Karson, J.A., 1989: Structure and stratigraphy of the Turkana Rift from seismic reflection data: *Journal of African Earth Sciences*, v. 8, p. 489-510.
- East African Meteorological Department, 1975. Climatological statistics for East Africa. Part 1: Kenya, East African Community/East African Meteorological Department, Nairobi, pp. 92.
- Ebinger, C.J. and Ibrahim, A. (1994) Multiple episodes of rifting in Central and East Africa: A re-evaluation of gravity data, *Geol. Rundsch.* 83, 689-702.
- Ego, J. K., 1994. Sedimentology and diagenesis of Neogene sediments in the central Kenya Rift Valley. M.Sc. thesis (unpublished), University of Saskatchewan, 148p
- Exploration and Production (E&P): *Environmental Management in Oil and Gas Exploration and Production*. E&P Forum/ UNEP 1997. Report No. 2, 72/254.
- Fairhead, J.D. (1988) Late Mesozoic rifting in Africa, in W. Manspeizer (ed.) Triassic-Jurassic Rifting, Continental Breakup and the Origin of the Atlantic Ocean and Passive Margins, Part B, *Developments in Geotectonics* 22, Elsevier, 821-831.
- FAO/UNEP, 1977. Assessing Soil Degradation. FAO Soils Bulletin 34, FAO, Rome.
- FAO/UNESCO, 1997. Soil Map of the World; revised legend with corrections and updates, ISRIC, Wageningen, 1997.
- Garcin, Y., Juninger, A., Melnick, D., Olago, D.O., Strecker, M.R., Trauth, M.H. Late Pleistocene-Holocene rise and collapse of Lake Suguta, northern Kenya Rift. *Quaternary Science Reviews*, 28 (9-10): 911-925.
- Government of Kenya, 1999. National Policy on Water Resources Management and Development, Sessional Paper No 1 of 1999, Government Printer, Nairobi.
- Government of Kenya, Environmental Management and Coordination Act (No 8 of 1999)
- Guiraud, R. and Maurin, J.C. (1992) Early Cretaceous rifts of Western and Central Africa: an overview, in P.A. Ziegler (ed.), *Geodynamics of Rifting*, Volume II. Case History Studies on Rifts: North and South America and Africa, *Tectonophysics* 213, 153-158.
- Hautot, S., Tarits, P., Whaler, K., Le Gall, B., Tiercelin, J.-J. and Le Turdu, C. (2000) Deep structure of the Baringo Rift Basin (Central Kenya) from three-dimensional magnetotelluric imaging: Implications for rift evolution, *J. Geophys. Res.* 105, 493-518.
- Hendrie, D.B., Kusznir, N.J., Morley, C.K. and Ebinger, C.J. (1994) Cenozoic extension in northern Kenya: a quantitative model of rift basin development in the Turkana region, in C. Prodehl, G.R. Keller and M.A. Khan (eds.), *Crustal and Upper Mantle Structure of the Kenya Rift*, *Tectonophysics* 236, 409-438.
- Hill A. 1985. Early hominid from Baringo, Kenya. *Nature* 315:222-224.
- Hill A. 1995. Faunal and environmental change in the Neogene of East Africa: Evidence from the Tugen Hills Sequence, Baringo District, Kenya. In: Vrba ES, Denton GH, Partridge TC, Burckle LH (eds) *Paleoclimate and evolution, with emphasis on human origins*. Yale University Press, New Haven, pp 178-193.
- Hill, A. (1999) The Baringo Basin, Kenya: from Bill Bishop to BPRP, in P. Andrews and P. Banham (eds.), *Late Cenozoic Environments and Hominid Evolution: a tribute to Bill Bishop*, Geological Society, London, 85-97.

- Hill, A., Curtis, G. and Drake, R. (1986) Sedimentary stratigraphy of the Tugen Hills, Baringo, Kenya, in L.E. Frostick, R.W. Renaut, I. Reid and J.-J. Tiercelin (eds.), *Sedimentation in the African Rifts*, *Geol. Soc. London Spec. Publ.* 25, 285-295.
- Hill A, Wark S, Dein A, Garniss C, Drake R., 1992. Earliest *Homo*. *Nature* 355:719-722.
- Hill A., Leakey M., Kingston J.D., and Ward S., 2002. New cercopithecoids and a hominoid from 12.5 Ma in the Tugen Hills succession, Kenya. *Jour. Human Evol.* 42:75-93.
- Hughes, R.H. and Hughes, J.S. (1992). A Directory of African Wetlands. IUCN/UNEP/WCMC.
- IUCN (1993). Oil and Gas Exploration and Production in Mangrove Areas. IUCN Gland, Switzerland and Cambridge, UK, with E&P Forum, London, UK. Viii+47pp
- Kamau, C. (1974) The Lake Naivasha Basin, Report, Geography Department, Nairobi University.
- Karner, G.D., Byamungu, B.R., Ebinger, C.J., Kampunzu, A.B., Mukasa, R.K., Nyakaana, J., Rubondo, E.N.T. and Upcott, N.M. (2000) Distribution of crustal extension and regional basin architecture of the Albertine rift system, East Africa, *Marine and Petroleum Geology* 17, 1131-1150.
- Kenya Gazette Supplement No. 3 (Acts No. 1), 2000. Government Printer, Republic of Kenya.
- Kenya Soil Survey, M24; 1987. Manual for soil survey and land evaluation.
- Krhoda, G.O., 1989. Goundwater assessment in sedimentary basins of eastern Kenya, Africa. *Regional Characterization of Water Quality* (Proceedings of the Baltimore Symposium, May 1989). IAHS Publ. no.182, 1989.
- Landon, J.R (ed)., 1984. Booker tropical Soil manual. A handbook for soil survey and agricultural land evaluation in the tropics and subtropics.
- LaVigne, M. and G. M. Ashley, 2002. Climatology and Rainfall Patterns: Lake Bogoria National Reserve (1976–2001), Department of Geological Sciences, Rutgers University, Piscataway, NJ, U.S.A.
- Le Gall, B., Tiercelin, J.-J., Richert, J.P., Gente, P., Sturchio, N.C., Stead, D., Le Turdu, C. (2000). A morphotectonic study of an extensional fault zone in a magma-rich rift: the Baringo Trachyte Fault System, central Kenya Rift, *Tectonophysics* 320, 87-106.
- Lippard, S.J. (1973) Plateau phonolite lava flows, Kenya, *Geological Magazine* 110, 543-549.
- Lippard, S. J., 1973. The petrology of phonolites from the Kenya Rift. *Lithos* 6, 217 – 234.
- Makinouchi, T., Koyaguchi, T., Matsuda, T., Mitsushio, H. and Ishida, S., 1984. Geology of the Nachola area and the Samburu Hills, west of Baragoi, Northern Kenya. *Afr. Stud. Monogr., Sup. Issue* 2, 15-44.
- Mariita, N.O., 2003. An Integrated geophysical study of the northern Kenya rift crustal structure: Implications for geothermal energy prospecting for Menengai area. PhD dissertation, University of Texas at El Paso, USA.
- Mariita, N.O., 2003. An Integrated geophysical study of the northern Kenya rift crustal structure: Implications for geothermal energy prospecting for Menengai area. PhD dissertation, University of Texas at El Paso, USA.
- Martyn, J.E. and Tobias, P.V. (1967) Pleistocene deposits and new fossil localities in Kenya, *Nature* 215, 476-480.
- Morley, C.K. (1999) Marked along-strike variations in dip of normal faults - the Lokichar fault, N. Kenya rift: a possible cause for metamorphic core complexes, *J. Structural Geology* 21, 479-492.
- Morley, C.K., Wescott, W.A., Stone, D.M., Harper, R.M., Wigger, S.T. and Karanja, F.M. (1992) Tectonic evolution of the northern Kenyan Rift, *J. Geological Society, London* 149, 333-348.
- Morley, C.K., Wescott, W.A., Stone, D.M., Harper, R.M., Wigger, S.T., and Karanja, F.M., 1992, Tectonic evolution of the northern Kenya Rift: *Journal of the Geological Society of London*, v. 149, p. 333-348.

