REPORT

Tullow Kenya B.V.

Early Oil Pilot Scheme Phase II Environment and Social Impact Assessment: VOLUME II

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1.0 EOPS PHASE II STAKEHOLDER ENGAGEMENT PLAN

REPORT

South Lokichar Basin: Early Oil Pilot Scheme (EOPS)

ESIA Stakeholder Engagement Plan

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The following definitions are used in this SEP:

- **Environmental and Social Baseline:** A component of an ESIA process undertaken to develop an understanding of the existing environmental and socio-economic conditions in the areas that may be affected by a Project. Baseline studies provide a basis for analysis of potential positive and negative impacts of a Project in the ESIA and, where possible, provides information for monitoring and measuring impact throughout implementation of the ESMP (see below).
- **Environmental and Social Impact Assessment (ESIA):** Formal assessment required when a project may create significant adverse impacts that are diverse and irreversible. An ESIA is often called an Environmental Assessment (EA) or Environmental Impact Assessment (EIA) in Kenyan legislation. Even if the word "social" is not included, readers should understand that the acronyms EA, EIA and ESIA are used interchangeably. The term and acronym adopted by this Project is "ESIA".
- **Environmental, Social and Management Plan (ESMP):** Component of the ESIA that provides an action plan or series of plans for implementation of mitigation measures required to avoid or minimise adverse impacts and to optimise beneficial effects of a project. An ESMP also includes information on management, monitoring and reporting related to environmental and social performance.
- **Scoping:** Scoping is the process of determining the content and extent of the matters that will be studied during the baseline and ESIA. The scoping process will vary depending on the proximity of surrounding communities, legal requirements, the capacity of authorities, and the specifics of the Project. The Scoping Report (or Project Report Study as defined by NEMA) is submitted to the regulatory authority for review and approval.
- **Socio-economic Investment:** Resources provided prior, to, and beyond, committed expenditure defined in the ESMP. Social investment is above and beyond international requirements and is part of TKBV's goal to build positive and beneficial relationships with governments, communities and industry wherever it does business.
- **Stakeholder(s):** Stakeholders are persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively (IFC, 2007).
- **Stakeholder Engagement Plan (SEP):** The SEP, sometimes called a Public Consultation and Disclosure Plan (PCDP), is a key component required for verifying compliance with international standards on public disclosure.

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1.0 INTRODUCTION

This document has been prepared by Golder Associates UK (Ltd) (Golder) for Tullow Kenya B.V. (TKBV). This Environmental and Social Impact Assessment (ESIA) Stakeholder Engagement Plan (SEP) is a planning and management document for the South Lokichar Basin Early Oil Pilot Scheme (EOPS) ESIA. The ESIA SEP explains what engagement will be done and how this will be achieved during the preparation of the ESIA and throughout the lifespan of the EOPS Project. As the EOPS Project develops, the SEP will be revised and updated to reflect any significant changes or alterations to the Project (e.g. in Project design parameters) and to planned stakeholder engagement activities.

1.1 Objectives

The overall objective of the SEP is to explain how **TKBV** will engage with stakeholders during the preparation of the ESIA and throughout the lifespan of the EOPS Project.

As part of the ESIA process, stakeholder engagement will accurately capture issues, comments and questions from stakeholders in a meaningful manner. The capture of the information and reference to stakeholder concerns will inform the ESIA, so it is relevant to those stakeholders most affected and interested in the results of TKBV's activities.

1.2 Project Background

TKBV is evaluating the development of a series of oil discoveries in the South Lokichar Basin, northwest Kenya.

The South Lokichar Full Field Development (FFD) Project includes the development of discoveries from a number of oil fields within Blocks 10BB and 13T in Turkana County and export of crude oil via an underground pipeline to a terminal on the Kenyan coastline, where oil will be loaded onto tankers waiting offshore to transport crude to international markets.

The approach to stakeholder engagement for FFD is described in Golder document 14514160360.501, dated November 2014, and the Project is described in the FFD Project Report: Golder document: 14514160360.516, dated December 2015.

FFD is considered a separate project from EOPS and therefore will have a separate SEP, ESIA and ESMP.