- Morley, C.K., and Ngenoh, D.K., and Ego, J.K. (part 2), 1999a, Introduction to the East African Rift System, in C.K. Morley, ed., *Geoscience of rift systems-evolution of East Africa: AAPG Studies in Geology*, v. 44, p. 1-18.
- Odada, E.O., Onyando, J.O. & Obudho, P.A. (2005). Lake Baringo: Experience and Lessons Learned Brief. In: *ILEC (2005) Managing Lakes and their Basins for Sustainable Use: A Report for Lake Basin Managers and Stakeholders*. International Lake Environment Committee Foundation, Kusatsu, Japan.
- OSHA Guide for Drilling Rigs (2009) .Directorate of Technical Support and Emergency Management, Salt Lake Technical Centre; Salt Lake City, UT. [http://www.osha.gov/SLTC/etools/oilandgas/illustrated\\_glossary.html/](http://www.osha.gov/SLTC/etools/oilandgas/illustrated_glossary.html/)
- Owen, R.B., Renaut, R.W., Hover, V.C., Ashley, G.M. and Muasya, A.M. (2004) Swamps, springs and diatoms: wetlands of the semi-arid Bogoria-Baringo Rift, Kenya. *Hydrobiologia* 518: 59–78, 2004.
- Pauluis, C.D.A., 1994. Environmental Impact of Oil Production Activities on Tropical Rain Forest: The Rabi Case. Society of Petroleum Engineers, Inc., Richardson, TX, SPE 27182, pp. 5-6.
- Pickford, M. (1978) Geology, palaeoenvironments and vertebrate faunas of the mid-Miocene Ngorora Formation, Kenya, in W.W. Bishop (ed.), *Geological Background to Fossil Man*, Geological Society, London, Scottish Academic, 237-262.
- Renaut, R.W. (1982) Late Quaternary geology of the Lake Bogoria fault-trough, Kenya Rift Valley, Unpublished PhD thesis, University of London, 498 pp.
- Renaut, R.W., Ego, J., Tiercelin, J.-J., Le Turdu, C. and Owen, R.B. (1999) Saline, alkaline palaeolakes of the Tugen Hills-Kerio Valley region, Kenya Rift Valley, in P. Andrews and P. Banham (eds.), *Late Cenozoic Environments and Hominid Evolution: a tribute to Bill Bishop*, Geological Society, London, 41-58.
- Richardson, J.L. (1966) Changes in level of Lake Naivasha, Kenya, during postglacial times, *Nature* 209, 290-291.
- Richardson, J.L. and Richardson, A.E. (1972). History of an African rift lake and its climatic implications, *Ecological Monographs* 42, 499-534.
- Rosendahl, B. R., Versfelt, J. W., Scholz, C. A., Buck J. E. and Woods L. D. (1988) Seismic atlas of Lake Tanganyika, East Africa, Project PROBE Geophysical Atlas Series, folio 1, Durham, North Carolina, Duke University.
- Rosendahl, B.R., Reynolds, D.J., Lorber, P.M., Burgess, C.F., McGill, J., Scott, D., Lambiase, J.-J. and Derksen, S.J. (1986) Structural expressions of rifting: lessons from Lake Tanganyika, Africa, in L.E. Frostick, R.W. Renaut, I. Reid and J.-J. Tiercelin (eds.), *Sedimentation in the African Rifts*, *Geol. Soc. London Spec. Publ.* 25, 29-43.
- Senut, B., Pickford, M., Gommery, D., Mein, P., Cheboi, K., and Coppens, Y. 2001. First hominid from the Miocene (Lukeino formation, Kenya). *CR Acad Sci Paris*, Ser IIa 332:137-144.
- Sykes, H.L. 1934. The underground water resources of Kenya colony. (London: crown agent for the colonies)
- Tallon, P.W.J. (1976) *The stratigraphy, palaeoenvironments and geomorphology of the Pleistocene Kapthurin Formation, Kenya*, PhD thesis, University of London.
- Tallon, P.W.J. (1978) Geological setting of hominid fossils and Acheulian artefacts from the Kapthurin Formation, Baringo District, Kenya, in W.W. Bishop (ed.), *Geological Background to Fossil Man*, Geological Society, London, Scottish Academic, 361-378.
- Tiercelin, J.J. and Lezzar, K.-E, 2002. A 300 million years history of rift lakes in Central and East Africa: an updated broad review. In: Odada, E.O. and Olago, D.O. (Eds.) (2002). *The East African Great Lakes: Limnology, Palaeolimnology and Biodiversity*. Advances in Global Change Research, Volume 12. Kluwer Academic Publishers, pp.3-60.
- Truckle, P.H., 1976. Geology and Late Cainozoic Lake-Sediments of Suguta Trough, Kenya. *Nature* 263, 380-383.
- U.S. Department of Energy (DOE). 2005. F/H Area High Level Waste Tank Status Report for CY2004. CBU-ENG-2005-00005. Aiken, S.C



- Upcott, N.M., Mukasa, R.K., Ebinger, C.J. and Karner, G.D. (1996) Along-axis segmentation and isostasy in the Western Rift, East Africa, *J. Geophys. Res.* 101, 3247-3268.
- W. A. Fairburn and F. J. Matheson, 1970. Geology of Loiya-Lorugumu area.
- Weaver, S.D., 1973. The Quaternary caldera volcano Emurugogolak, Kenya Rift, and the petrology of a bimodal ferrobalt-pantelleritic trachyte association. *Bull. Volcanol.* 40.
- Wescott, W.A., Krebs, W.N., Engelhardt, D.W. and Cunningham, S.M. (1991) New biostratigraphic age dates from the Lake Rukwa rift basin in western Tanzania, *Am. Assoc. Pet. Geol. Bull.* 75, 1255-1263.
- Williams, R.E.G. and Johnson, A.S., 1976. Birmingham University Radiocarbon Dates X. *Radiocarbon* 18, 249-267.

## **APPENDICES:**

1. Minutes of the meeting
2. Copies of laboratory results
3. Certificates
4. Pin number
5. Other relevant documents

## STAKEHOLDERS MEETING HELD AT THE DC's OFFICE IN LOKORI LOCATION, LOKORI DIVISION IN TURKANA EAST DISTRICT ON WEDNESDAY 16<sup>TH</sup> MARCH, 2011

### Stakeholder's attendance list

NO	NAMES	DESIGNATION/ ORGANIZATION
1	Daniel .O. Obulla	DC Turkana East
2	Washing .O. Ogutu	DO I Lokori Division
3	George Ochieng'	DO Lokori Division
4	Looyapus Kerio Titus	Teacher
5	Esther Akitela	Vice chairlady, Lokori
6	Sylvester Emoiti	Chairperson, Lokori peace
7	Napeyoli Lydia	Asst. Chief Lokori
8	Selina Lokope	Treasurer, CDF Turkana South
9	David .W. Ikaru	Senior Chief I Lokori Location
10	Joseph Kamaro	Asst. Chief I Kamuge Location
11	Wilfred .K. Edome	Chairmen Napeitom LATF
12	Leah Amuria Ebokon	Women chairlady
13	John .L. Lengiro	Acting Chief Kochodin
14	Margaret Eregae	Head teacher Emaniman
15	Veronica Lokaran	DNC Women representative
16	Spurgeon .K. Esekon	Faith Based Organization representative
17	Johnmark Oyan	Chief, Kamuge location
18	Ezekiel Ewokit	Asst. chief- Kang'itit
19	Josephat Morungole	County Council of Turkana
20	Eletia Eyanae Jackson	Chairman, Lokori division
21	Joseph Achuka	DPC Representative Turkana East
22	John Loirian	Chief elder-Lokori
23	Peter Ekunoit	Chief elder- Morulem
24	Jairus Lokwawi	Chairman, Business community- Lokori
25	Jescah luren	Napeitom community
26	Anne .K. Emoiti	Peace member
27	Josphat sikirin	Chairman, LMA Sale yard
28	James ekalale	Chairman, IDPs
29	James Losut	Chief elder-Lokori
30	Chepkow Ikori	Chief elder-Lomelo
31	Ekai Kantaman	Chief elder-Nadome
32	Erupe Pelpel	Chief elder-Napeitom
33	Ibrahim Lotii	Coordinator, Kaso group- Napeitom
34	Lotabo .L. Shaaban	Lokori Girls' Primary School
35	Joseph Ebei	Chairman, Disabled Person- Lokori
36	Wilson .L. Ethekeon	Asst. Chief, Ngilukia Kamuge Location
37	William .E. Logiron	Head teacher Kamuge Primary School
38	Joseph Longole	Vice chairman- Lokori
39	Joseph Loibach	Tullow Oil Kenya B.V representative
40	Evelyn Sindani	E.I.A team- Earthview Geoconsultants Ltd
41	Nicholas Aketch	E.I.A team- Earthview Geoconsultants Ltd
42	James Ndunda	E.I.A team- Earthview Geoconsultants Ltd

The meeting was chaired by the DC Turkana East, Mr. Daniel Obulla and it commenced with a prayer at 9:07 a.m. The meeting had a good representation of the stakeholders in Turkana East District although not all the stakeholders attended the meeting. Introduction of the stakeholders was done. He reported that the area MP was impressed with the stakeholders meeting held in the area. He gave a brief background of the proposed project and objective of the meeting.

Mr. Nicholas then addressed the meeting on the background of the proposed project and the aim of the meeting. He highlighted the procedures involved in the preparation of the EIA report for the proposed project. He also reported that Tullow Oil Kenya B.V is proposing for seismic survey project in Blocks 13T, 10BA and 12A which covers various districts in Turkana County.

He reported that various community meetings were held in Blocks 13T and 10BA and other meetings were planned to be held in Block 12A which covers parts of Turkana East district and other districts in Rift valley province. He emphasized that the proposed project in Block 12A involves seismic survey and not oil drilling/exploitation. He also emphasized that license has to be granted by NEMA and other relevant authorities concerned with the proposed project before the project operations commences in the blocks.

The DC encouraged the stakeholders to present their views concerning the proposed project;

- They welcome all development projects in the district and especially the proposed project of seismic survey.
- They wanted to know why Tullow Oil Kenya B.V wanted to conduct seismic survey in the area yet the report and results of Africa oil B.G.P operating in Loperot has not been released to the community members and the stakeholders.
- They wanted to know whether the EIA team had employed the local youths as tour guard to help them in conducting the study.
- They reported that the area is a conflict prone area and requested the EIA team to work with the district administration to avoid conflict with the community.
- They requested the proponent to employ the locals both skilled and unskilled labour.
- They requested for the disabled community members to be considered during recruitment process and occupational health and safety of the employees must be considered.
- They want the locals to be employed according to their academic specialization and conditions of work must be precise to the employees.
- They wanted to know the type of labour which will be offered to the community members.
- They said that community members must be educated and trained on various jobs that the proponent will undertake. They therefore, suggested for the formation of committee to oversee recruitment process.
- They want the proponent to hold consultative meetings with all the stakeholders in the district before the project commence its operations in the area.
- They wanted to know the proponents' country of origin.
- They reported that Lokori community members did not benefit from Africa oil B.G.P operating in Loperot in Turkana South District.
- The business community of Lokori asked whether they will benefit from the proposed project
- They requested for academic scholarships and bursaries to be offered to the needy students
- They demanded for respect of their women and children especially girls by company staffs.
- They requested the proponent to provide potable water to the communities facing water scarcity.

Responses to the views were addressed by highlighting that the proposed project will be beneficial to the community through employment. Some experts will be sourced from other districts in the country while others will be sourced within the district. The areas were classified into blocks by the National Oil Corporation of Kenya. Before the project operates in the area, consultative meetings will be held both with the community members and the stakeholders. The business community in the district will benefit in various ways. Assurance was made that the views raised will be taken into consideration and that their interest will be protected by the relevant laws and policies governing the proposed project.

Closing remarks were made by the DC by saying that the proposed project has been approved by the stakeholders in Turkana East District. He requested the views presented to be taken into considerations. He encouraged the community members to be flexible to all kinds of jobs that the proponent will offer. Lastly, he said that the committee will be formed to oversee recruitment and other project operations. The meeting adjourned with a prayer at 10:56 a.m.



**MEETING HELD AT NAPEITOM PRIMARY SCHOOL IN NAPEITOM SUB LOCATION, NAPEITOM LOCATION IN LOMELO DIVISION IN TURKANA EAST DISTRICT ON WEDNESDAY 16<sup>TH</sup> MARCH, 2011.**

**Attendance:**

1. Chief, Napeitom location.....Mr. William Lokiyor
2. Community elders and members

The meeting commenced at 1:52 p.m. with a word of prayer. The chief Napeitom location, Mr. William Lokiyor chaired the meeting and welcomed all the members present. Introduction of the EIA team was done. Explanation of how seismic survey will be conducted was addressed. He emphasized that the proponent intended to conduct seismic survey and not oil drilling. Some of the project's benefits were highlighted to the members like employment and other development projects that might arise during the project operation. The community raised the following views.

- They welcome the proposed project in the area because they believe that the state of insecurity between the Turkana and Pokot communities will be improved and living standard will be improved.
- They said that Napeitom community members are pastoralist and were concerned of the trees that provide pasture to the livestock.
- They said that the proponent should work together with their leaders who will help them in identifying the sites for the proposed project.
- The chief informed the community that small part of land will be utilized by the project.
- They want employment opportunities to be given to the local community members.
- They want the project operations not to interfere with trees which have cultural values and provide pasture to the livestock like some of the acacia tree species.
- They suggested that the proponent should consult the community members on various Corporate Social Responsibilities that they would like to be implemented in the area.
- They reported that projects take longer time to be implemented in the area. They therefore, want the proposed project to commence its operations as soon as possible in order for the community to benefit.

Responses to the issues raised were addressed by assuring the community members that the proposed project will not have adverse negative impacts. The trees, watering points and other vegetation will be conserved by the company. Series of meetings will be held with the communities and leaders before any project commences in the area. They were informed that that oil exploitation has various stages and before oil is exploited in the area, seismic survey has to be conducted and that the operations might take a longer time before oil is exploited in the area.

Closing remarks were made by chief and he thanked all the members. He also assured the community members that the proposed project will benefit the community. Lastly, he said that proposed project had the community's blessing. The meeting adjourned with a prayer at 2:36 p.m.

**MEETING HELD IN KAPEDO LOCATION, LOMELO DIVISION IN TURKANA EAST DISTRICT ON SATURDAY 19<sup>TH</sup> MARCH, 2011 AT THE BARAZA GROUND.**

**Attendance:**

1. Chief, Kapedo Location.....Mr. Josphat Lopala
2. Assistant chief, Kapedo Sub location.....Mr. John Ing'oria
3. Chief, Nadome Location.....Mr. Moding Rengei
4. Chairman, Peace Committee Kapedo....Mr. Nicodemus Iuren
5. Community elders and members

The meeting commenced with a prayer at 9:07 a.m. The chief welcomed all the members present and encouraged the community members to participate by presenting their views. Introduction of the E.I.A team was done and an explanation of how seismic survey will be conducted was addressed. They then presented their views as follows;

- They reported that the community members usually face insecurity from the neighbouring Pokot community as a result of cattle raiding.
- They welcome the proposed project in the area.
- They suggested that trees, watering points, structures and settlements should not be affected by the project operation.
- They were grateful for the meeting that was held with the E.I.A team.
- They said that employment opportunities should be given to the local youths and other community members should also benefit from the proposed project.
- They requested that the project operations should not pollute environment by dust and smoke emission from vehicles and machines.
- They do not want to work together with the neighbouring Pokot community members and suggested that the project should be conducted separately in various districts within the block.
- They want recruitment to be equal, transparent and gender sensitive to the locals.
- They want the proponent to implement some of the corporate social responsibilities like construction of schools, health facilities, roads, communication network and provision of potable water.
- They requested the government and the proponent to improve security in Kapedo area.
- They want the proponent to create awareness to the community on various projects activities through their leaders.
- They reported that the community members rely on relief food. They therefore, believe that the proposed project will improve their living standards through employment.
- The chairman of peace committee in Kapedo requested that the proponent should hold meetings with all the community members in order to improve security and enhance peace among communities bordering Kapedo.
- They requested to be briefed of community views that the E.I.A team had collected from various district in Turkana County.