1.3 EOPS Project Description

1.3.1 Early Oil Pilot Scheme

EOPS is not an alternative to the FFD, but rather it represents an intermediate step on the road to the full commercialisation of discovered resources. Within the context of Turkana, the pilot scheme involves the use of existing well pads and existing wells at Amosing and Ngamia fields in South Lokichar, with oil transported for export into oil tanks in Mombasa using existing road infrastructure. The initial phase of EOPS will involve producing up to 2,000 barrels of oil per day.

The upstream component of EOPS (Figure 1) includes the following key activities and infrastructure:

- An Early Production Facility (EPF) at Amosing-1 well pad and three satellite degassing well pads in the Ngamia field, all within the South Lokichar Basin;
- Infield transportation; and
- Support facilities and infrastructure.

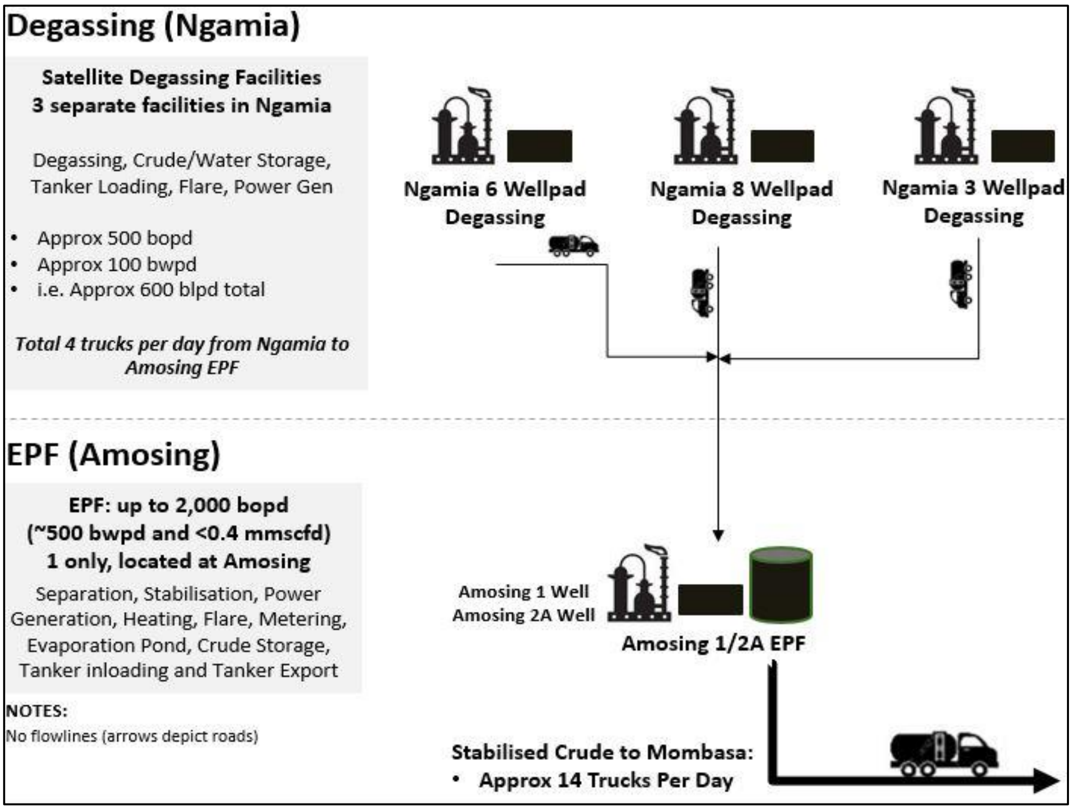


Figure 1: Flow chart showing key infrastructure and activities in the upstream component of the EOPS project

The Midstream activity consists of road transport of tanktainers from the EPF at the Amosing-1 well pad to Changamwe Refinery in Mombasa (route presented in Figure 2).

Other activities that are fundamental to the EOPS concept, but which are outside the scope of the EOPS ESIA, are:

- Unloading oil from tanktainers into a storage and distribution network at Changamwe Refinery;
- Onward pipeline transport of oil from Changamwe Refinery to Kipevu Oil Terminal (KOT); and
- Storage of crude oil at KOT and transfer into vessels for export to international markets.

These activities are permitted through a separate process.

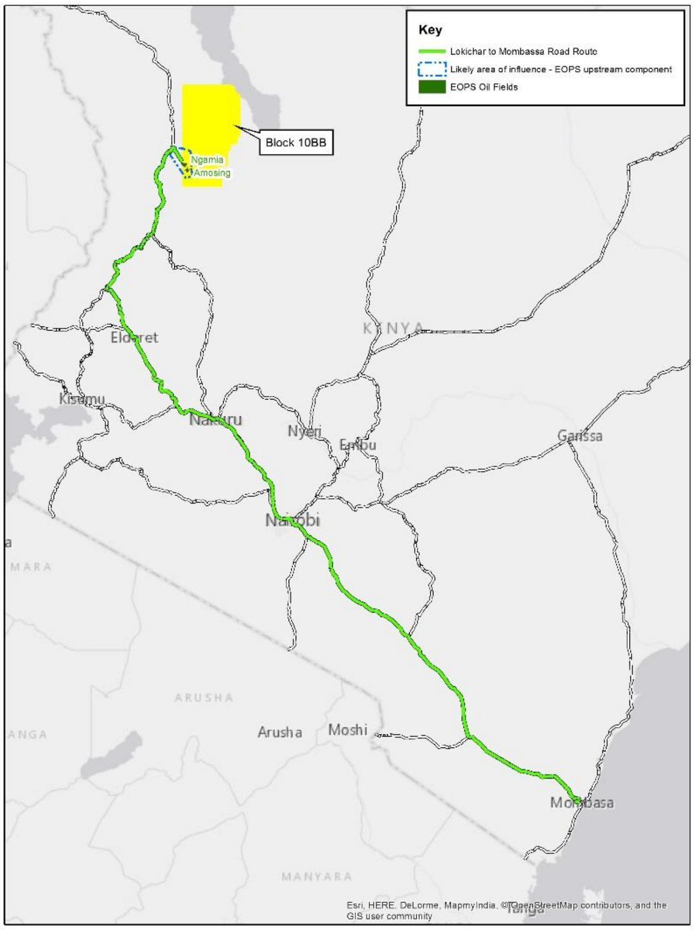


Figure 2: Road Transport route from Lokichar to Mombasa

The proponents of the EOPS Project include the Government of Kenya, Kenya Petroleum Refineries (KPRL) TKBV and their project partners, Africa Oil Company (AOC) and Total.

The likely AOI for the Upstream infrastructure comprises the area spanning the South Lokichar valley (shown in Figure 2) from the town of Lokichar, south to the narrowest part of the valley south of the Amosing field. The likely AOI for the midstream component is a 200 m wide corridor, 100 m either side of the road network used to transport crude oil between the EPF at Amosing-1 and the gate of the Changamwe Refinery in Mombasa. The geographic coverage of the SEP is consistent with the likely AOIs of the EOPS ESIA.

2.0 REGULATIONS AND INTERNATIONAL STANDARDS

The following regulations, international standards and company policies have been taken into account in developing this SEP.

2.1 Kenyan National Regulations

The Kenyan regulatory framework contains a number of stakeholder engagement requirements. The principle relevant regulations and requirements are as follows:

- Environmental Management & Coordination Act (1999): establishes the principle of public participation in the development of policies, plans and processes for the management of the environment, including within the EIA process;
- Environmental (Impact Assessment & Audit) Regulations (2003) (as Amended): Reg. (17) contains public participation requirements during the ESIA study regarding seeking the views of the people or communities which are likely to be affected by the Project. This includes requirements related to public announcements and notices, public meetings and recording of oral and written comments; and
- The Constitution of Kenya (2010):
  - Article 1(2) provides that all sovereign power belongs to the people of Kenya. It further states that people may exercise their sovereignty directly or through their elected representatives. Public participation is direct exercise of sovereignty;
  - Article 10(2) indicates that public participation is among the national values and principles of governance;
  - Article 33 guarantees the freedom of expression including the freedom to seek, receive or impart information or ideas;
  - Article 35 provides for the right to access information. It guarantees every citizen the right to access information held by the state;
  - Article 174(c), gives powers of self-governance to the people. The people can derive direct benefit from meaningful public participation as this contributes to better informed decision-makers armed with additional facts, values and perspectives obtained through public input;
  - Article 174(d) recognizes the rights of communities to manage their own affairs and to further their development. Article 232(1) (d) provides for the involvement of the people in the process of policy making and part (f) provides for transparency and provision to the public of timely and accurate information. Access to information for Kenyan citizens is guaranteed by Article 35 of the Constitution; and
  - Article 37 and 104 include a provision on grievance mechanisms, including a right to assemble, demonstrate, to picket and to present petitions or seek redress within the judicial system.