Mr. Nicholas responded to the issues raised by emphasizing that the proposed project will benefit the community and that it will not have negative impacts. He said that community views in various blocks covered within the Turkana County will be presented in the EIA report which a copy will be available at the County Council of Turkana and NEMA offices in the districts. Lastly, he assured them that the views raised will be taken into consideration. The chief made closing remarks by thanking the members and welcomed the proposed project in the area. The meeting adjourned with a prayer at 10:47 a.m.

## **MEETING HELD AT SILALE PRIMARY SCHOOL IN LOMELO LOCATION, LOMELO DIVISION IN TURKANA EAST DISTRICT ON SATURDAY 19<sup>TH</sup> MARCH, 2011.**

### **Attendance:**

1. Acting Chief, Lomelo Location.....Mr. Peter Nang'ole
2. Assistant Chief, Ekipor Sub location....Mr. Francis Aiton
3. Community elders and members

The meeting started at 12:06 p.m with a word of prayer. The acting chief Mr. Peter Nang'ole welcomed and thanked all the members who attended the meeting. Introduction of the EIA team was done and a brief background of how seismic survey will be conducted in the area was addressed. The community members then presented the following views;

- They wanted to know the specific activity that the proponent intended to undertake in Lomelo area and also wanted to know if the EIA team was given permission by the administrative leaders to hold meetings with the community members.
- They wanted to know what the proponent will give back to the community.
- They wanted to know what will be done to the community members in case of destruction.
- They said that grazing land and watering points should not be destroyed.
- They want the community members to be informed of all the project operations that the proponent intends to undertake in the area in order to avoid suspicion.
- They reported that insecurity is high in Lomelo because of the attacks from the neighbouring Pokot community as a result of cattle rustling.
- They suggested that the proponent should camp in Lomelo because they expect to benefit from the project operation through employment and improvement of security in the area.
- Lastly, they welcome the proposed project in Lomelo

Responses were made to the issues raised by assuring them that the project operations will not have negative impacts and that the community will benefit from the project through employment. The views raised will be taken into consideration and their interest will be protected by relevant laws and policies governing the proposed project.

The acting chief made his closing remarks by thanking the members and the EIA team for holding the meeting with the community members. He requested the proponent to employ the locals and KPR in the area in order to improve their living standards. He also said that the proponent should implement some of the corporate social responsibilities like provision of potable water. Lastly, he encouraged the community members to cooperate with the proponent when the project commences its operation in the area. The meeting ended with a prayer at 1:16 p.m. with a word of prayer.

**MEETING HELD WITH THE COOMUNITY ELDERS IN KULAL SUBLOCATION, AKORET LOCATION IN NGINYANG DIVISION IN EAST POKOT DISTRICT ON SATURDAY 19<sup>TH</sup> MARCH, 2011.**

**Attendance:**

1. Community elders
2. EIA Social team

The meeting started at 3:20 p.m. The elders were briefed on how the proposed project will be conducted in the area. They then raised the following views concerning the proposed project.

- They said that they have never heard of such project in the area and wanted the EIA team to inform their leaders like chiefs so as to advice the elders whether to accept or reject the proposed project.
- They said that the proposed project has covered a larger area in Turkana district than in East Pokot district.
- They welcome the proposed project in the area though they did not know the impacts associated with the project.
- Lastly, they said that they will be receptive to the proposed project because they believe that it will enhance development in the area through employment and other projects that might arise during the project operation.

Their views were responded to by Mr. James and he assured them that the proposed project will not cause any negative impact to the environment instead it will benefit the community. The area was classified into blocks by the National Oil Corporation of Kenya according to the geological characteristic of the area. The meeting adjourned at 4:00 p.m with an assurance that their views will be taken into consideration.



## STAKEHOLDERS MEETING HELD AT THE DO's OFFICE IN LOYAMOROK LOCATION IN MONDI DIVISION IN EAST POKOT DISTRICT ON MONDAY 21<sup>ST</sup> MARCH, 2011.

### Stakeholder's attendance list

N O	NAMES	DESIGNATION/ ORGANIZATION
1	Robert Kanyakera	Chief, Loyamorok location
2	Solomon Kapkoyo	Retired Senior Chief, Loyamorok Location
3	Joseph Akure Chereba	Former councilor, Loyamorok Location
4	David Arupe	Assistant chief, Naudo Location
5	Tepargoria Samich	Elder
6	Yiano .K. Williamson	Youth Leader, Mond Division
7	Daniel .A. Pkiror Meriong'or	Youth
8	Joseph Yego Bibich	Youth
9	Geoffrey Lokoritepa	Councilor
10	Charles Ngolia	Pastor, P.A.G church Nginyang
11	Limaruk Kiplilan	Elder
12	John Naroo	Elder
13	Gideon Asil	Pastor, A.I.C church Nginyang
14	Domoo Lodiong'ole	Elder
15	Ripoo Lopokoi	Elder
16	Yaramoler Kodonya	Elder
17	Musa Kipkech	Youth
18	Yudah Losutan Lokoangot	Elder
19	Gideon Kalegeno	Public Health Officer- Mond
20	Peter .M. Adomong'ura	Chief, Silale Location
21	Yuka Lochekeruk	Youth
22	Moses Pkirur	Youth
23	Francis Tonguya	Youth
24	Kevin Kukat	Youth
25	Edwin .M. Akale	Youth
26	Nyang'atiang Sikayang	Elder
27	Alex Tonyar	Youth
28	Tadang'olei Porony	Elder
29	Eunice Wakak	Youth
30	Moses Kipkukat Hosea	Youth
31	Joseph Loibach	Tullow Oil Kenya B.V representative
32	Evelyne Sindani	E.I.A team- Earthview Geoconsultants Ltd
33	Nicholas Aketch	E.I.A team- Earthview Geoconsultants Ltd
34	James Ndunda	E.I.A team- Earthview Geoconsultants Ltd

The meeting was chaired by the chief Loyamorok location, Mr. Robert Kanyakera and it started at 11:05 a.m with a word of prayer. He welcomed and thanked all the stakeholders present. Introduction of stakeholders was done and the EIA team took the floor and addressed the meeting.

The explanations of how seismic survey will be conducted in the area were addressed. Some of the benefits of the proposed project were also mentioned like employment. The stakeholders were then welcomed to present their views concerning the proposed project.

- They wanted to know the negative impacts that might arise during the project operations.
- They wanted to know if the proponent will conduct survey of other resources like minerals.
- They suggested that trees and settlements should not be destroyed by the proposed project
- They wanted to know what the proponent will give back to the community apart from employing the locals during the project operations.

- They reported that the area usually have border conflict with the neighbouring Turkana community. They therefore, wanted to know how the proponent will handle the issue of insecurity in the area.
- They wanted to know the period of time that the proposed project will take to commence its operations.
- They asked whether the EIA team had employed youths as tour guides.
- They said that priority should be given to the youths from the local community during recruitment process.
- They requested the proponent to provide tree seedlings to the community for planting because deforestation is accelerating in the area.
- They wanted to know if the youths from the two communities of Turkana and Pokot will be recruited and expected to work together because they usually experience border conflict.
- They believe that the area has many resources like fluorspar, geothermal power and many more and suggested that the project operation should commence as soon as possible.
- The chief reported that the community members might not be receptive to the project especially the ones living in the interior parts of the district. Therefore, they suggested that some members should be taken for a tour to a place where such activities have been conducted in the past like Isiolo or Loperot in Turkana district.

Responses were made by informing the stakeholders that the community members will benefit from the proposed project through employment. Assurance was made that recruitment will be equal, transparent and gender sensitive. He also informed them that Tullow Oil Kenya B.V will only be given license for seismic survey of oil and gas exploration and not to exploit other resources. Lastly, the views raised will be taken into consideration and Corporate Social Responsibilities that the community might wish the proponent to implement will be discussed at a later stage.