2.2 International Standards

TKBV has committed to meet the requirements of the IFC Performance Standards on Environmental and Social Sustainability (2012). The IFC Performance Standards set out a framework for managing and improving project performance from planning and assessment, through construction and operations to closure and after-care. The Equator Principles are a common set of principles agreed by some of the world's leading financial institutions that define basic environmental and social standards to be met in certain transactions. The IFC Performance Standards provide a generally accepted basis for good practice and is the technical cornerstone for the Equator Principles.

The IFC Performance Standards stress that public consultation should be started early in project development and that engagement with interested parties at every stage should be:

- "Free" (free of intimidation or coercion);
- "Prior" (timely disclosure of information); and
- "Informed" (relevant, understandable and accessible information).

Specific requirements of the IFC include:

- Stakeholder Analysis and Engagement Planning:

  - Identify affected stakeholders and other stakeholders that may be interested in the project and consider how external communications might facilitate a dialogue with all stakeholders; and
  - Development of a SEP, including measures to allow for the effective participation of stakeholders identified as disadvantaged or vulnerable.
- Disclosure of Information:
  - Provision of relevant information on (i) the purpose, nature and scale of the Project; (ii) duration of the proposed activities; (iii) any risks to and potential impacts on such stakeholders and the relevant mitigation measures; (iv) the envisaged stakeholder engagement process; and (v) the grievance mechanism.
- Consultation:
  - Undertake a process of consultation that provides affected stakeholders with opportunities to express their views on project risks, impacts and mitigation measures;
  - Include a two-way process which (i) begins early in the process of identification of environmental and social impacts and continues on an on-going basis as impacts arise; (ii) is based on prior disclosure and dissemination of relevant, transparent, objective, meaningful and easily accessible information that is in a culturally appropriate local language; (iii) focuses inclusive engagement on those directly affected as opposed to those not directly affected; (iv) is free of external manipulation, interference, coercion, or intimidation; (v) enables meaningful participation where applicable; and (vi) is documented; and
  - Tailor consultation to the language preferences of the affected communities, their decision-making process and the needs of disadvantaged or vulnerable groups.
- Informed Consultation and Participation:
  - Conduct an Informed Consultation and Participation (ICP) process that will result in affected stakeholders' informed participation;
  - Managed a consultation process that (i) captures both men's and women's views, if necessary through separate forums or engagements, and (ii) reflect men's and women's different concerns and priorities about impacts, mitigation mechanisms, and benefits, where appropriate; and
  - Document the process, in particular the measures taken to avoid or minimize risks to and adverse impacts on the affected communities, and will inform those affected about how their concerns have been considered.
- External Communications:
  - Implementation of a procedure for external communications that includes methods to (i) receive and register external communications from the public; (ii) screen and assess the issues raised and determine how to address them; (iii) provide, track and document responses; and (iv) adjust the environmental and social management program.
- Grievance Mechanism for Affected Stakeholders:
  - Establish a grievance mechanism to receive and facilitate resolution of affected stakeholders' concerns and grievances about the environmental and social performance; and
  - Inform the Affected Stakeholders about the mechanism in the course of the stakeholder engagement process.
- On-going Reporting to Affected Stakeholders:
  - Provision of a schedule for periodic reports to the affected stakeholders that describe the progress with implementation of the Project action plans on issues that involved ongoing impacts on affected

stakeholders and on issues that the consultation process or grievance mechanism have identified as a concern to those communities; and

- Provision of reports not less than annually (IFC, 2012).

2.3 TKBV Policies

The EOPS stakeholder engagement will be governed by TKBV's internal policies and standards and the TKBV Stakeholder Engagement Principles, provided in the TKBV Stakeholder Engagement Framework, listed below:

- Identify and assess all stakeholders directly or indirectly affected by planned activities based on the Project's potential risks and adverse impacts;
- Develop and implement a Stakeholder Engagement Plan that is scaled to project risks, potential impacts and the stage of the Project, that describes how stakeholders will be provided with access to timely, relevant, understandable and accessible (i.e. culturally appropriate and in the local language) information, and that describes how project impacted people will be provided an opportunity to discuss and have input into project design, scope, impacts and mitigation measures prior to the start of project activities;
- Identify priorities of impacted peoples regarding economic and social development aspirations and take steps to increase understanding of traditional resource use, economic activity, local decision making practices, location of cultural heritage sites in the areas of our operations;
- Establish a commitment register to document any and all commitments made on behalf of TKBV and track, report and record progress towards completion of all commitments in the register;
- Establish a Grievance Mechanism compatible with the level of risks and impacts associated with the Project's activities to facilitate resolution of any grievances arising in relation to its activities prior to conducting operations;
  - Ensure that the Grievance Mechanism process is straightforward and easy for all segments of impacted stakeholders to use at no cost;
  - Design the Grievance Mechanism in a manner that minimises the potential for retribution against a grievant and does not impede access to other remedies;
  - Consider local language, gender roles, traditional decision-making processes and communications preferences;
  - Document the various requirements of the Grievance Mechanism and ensure that all applicable staff and contractors are familiar with the process and can adequately explain it to external stakeholders;
  - Ensure that all applicable staff and contractors are fully informed about the Grievance Mechanism through its stakeholder consultation activities and communications materials;
  - Establish maximum timeframes for formally acknowledging a grievance/complaint and ensure resolutions are achieved as promptly as possible;
  - Establish a formal Grievance Register to record, investigate, and track resolution of all grievances and complaints; and
  - Monitor the use and effectiveness of the Grievance Mechanism and its outcomes with a view towards continuous improvement.

3.0 OVERVIEW OF PREVIOUS ENGAGEMENT

3.1 TKBV led engagement for Full Field Development

TKBV has been active in Kenya since 2010 and oil exploration activities have been occurring within the area of operations (northwest Kenya) since 2011. During this period, the extent and complexity of stakeholder engagement activities at a national, county and community level has increased substantially. This increase has been driven by several factors including:

- An increase in exploration and appraisal activities (e.g. seismic and drilling operations);
- The geographic footprint of the operations expanded significantly between 2013 and 2015 as new basins/areas were targeted within the extensive licence areas, although activities are now concentrated in the South Lokichar Basin;
- The on-going management of new contractors with different operating models and experience;
- Changes in government roles and responsibilities as a result of newly devolved county government powers; and
- Increasing requests for information from communities.

Considering that Kenya is a new hydrocarbon province, engagement activities to date at both national and local levels have focused on building broad based understanding of the oil and gas industry in parallel to operational specific engagement and consultation activities.

During the course of previous engagement and consultation activities, external stakeholders have raised a range of issues. Given the current stage of the oil lifecycle (post-exploration and appraisal; pre-development), many of the issues raised focus on more immediate activities and short-term impacts. However, these can often be relevant for future lifecycle phases such as Development and Production. Stakeholders have also raised issues that have longer term and far reaching implications.

Various engagement methods have been utilised with prioritisation to oral and visual engagement, given the prominence of such methods in Turkana's traditional society. Other engagement methods have included:

- Engagement through the existing Community Resource Centres, including those located in Lokichar, Lokori and Lodwar;
- Individual, focus group or *baraza* (traditional community meeting) community engagement;
- Information, education and communication material, including written materials and video;
- Preparation and distribution of a monthly community newsletter, *Eana Atopupokin*, Turkana for “Let's Talk and Agree”;
- Participation in radio engagements;
- Use of theatre groups to explain specific topics such as the TKBV's Grievance Mechanism; and
- Targeted site visits for community representatives and leaders, in order, to explain ongoing TKBV activities.