Closing remarks were made by chief and he informed the stakeholders that the proposed project will benefit the community. He said that the area has been blessed with development projects like the geothermal power at Silale area. They therefore welcome the proposed project in the area. Lastly, he thanked all the stakeholders for attending the meeting and assured them that their views will be taken into consideration. The meeting adjourned at 12:12 p.m with a word of prayer.

## MEETING HELD AT THE BARAZA GROUND IN KOSITEI LOCATION IN NGINYANG DIVISION IN EAST POKOT DISTRICT ON MONDAY 21<sup>ST</sup> MARCH, 2011.

### Attendance

1. Mr. Joshua Akeno.....Chief, Kositei Location
2. Mr. John Kamama.....Assistant chief Nginyang West Sub location
3. Community members

The assistant chief, Nginyang west sub location Mr. John Kamama chaired the meeting which started at 3:06 p.m. Introduction of the EIA team was done and the members were addressed on the background of the proposed project. Some of the benefits were highlighted to the members like employment. The community members were then welcomed to present their views concerning the proposed project.

- They wanted to know how recruitment process will be conducted in block 12A which covers several districts and if the employees from various districts will work together.
- They wanted to know the specific site in East Pokot where the project will be conducted and how and where the cut lines will be made in the area.
- They welcome the proposed project in the area.
- They suggested that the proponent should locate their camp in Kositei Location.
- They want recruitment process to be equal, transparent and gender sensitive.
- They want the community to benefit from the proposed project especially during recruitment.
- They wanted to know the period of time that the project will take to commence its operations
- They said that EIA team took the right procedure by informing the community members of the proposed project in the area.
- They want the proponent to create awareness and educate the community on all the projects operations and they should work together with the community members.
- They want the trees locally known as “sorich”, “loma” and *acacia tortilis* not to be cut because they provide pasture to the livestock and wild fruit to the community members.
- They said that the communities in the remote areas are pastoralists and requested that their grazing land and watering point should not be destroyed.
- They requested to know if the machines to be used will cause adverse negative impacts like destruction of environment, ground shaking and noise pollution that might affect both livestock and community members.
- They suggested that the proponent should start its operation in Kositei Location as soon as possible because they believe that oil will be found in the area.
- They wanted to know if oil has been exploited in Kenya and especially in Isiolo.
- They wanted to know other jobs apart from the unskilled labour which will be offered.
- They also wanted to know how the government came up with blocks and the factors that were considered to classify the areas into blocks.

- They believe that oil exploitation in the area will enhance peace among the conflicting communities of Pokot and Turkana.

Responses were made by informing them that youths from different districts within the block will be recruited and expected to work together during the project operation. They were informed that settlement, structures and trees will not be destroyed. Series of meetings will be held in the area order to sensitize the community members of various activities that the proponent will undertake in the area. In addition, they were told that seismic survey will commence when the proponent will be given licenses by the relevant authorities like NEMA and it might take a period of about six months. The mitigation measures will be taken into considerations to mitigate any negative impact that might arise during the project operation. An example of Isiolo and Loperot projects were given and were told that the results of whether oil prospects have been found have not yet been released. Lastly, the areas were classified into blocks by national oil corporation of Kenya according to the geological characteristic of the areas.

The assistant chief thanked the members and requested the EIA team to take into considerations the views raised by the community members. The meeting adjourned at 4:28 p.m with a word of prayer.

**MEETING HELD AT CHEPILAT VILLAGE IN LORUK-KONGASIS SUB LOCATION, LORUK LOCATION IN MONDI DIVISION IN EAST POKOT DISTRICT ON TUESDAY 22<sup>ND</sup> MARCH, 2011.**

**Attendance:**

1. Mr. Joseph Lonete.....Assistant Chief, Loruk-Kongasis Sub location
2. Community members

The meeting started with a prayer at 11:47 a.m. Assistant chief, Loruk-kongasis sub location Mr. Joseph Lonete chaired the meeting and welcomed the members present. A brief background of the proposed seismic survey project was addressed. The community raised the following views concerning the proposed project.

- They wanted to know if the proposed project operations will cause displacement.
- They wanted to know the negative impacts that might arise during project operation.
- They said that the EIA team took the right procedure by informing the local community.
- They welcome the proposed project in the area.
- They wanted to know the period of time that the seismic survey will be conducted in the area
- They asked whether the locals will be employed during project operation in the area.
- They want cut lines which will be made to be left to the community to use as access roads.
- They want the proponent to consult village elders before the project commence.
- They asked what will happen in case oil will be found at people's lands.
- They asked whether the proponent will set its camp in Loruk area.
- They were concerned of environmental degradation caused by the training of the armed forces. They said that livestock have been affected because they feed on the garbage and other wastes disposed in the area.

The issues raised were responded to by informing them that the proposed project will benefit the community through employment and other projects that might arise during the project operations. They were assured that the project will not cause negative impacts. Lastly, series of meetings will be held with the community before the project commences its operations in the area.

The assistant chief encouraged the members present to inform other community members who did not attend the meeting of the proposed project in the area. The proposed project had their blessings. The meeting ended at 12:44 p.m.

## **MEETING HELD AT THE BARAZA GROUND IN TANGULBEI LOCATION IN TANGULBEI DIVISION IN EAST POKOT DISTRICT ON TUESDAY 22<sup>ND</sup> MARCH, 2011**

### **Attendance:**

1. Mr. Josphat Kipkiror.....Chief, Tangulbei Location
2. Community members

The meeting started at 3:07 p.m. Introduction of the team was done and a brief background of the proposed project was addressed. The community members then raised the following views concerning the proposed project.

- They reported that there are cultural sites in Tangulbei area which needs to be respected during project operations.
- They want the community to benefit through employment both skilled and unskilled labor and should be equal, transparent and gender sensitive and also should be sourced locally.
- They welcome the proposed project in the area.
- They want the proponent to work together with the community members.
- They want the project operation not to destroy grazing lands, watering points and settlements.
- They believe that the proposed project will enhance peace and unity among pastoral communities living within the block.
- They wanted to know what the proponent will give back to the community of Tangulbei.

The issues raised were responded to by informing the community that the specific site for oil exploration has not yet been known in the block. The proposed project will not have negative impacts to the environment. Consultative meetings will be held with the leaders and the community members in order for the community to be informed. The views raised will be taken into considerations and their interests will be protected by the relevant laws and policies governing the proposed project.

The chief made his closing remarks by emphasizing that recruitment must be gender sensitive and the proponent should initiate projects which will empower women in the area. The meeting adjourned at 4:00 p.m.



**MEEETING HELD AT CHEPKUM CENTRE IN CHEPKUM SUBLOCATION IN CHESUMAN LOCATION IN TUNYO DIVISION IN MARAKWET WEST DISTRICT ON THURSDAY 24<sup>TH</sup> MARCH, 2011.**

**Attendance:**

1. Mr. Simon Suter.....Chief,Chesuman Location
2. Mr. Barnabas Cheserek....Assistant Chief, Chepkum Sub location
3. Community members

The meeting commenced at 5:17p.m. Introduction of the EIA team was done and shortly followed by the background of the proposed seismic survey project.

- They were concerned of displacement and compensation during the project operation.
- They wanted to know how the community will benefit from the proposed project.
- They asked whether the operations will affect chepkum irrigation scheme.
- They reported that the community has farms but they do not have title deeds. They therefore, asked whether their farms and lands will be occupied by the project.
- They wanted to know the size of land which will be utilized by the project.
- They wanted to know when the project will commence its operations in the area.
- They requested that the trees providing pasture to the livestock should not be cut and watering points should not be destroyed.
- They were concerned with the compensation of the destroyed crops and structures.

They were informed that the proposed project will not cause negative impacts and community will benefits through employment. Emphasis was made that series of meetings will be held with the community leaders and members as a way of informing them on projects operations in the area. Compensation of crops might be done in case they are affected. Oil exploitation might take a very long time in the country. The meeting ended at 5:55 p.m. with an assurance that the views raised will be taken into considerations and that the proposed project had the community blessing.