3.2 ESIA Scoping Consultation for FFD

ESIA scoping consultations for the FFD were initiated by a Golder and TKBV team in November 2015 and included a series of meetings to disclose the FFD Project concept and explain the ESIA process. Consultations were held with government, international organisations, international, national and regional NGOs and regional media.

All meetings were started with two brief presentations. The first outlined the development's project description as well as the on-going technical and engineering studies underway to further define the project design. The second presentation provided information on the ESIA and stakeholder engagement process.

The output from the FFD scoping consultation are summarised in the FFD ESIA Project Report (Golder document: 14514160360.516, dated December 2015). Details of the results of the scoping consultation are not shared here as they only provide some context for the EOPS engagement.

3.3 ESIA Scoping Consultation for EOPS

As EOPS also requires an ESIA, ESIA scoping consultations were held in May and June 2016.

These meetings consisted of a series of sessions to disclose the approach to the EOPS ESIA and preliminary project description scheme, which at the time included the road route to Eldoret and rail transport from Eldoret to Mombasa. Subsequently the project description was updated to export via road only (Section 1.3) and further scoping consultation activities (described in Section 3.4) were completed.

Consultations were held with government, international organisations, international, national and regional non-governmental organisation (NGOs) and regional media. The engagement was expanded beyond the previous list of stakeholders engaged in Nairobi and Turkana County to include key stakeholders in the Uasin Gishu County, where trucks traveling from the Lokichar Basin were expected to transfer oil tanks on to existing rail infrastructure in the city of Eldoret.

During 15 meetings with 132 stakeholders, a total of 212 issues, questions and concerns were documented. They are presented below[1] with the first listed topic being the most commonly raised topic:

- Engagement – 21% (of all comments);
- Environment – 17%:
  - Water – 4%;
  - Traffic – 4%;
  - Air Quality and Climate – 4%;
  - Biology – 2%;
  - Restoration / Reinstatement - 1%; and
  - Pollution / Waste – 1%.
- General Project Updates / enquiries – 16%;
- Community Aspects – 12%:
  - Benefits – 6%;
  - Health, Safety & Security – 4%; and
  - Cultural Heritage – 1%.
- ESIA General enquiries – 11%;
- Land Access & Acquisition – 5%;
- Security – 5%;

[1] Rounded to the nearest whole percentage point

- National Content – 4%; and
- Other – 9%.

The most commonly raised topic was in relation to the TKBV's past and on-going engagement. Comments on this topic represented 21% of the total comments made. Substantial attention was directed to how TKBV has engaged with potentially affected people in the past and what plans there are to distribute information in the future.

General project updates and environment issues both represented 16% of the total of all comments. Questions on the Project frequently sought clarification on the EOPS technical process and the relationship between EOPS and FFD.

Among environmental issues, the most commonly raised questions were in relation to water, air quality and traffic; the latter of substantial interest to stakeholders in Eldoret.

Community aspects represented 12% of all comments and there was substantial attention given to community benefits, profit sharing and how TKBV would manage the negotiation between different levels of government in discussing the profit sharing. Responses highlighted that the issue of profit sharing is wholly the responsibility of the government.

ESIA enquiries constituted 11% of the comments, many of which were related to the scope of the impact assessment and what commitments would be made to deal with negative impacts. The TKBV and Golder team used the responses to reiterate that specific commitments are not currently in place and that these will be developed only after the completion of the baseline data and information collection. Responses highlighted that these commitments would only be disclosed when the ESIA neared completion.

Relative to the FFD scoping consultation, land access and acquisition was less frequently mentioned with only 5% (compared to 15% in FFD) of total comments. This is assumed to be due to the fact that no new land is required for the EOPS Project. Nevertheless, several participants still questioned how land would be managed and highlighted the regulatory challenges in acquiring land while the Kenyan Community Land Bill has not yet been passed into law (now enacted). Questions on land also focused on how land acquisition will take into account the pastoralist livelihoods of local residents near the Project. Responses explained that the Land Access Framework (LAF) is being developed and has gone slower than initially expected. It was also frequently explained that the LAF and all work related to land acquisition would comply with IFC Performance Standard 5, which would ensure issues related to traditional land use would be taken into consideration.