**STAKEHOLDERS MEETING HELD AT THE COUNTY COUNCIL OF BARINGO HALL IN KABARNET DIVISION IN BARINGO CENTRAL DISTRICT ON FRIDAY 25<sup>TH</sup> MARCH, 2011**

**Stakeholder's attendance list**

NO	NAMES	DESIGNATION/ORGANIZATION
1	Noah Tanui	DO I Kabarnet Division
2	Ednah Songoi	DPLO's Office
3	Kurgat .K. Henry	District geologist
4	Joseph Ekiru	District gender and social development officer
5	Stanley Tonyewo	Press
6	Mkonyo .M. Mwamboze	Police
7	Joseph .K. Mwalo	Prisons
8	Henry .N. Omwando	Water and irrigation
9	Samuel .K. Kemoi	Procurement-DC's office
10	Daniel .K. Kilele	Assistant officer- KNBS
11	David .K. Maina	District cooperative officer
12	David .M. Okoma	Ag. Fund manager, CDF Baringo Central
13	Francis .C. Chesang	WAFA Director
14	Benson Ngetich	Depot manager-KNCPB
15	Dominic .K. Chelelgo	Works officer- Municipal council
16	Wickliff .K. Maritim	District culture officer-Baringo
17	Dr. Abakalwa M.S.G.	DMOH-Baringo Central
18	Joshua Kiptum	QASO DEO's office Baringo
19	Charles Kamuren	KNUT Baringo
20	Koskei .J. K.	For District agriculture officer
21	Robert .K. Chemitei	District registrar of persons
22	Renson Mwarabu	Deputy officer ,KVDA
23	Dr. John Wambyo	Veterinary department
24	Abraham Sewer	Land registrar
25	Luka Kiptanui	District Information Officer
26	David Adenyi	Deputy head teacher, S.D.A Academy
27	Joseph Loibach	Tullow oil Kenya B.V representative
28	Nicholas Aketch	EIA Team-Earthview Geoconsultants Ltd.
29	Evelyne Sindani	EIA Team-Earthview Geoconsultants Ltd.
30	James Ndunda	EIA Team-Earthview Geoconsultants Ltd.

The meeting was chaired by the DO Mr. Tanui and it started with a prayer at 11:17 a.m shortly followed by introduction of the stakeholders. He gave an overview of the proposed project. The background of the proposed project and the objectives of the meeting were addressed by Mr. James. He informed them of the teams' mission in the area. He further explained how seismic survey will be conducted in the area and mentioned of seismic technologies which might be used during the project operation. He emphasized that their views were important for report preparation. They raised the following views concerning the proposed project.

- They asked whether the existing roads will be used or new roads (cut lines) will be made for project operations.
- They said that the proposed project will enhance development in the area.
- They asked whether the proponent has been given license for the seismic survey.
- They reported that the area is prone to soil erosion and wanted to know how it will be controlled during the project operations.

- They wanted to know the specific site in the block where seismic survey will be conducted.
- They wanted to know the measures that have been put in place to ensure that the project does not affect sources of water.
- They asked whether the proponent will involve relevant authorities in the project operations.
- They wanted to know whether labour will be sourced locally.

Responses were made by informing them that seismic survey will not cause any adverse negative impacts and mitigation measures will be put in place to minimize any impacts. Series of meetings will be held with both the stakeholders and the community members as away of informing the members of the project operations. Assurance were made that labour will be sourced locally especially the unskilled labour. The DO thanked all the stakeholders and further said that they welcome the proposed project in the area. The meeting adjourned at 11:51 a.m.

# **MEETING HELD IN TENGES LOCATION IN TENGES DIVISION IN BARINGO CENTRAL DISTRICT ON FRIDAY 25<sup>TH</sup> MARCH, 2011 AT THE BARAZA GROUND**

## **Attendance:**

1. Mr. Henry Ngotie.....Chief, Tenges Location
2. Mr. Benson Ngetich.....Chief, Bekibon Location
3. Mr. Samuel Cheroitich.....Chief, Kisonei Location
4. Mr. Michael Kiplimo.....Acting Chief, Tuluwongoi Location
5. Mr. Erick Lagat.....Acting Chief, Emom Location
6. Mrs. Jennifer Kipchocho.....Divisional Agricultural Officer, Tenges Division
7. Mr. Isaac Limo.....Divisional Forest Officer, Tenges Division
8. Mr. David Bitok.....Divisional Livestock Officer, Tenges Division
9. Community members

The meeting was chaired by chief, Tenges location Mr. Henry Ngotie and it started with a word of prayer at 3:46 p.m. A brief background of the proposed project was addressed. The community raised the following views concerning the proposed project.

- They asked what will happen in case the cut lines destroy farms or settlements.
- They reported that companies in the past have been researching for oil in the area but the communities have never been informed of the results.
- They said that project operations might cause destruction of settlement and the terrain of the area might hinder project operation.
- They welcome the proposed project because they said it will enhance development.
- They believe that oil will be exploited in the area.
- They requested the proponent to employ the locals for skilled and unskilled labour.
- They expressed fear of war as a result of oil exploitation in the country.
- They wanted to know the proponents' country of origin.
- They said that the affected community should be compensated.
- They requested for seismic survey to be conducted on government land and should not interfere with private land.
- They asked whether the project operation will cause any negative impacts to the environment and the community as a whole.
- They wanted to know how soil erosion will be controlled during the project operations.
- They wanted to know why the area has been classified as block 12A.

Responses were made by informing them that the project will not have any negative impacts to the farms, settlement and structures. Other technologies might be used if the terrains will pose a major challenge to construction of cut lines. Some of the project's benefits were highlighted like employment. Assurance was made that war will not occur in the country and

that their views will be taken into considerations. The area was classified into blocks by the National Oil Corporation of Kenya according to its geological features. The community thanked the EIA team for holding the meeting and said that the proposed project had their blessing. The meeting ended with a prayer at 5:01p.m.

**MEEETING HELD IN KORIEMA SUBLOCATION IN KIMALEL LOCATION IN MARIGAT DIVISION IN MARIGAT DISTRICT ON SATURDAY 26<sup>TH</sup> MARCH, 2011 AT THE BARAZA GROUND.**

**Attendance:**

1. Mr. Andrew Rumenya.....Chief, Kimalel Location
2. Community members

The meeting was chaired by chief, Kimalel location Mr. Andrew Rumenya and it started at 12:00 p.m. with a word of prayer. The chief thanked and welcomed all the members. He informed the team that it was a market day in Koriema centre and that the members who attended will inform others of the proposed project in the area. Introduction of the EIA team was done and shortly followed by a brief background of the proposed project. Explanation of how seismic survey will be conducted in the area was made and the community members raised the following views;

- They welcome the proposed project because it will enhance development in the area.
- They suggested that the proponent should work together with the community members and leaders through organizing consultative meetings.
- They said that the company staffs should respect the cultural sites, cultural practices and especially girls and women.
- They want the project operation not to destroy water sources and trees which provide pasture to the livestock.
- They requested the proponent to support the community by implementing corporate social responsibilities especially on water projects.

Responses were made by assuring them that the proposed project will enhance development and the community will benefit through employment. Lastly, the project operations will not cause adverse negative impacts to the environment.

The chief encouraged the members to inform others of the proposed project and urged them to cooperate during the project operations. The proposed project had their blessings. The meeting ended at 12:42 p.m. with a word of prayer.



# **MEETING HELD IN KISERIAN LOCATION IN MUKUTAN DIVISION IN MARIGAT DISTRICT ON SATURDAY 26TH MARCH, 2011 AT SOKOTEI PRIMARY SCHOOL.**

## **Attendance:**

1. Joseph Lenaseku.....Chief, Ng'ambo Location
2. Daniel Nakure.....Chief, Kiserian Location
3. Benjamin Locher.....Chief, Mukutan Location
4. Jones Lanoi.....Assistant Chief, Ilng'arua Sub location
5. Joel Lechuta.....Assistant Chief, Logumgum Sub location
6. Stephen Lekwaru.....Councillor, Mukutan ward
7. Jacob Olesikoimoi.....Nominated councilor, County Council of Baringo
8. David Lechamakany.....Divisional Education Officer, Mukutan Division
9. Thomas Lenongonop.....Principle, Kiserian Secondary School
10. Jackson Lekombe.....Head teacher, Sokotei Primary School
11. Community elders and members

The meeting was chaired by chief, Kiserian location Mr. Daniel Nakure and it started at 5:55 p.m. The community members had a meeting to discuss security matters in the area. The meeting comprised of community members from Ng'ambo, Kiserian, Mukutan, Ilchamus and Rugus locations. The background of the proposed project was addressed to the community. They raised the following views concerning the proposed project in the area.

- They asked whether the community will be displaced and the youths will be employed.
- They reported that they do not have good roads and requested the proponent to construct good roads in the area.
- They expressed fear of boundary conflict among the communities bordering Kiserian.
- They asked how long the proposed project will take to commence its operations in the area.
- They welcome the proposed project in the area and wanted to know what the proponent will give back to the community.

The community was informed that there will be no displacement or destruction of settlements and structures. Recruitment will be equal, transparent and gender sensitive to the community members in block 12A.

Closing remarks were made by chief and he encouraged the community to cooperate with the proponent during the project operation. The meeting adjourned at 6:30 p.m. with an assurance that their views will be taken into consideration and that series of meetings will be held with the community before the project commences its operations in the area.

**MINUTES OF THE MEETING HELD AT KIMWARER CENTRE IN CHOP SUB LOCATION IN SOY LOCATION IN SOY DIVISION IN KEIYO SOUTH DISTRICT ON SUNDAY 27<sup>TH</sup> MARCH, 2011.**

**Attendance:**

1. Mr. Victor Tuitoek.....Councilor, Soy ward
2. Community members

The meeting started at 1:17 p.m. Introduction of the EIA team was done and the background of the proposed project operations was addressed to the community. Some of the benefits of the proposed project were highlighted like employment and many more. The community then presented their views concerning the proposed project in the area.

- They welcome all development projects and reported that the community has been facing problems with land ownership and wanted to know how the proponent will handle issues of land ownership in the area.
- They believe that the proposed project will enhance development in the area through employment during project operation.
- They do not want the project operations to destroy the environment because they said that the fluorspar company has caused adverse negative impacts to the environment and especially of water pollution.
- They wanted to know when the proposed project will commence its operations in the area.
- They asked whether the community will be compensated in case the project operations affect farms, structures and settlements.
- They asked whether the community will benefit from the proposed project and wanted to know all the areas covered in the block.
- They asked if the proponent will discuss with the fluorspar company on issues concerning land ownership or they will discuss openly with community and whether fluorspar company will stop its operation when oil will be found.
- They requested the proponent to form direct links with the community members and awareness created in order to avoid suspicion.
- They reported that fluorspar company started its operations in the area but they have never implemented development projects that they promised the community. They therefore, want the proponent to implement corporate social responsibilities that the community will identify.

Responses were made by informing the community that the views raised will be taken into considerations. Series of consultative meetings will be held. The project will not cause any adverse negative impacts to the environment. Corporate social responsibilities that the community might wish the proponent to implement will be discussed at a later stage. The area councilor thanked all the members present and encouraged them to inform others of the proposed project in the area. The meeting ended at 1:58p.m.

**STAKEHOLDERS MEETING HELD AT THE NATIONAL IRRIGATION BOARD HALL IN MARIGAT DIVISION IN MARIGAT DISTRICT ON MONDAY 28<sup>TH</sup> MARCH, 2011.**

**Stakeholder's attendance list**

<b>S/NO.</b>	<b>NAMES</b>	<b>DESIGNATION/ ORGANIZATION</b>
1	Obwocha Bwobwocha	DO Marigat
2	Cllr. Olekeis Francis	Kailer village development committee
3	Bett Cosmas	Children's department
4	Daniel Koech	District development officer
5	Wesley Nalekem	Records management officer-Marigat
6	William .K. Kiplagat	Community policing
7	Raymond Tomno	Opinion laeder
8	Daniel .K. Kipkurere	Businessman
9	Paul Lekituli	Youth representative
10	Pastor Isaiah Yatich	Religious leader
11	Salim .K. Baimett	Religious leader
12	Wilson .L. Lekosi	Kailer CBO
13	Samuel Kaptunai	D.M.C. Marigat
14	Dixon Olemiran	Rugus H/men
15	Singh Lenaponya	H/men
16	John Letangule	Pastor
17	Wesley Kiplong	Loberet water project
18	Samson Kiptai	Catechist Sandai
19	Samson .K. Moek	Public health officer
20	Peter Kachike	Village elder/ religious leader
21	David lakachuma	Silonga community water project
22	John .K. Kirui	Religious leader- Kimalel
23	Gideon .K. Kendagor	NIB accountant
24	Steven Marteu	Chairman, environment
25	Khalid Abdala	Ustath/ Imam Marigat
26	Samson Leparsalaach	Gender and social development
27	Daniel Ledaa	Retired assistant chief
28	Wesley Cherutich	Chairman, community policing
29	Stanley .K. Chebet	Ministry of education
30	J. Karato Opron	Leader Lobos
31	Vincent Lesongono Kitily	Village elder, Eldume
32	Tames Mureithi	District A.P. Commander
33	Silas Chebon	Chairman, NICODEPP C.B.O
34	Mary Kiptekong	Treasurer, environment
35	Hillary Ndung'u	Kenya police
36	Cllr. Isaiah Kibowes	Baringo County Council
37	Abram Leweri	Village elder
38	Grace Kipese	Secretary, Yatoi women group
39	Changwony Joshua	ODM party leader and D.A.C Member
40	Kahara .D. Rufus	DO Marigat division
41	Weston Laanoi	Chairman, Perkerra irrigation scheme
42	John Kiptek	Catechist
43	Raphael Tenges	Location environment chairman
44	David Chelal	Chairman, water boreholes.
45	Rotich .K. Kandagor	Religious leader
46	Kerieny .S. C.	Livestock department, Marigat
47	Joseph Loibach	Tullov Oil Kenya B.V representative
48	Evelyne Sindani	E.I.A team- Earthview Geoconsultants Ltd
49	Nicholas Aketch	E.I.A team- Earthview Geoconsultants Ltd
50	James Ndunda	E.I.A team- Earthview Geoconsultants Ltd

The meeting commenced at 11:40 a.m. with a word prayer. The DO chaired the meeting and thanked all the stakeholders present. Introduction of the stakeholders and the EIA team was done. The background of the proposed project was addressed and explanation of how seismic survey will be conducted in the block was done. Emphasis were made that the EIA report is required by NEMA before the proponent is given license by the relevant authorities like NEMA.

The DC encouraged the stakeholders to present their views concerning the proposed project.

- They asked whether seismic survey was being conducted at the time of data collection for EIA report preparation or the proponent was planning to conduct it later.
- A member encouraged others to inform other community leaders and members in order for the community to cooperate during the project operations in the area.
- They asked whether the community will benefit from the proposed project and wanted to know how the proponent will handle issues of land ownership in the area.
- They wanted to know how project operations will be conducted when making cut lines in the area.
- They asked whether the proponent will construct good roads or repair the old roads which are in dilapidated state.
- They wanted to know how the proponent will control environmental degradation as a result of oil spills during the project operation.
- They asked whether the community will be displaced during the project operation.
- They welcome the proposed project in the area and requested that the EIA report which will be prepared to be available to the stakeholders for review.
- They want both skilled and unskilled labour to be sourced locally.
- They requested for maps to be used in order to demarcate the districts boundaries in order to avoid district conflict.
- They requested for the formation of stakeholders committee which will help in liaising with the proponent.
- They requested all the project operations to be transparent to the community members.
- They requested the proponent to take into considerations the environmental concerns in Marigat district.
- They requested for other meetings at location levels to be held by the proponent in order to sensitize the local community on the project operations in the area.
- They urged the community leaders and stakeholders to accept all development projects.
- They expressed fear of earthquakes or ground shakes during the project operation.
- They wanted to know if the project operation will use hazardous materials and also if radiations will be emitted which can cause health to the community.
- They requested the company staffs to respect their community members especially women and girls and should not cause an increase in social decadency.