Security enquiries, both related to tensions between Turkana and Pokot, as well as general security along the A1 highway, totalled 5% of total comments. Questions were related to the boundaries of the oil reservoirs and whether any disagreement over the borders of the reservoirs could generate conflict between neighbouring counties in Kenya, as well as with international neighbours.

National content questions were raised in many meetings and represented 4% of the total comments. Stakeholder expectations remain very high for employment and there is an on-going tension between national content and local content, indicating that employment given to people outside the Turkana Country of operation needs to be clearly justified. Responses summarised what TKBV has done to date through support for vocational education in Lodwar and the Enterprise Development Centre.

3.4 ESIA Scoping Consultation for EOPS (project description change)

The change in export route to use road only between Lokichar and Mombasa for the transportation of oil, rather than the original route of road and rail was supported by additional Scoping Consultation activities in October 2016.

During a meeting between TKBV and NEMA on 16 September 2016, NEMA confirmed that the change in project description to export via road only, did not constitute a need to revisit all scoping consultation meetings. NEMA confirmed that it would be sufficient to send letters to stakeholders originally engaged during scoping consultation to explain the change in project description. A list of the stakeholders in receipt of this letter is presented in Appendix A.

4.0 STAKEHOLDER IDENTIFICATION

Stakeholders are persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively.

Formal stakeholder identification exercises were conducted for the following areas:

- Significant urban centres relevant to the Project; and
- Affected communities and interested parties.

An integrated stakeholder identification exercise was conducted by various functions within TKBV (including Social Performance, Communications, Government and Public Affairs, National Content, Asset Protection), to identify relevant urban and rural stakeholders across the area affected by the Project.

A consolidated stakeholder register has been developed for the Project Area of Influence (AOI). Stakeholders are categorised based on their area of geographical interest and alignment or otherwise with TKBV operational footprint. A total of approximately 300 stakeholders (either individuals or groups) have been identified across the Project AOI and recorded in the register. The stakeholder register considers those stakeholders who may have vulnerable status. Vulnerable groups may be defined as people that by virtue of gender, ethnicity, age, disability, economic disadvantage or social status may experience different or unique effects from the Project than others. The following measures will be implemented to enhance the ability of vulnerable stakeholder groups to participate meaningfully in the ESIA process:

- During the continued process of stakeholder identification, TKBV will identify disadvantaged or vulnerable persons or groups; and
- Staff will identify consultation approaches and activities that will support effective engagement of vulnerable persons.

It is recognised that defining which stakeholder group is affected or not can be challenging as communities outside of the area considered by TKBV to be the area impacted by activities may perceive that they have been impacted and/or have been and/or will be excluded from Project benefits. To counter this risk, TKBV has taken an inclusive approach to defining Project-affected settlements.

The consolidated stakeholder register will be updated on an on-going basis as new stakeholders are identified and TKBV activities change.

4.1 Stakeholder Groups

Project stakeholders include individuals, groups, communities, businesses, local government authorities, non-governmental organisations, faith-based organisations and other institutions. Table 1 provides a summary description of the main stakeholder groups linked to project activity.

Table 1: Summary description of key Project Stakeholders

Category	Stakeholder Group
Community Stakeholders	Traditional community leadership, including Council of Elders Project-affected community members Women Vulnerable persons Youth Disabled persons
National Government Elected Positions	Members of Parliament for all Sub-counties in the EOPS area of Influence
National Government Appointed Positions	National Government representatives at Location level (Chiefs) National Government representatives at Sub-location level (Assistant Chiefs) National Government Security Services and Kenya Police Reservists County Commissioner, Deputy County Commissioners and Sub-county Commissioners
County Government Elected Positions	Members of the County Assembly (MCAs)
County Government Appointed Positions	Sub-county Administrators Ward Administrators in Lokichar and Lokori/Kochodin National Land Commission – County Land Management Board
County Executive	Turkana County Governor Turkana County Deputy Governor Turkana County Senator Turkana County Executive Committee ▪ Health Services and Sanitation ▪ Finance and Planning ▪ Tourism, Trade and Industrialization ▪ Water Services, Energy, Environment and Natural Resources ▪ Public Service, Decentralised Administration and Disaster Management ▪ Pastoral Economy and Fisheries, Irrigation and Agriculture ▪ Education, Human Resource Development, Culture and Social Services ▪ Land, Physical Planning, Housing and Urban Area Management ▪ Roads, Transport, Housing and Public Works
Business Community	Current and potential suppliers for EOPS District Advisory Committees
Water Institutions	Water User Associations and Water Service Providers
Media Organisations	Radio Stations: Sayare Radio, Akicha, Jambo, Maata
Faith-based Organisations	Diocese of Lodwar Turkana Pastor’s Association