Responses were made to the issues raised by informing them that there will be no displacement or destruction of structures. The mitigation measures will be put in place to mitigate the anticipated negative impacts. Both short term and long term benefits will be channeled to the community and the issues of corporate social responsibilities will be discussed at a later stage. Recruitment will be equal, transparent and gender sensitive. Assurance was made that the views raised will be taken into considerations and their interest will be protected by the relevant laws and policies governing the proposed project. The DO made his closing remarks by requesting the stakeholders to welcome the proposed project in the area. The meeting adjourned at 1:27 p.m. with a word of prayer.

**MEETING HELD AT THE CHIEF'S OFFICE IN KAMPI YA SAMAKI VILLAGE IN AKORIAN SUBLOCATION IN BARTUM LOCATION IN KABARTONJO DIVISION IN BARINGO NORTH DISTRICT ON TUESDAY 29<sup>TH</sup> MARCH, 2011.**

**Attendance:**

1. Mr. William Chebii.....Assistant chief,Akorian sub location
2. Mr. Richard Kampala....Councillor, Bartum ward
3. Mr. Raimon Chelimo..... Chairman, Bartum group ranch
4. Community elders and members

The meeting was chaired by the assistant chief, Akorian location Mr. William Chebii and it started with a prayer at 12:17 p.m. He welcomed and thanked all the members present. Introduction of the EIA team was done then shortly followed by a brief explanation of seismic survey project intended to be conducted in the area. They were informed that the project will not cause any destruction or displacement of the community members.

They were also informed that the project covers many districts and employment opportunities will be given to the locals. They were then encouraged by the assistant chief to present their views concerning the proposed project.

- They welcome the proposed project in the area.
- They were impressed that the EIA team took the right procedure by informing the community members.
- They wanted to know how the proponent will handle issues on group ranches and land ownership in the area.
- They requested for the community to be sensitized on project operations through holding of meetings with the leaders and community members.
- They wanted to know the procedures that the proponent will use to approach the community members and how and where the cut lines will be made in the area
- They requested the proponent to source labour locally both the skilled and unskilled labour.
- They wanted to know who and when the community will be informed of the presence of oil wells in the area.
- They wanted to know the negative impacts associated with the proposed project.
- They reported that the area has had many development projects which have never benefited the community. Therefore, they do not want the proponent to conduct its operations the way past projects were conducted especially during recruitment period.
- They want recruitment to be equal, transparent and gender sensitive.
- They do not want the project operations to affect fish and fishing activities in Lake Baringo.
- They requested the proponent to have enough community liaison officers from all the communities covered in the block.



- That asked whether the affected community members will be compensated and advised the proponent to manage solid waste during the project operation in an environmental friendly manner.
- They asked whether the project operations will affect sources of water in the area.
- They want cultural sites and trees with cultural values to be respected and should not be destroyed by the project operations.

Responses were made to the issues raised by informing them that before license is granted to the proponent, recommendations will be made which must be adhered to in order to avoid environmental degradation. Series of meeting will be held with the community leaders and members in order to sensitize them. In case the project has negative impacts it will be mitigated. Lastly, emphasis were made that corporate social responsibilities that the community might wish the proponent to implement will be discussed at a later stage and the community will be responsible in identifying them.

The assistant chief urged the community members to cooperate with the proponent during the projects operations and the EIA team to take into considerations the views rose by the community members. The meeting ended at 1:56 p.m. with a word of prayer.

**MEETING HELD AT MAJI MOTO CENTRE IN MAJI MOTO SUB LOCATION IN KOIBOS LOCATION IN MOGOTIO DIVISION IN MOGOTIO DISTRICT ON TUESDAY 29<sup>TH</sup> MARCH, 2011**

**Attendance:**

1. Mr. Kibet Kobetbet.....Assistant chief, Maji Moto sub location
2. Community members

The meeting started at 5:43 p.m. shortly followed by the introduction of the EIA team. A brief explanation of how seismic survey will be conducted in the area was addressed to the members. Some of the socioeconomic benefits of the proposed project like employment were highlighted to the members. They raised the following views concerning the proposed project in the area.

- They asked whether the affected community members will be compensated in case the project operations destroy structures and settlements.
- They asked how long the EIA study will take and also the seismic survey operations in the area.
- They do not want wild animals, lakes and reserve areas to be destroyed by the project operations because they are attraction sites for tourists.
- They want Endorois community to benefit from the proposed project.
- They wanted to know why the area was classified as block 12A and the specific site where seismic survey will be conducted.
- They welcome the proposed project in the area.

The questions asked were responded to by informing them that there will be no displacement or destruction of the environment and the proposed project will take approximately six months before it commences its operations in the area. Series of meetings will be held with the leaders and the community members. The area was classified into blocks by the National Oil Corporation of Kenya and according to its geological characteristics.

The assistant chief and the community members said that the proposed project had their blessings and urged the proponent to work together with the community members during the project operations. The meeting adjourned with a prayer at 6:25p.m.

## STAKEHOLDERS MEETING HELD AT THE DO's OFFICE IN KABARTONJO DIVISION IN BARINGO NORTH DISTRICT ON WEDNESDAY 30<sup>TH</sup> MARCH, 2011.

### Stakeholder's attendance list:

NO	NAMES	DESIGNATION/ ORGANIZATION
1	Julius Narwa	District officer I
2	Alex Chebon	District development officer's office
3	Micah Kangogogo Kabbon	Livestock development sector
4	Kibett .J. Maina	Agriculture
5	Gedion .N. Ndole	Livestock development sector
6	Samuel .K. Koskei	District accountant
7	David Birgen	District Education Officer
8	Job .C. Sengenge	Former councilor, Saimo ward
9	Thomas .R. Chebor	Chief, Ngorora location
10	Francis Rotich	HRMO
11	Samuel .K. Limo	Keiyo location
12	Charles .K. Bowen	Former councilor, Kabutiei ward
13	Edward Kargungu	District youth officer
14	Joyce Onguso	DO Baringo North
15	Tobole .S. Lokorio	Chief Kaboskei, Kerio
16	Ezekiel .C. Cheson	Retired chief Ossen location
17	Paul .K. Cheptumo	Chief Kabutiei location
18	Johana .R. Chepkonga	Retired chief, Lawan location
19	Barsongol Bettion	KANU youth leader, Baringo North branch.Keiyo location
20	James Chepyaton	Councillor, Ossen ward
21	Joseph Loibach	Tullow Oil Kenya B.V representative
22	Evelyne Sindani	E.I.A team- Earthview Geoconsultants Ltd
23	Nicholas Aketch	E.I.A team- Earthview Geoconsultants Ltd
24	James Ndunda	E.I.A team- Earthview Geoconsultants Ltd

The meeting was chaired by the DO Mr. Julius Narwa and it started at 9:25 a.m. Introduction of the stakeholders and the EIA team was done then shortly followed by a brief explanation of how proposed seismic survey will be conducted in the area. Some of the benefits of the proposed project were highlighted to the stakeholders and they raised the following views concerning the proposed project in the area.

- They wanted to know how cut lines will be made and the specific sites for the proposed project in the district.
- They expressed fear of displacement of the community members during the project operations and asked whether the affected community members will be compensated.
- They urged the proponent and the EIA team to create awareness and educate the communities on the project operations in the areas.
- They wanted to know corporate social responsibilities that the proponent will implement.
- They welcome the proposed project in the area
- They reported that the major problem in the area is of land ownership and wanted to know how the proponent will handle issues of land ownership during the project operations.

- They urged the proponent to have consultative meetings with the stakeholders and the community members in order to sensitize the community on the project operations.
- They requested to be briefed of community views that the E.I.A team had collected from various areas in Baringo North district.

Responses were made to the issues raised by informing them that if the area terrains will pose challenge to cut lines construction, then other technologies will be used. The proposed project will not cause displacement or destruction of the environment. Series of consultative meetings will be held in the block before and during the project operation in the area. Lastly, corporate social responsibilities that the community might wish the proponent to implement will be discussed later and the community will be responsible in identifying them. The views raised will be taken into consideration and their interest will be protected by the relevant laws and policies governing the proposed project. The meeting adjourned at 11:44 a.m.