Category	Stakeholder Group
NGOs, Community-based Organisations and Donors	Friends of Lake Turkana CordAid Turkana Basin Institute Oxfam Kenya Extractive Industries Development Program World Vision Kenya Red Cross Human Rights Watch Danish Demining Group Northern Rangelands Trust Let Us Talk Turkana Pastoralists Development Organisation (TUPADO) St. Peter Community Network (SAPCONE) Turkana Civil Society Platform (coalition of 12 local CBOs) Turkana Natural Resource Hub Agency for Pastoralist Advocacy & Development (APAD) Alemun Pastoralist Empowerment Initiative (APEI) Turkana Women Advocacy Development Organization (TWADO) Turkana Development Organization Forum (TUDOF) National Environment Management Agency (NEMA) Water Resources Management Authority (WRMA) Health Organisations British Council United Nations Development Programme

5.0 STAKEHOLDER ENGAGEMENT PROGRAMME

5.1 Integration with ESIA

The results of stakeholder engagement will be integrated into the specialist baseline studies (if required) and impact analysis in the ESIA. Stakeholder issues must be considered in the ESIA and in the project planning and design.

Stakeholder engagement during the EOPS ESIA should include the following consultations:

- Golder and TKBV lead Scoping consultation;
- TKBV disclosure of the project, including the draft Background Information Document (BID), which is presented in Appendix B in English and Swahili; and
- During impact assessment and mitigation planning, Golder will lead consultation on the results of the ESIA studies.

5.2 General Principles for Engagement

The general principles of engagement will meet with IFC Performance Standards, will be completed for the EOPS ESIA according to Good International Industry Practice and Golder experience, and will adhere to the guiding principles set out in TKBV Stakeholder Engagement Framework, South Lokichar Basin (September, 2016).

5.3 Preliminary Impact Assessment and Mitigation Strategies

Prior to finalisation of the ESIA, all stakeholders will be provided with an opportunity to review and comment on the findings of the ESIA, including the associated mitigation commitments that aim to reduce all negative impacts and enhance benefits to the extent possible.

Engagement events during this stage are based on the draft ESIA report, which includes baseline studies, impact analysis, mitigation or management strategies. Following stakeholder engagement Golder will develop the Environmental and Social Management Plan (ESMP), which is an umbrella document that will include sub-plans for specific topics important for EOPS.

Given the size and complexity of the ESIA Report, information will be summarised in other formats to ensure non-technical stakeholders can understand key information and participate in engagement events. The full report will be summarised in a Non-Technical Summary (NTS) document that will be translated into Swahili.

Like the scoping stage, the methods of engagement are likely to include:

- One-to-one meetings;
- Workshops; and
- Forums targeted to different interest groups.

Materials will be disclosed and made available prior to formal engagement events. Meetings will be held in Nairobi to consult national-level stakeholders and in various locations in Turkana. At the national level, meetings will target regulators, national ministries and both international and Kenyan NGOs.

All meetings will include some summary presentations that remind participants of the key findings, but the majority of the time will be spent taking and answering questions. For participants unable to attend any of the meetings held, all written documentation will provide clear instructions about how issues, comments and questions can be submitted in person at TKBV offices and three community resource centres located in Turkana, phone, post or e-mail.

Results of this consultation phase will be compiled, summarised and presented as part of the revised ESIA document. As relevant, changes to the ESIA document resulting from engagement meetings will be indicated in the final report.

6.0 ROLES AND RESPONSIBILITIES

TKBV management of the above-ground operating environment is delivered through several functions including Social Performance (Stakeholder Engagement, Land Access and Resettlement, Social Impacts, Social Investment), Government and Public Affairs (GPA), Communications, Human Resources – Manpower and Industrial Relations, National Content and Asset Protection. These functions have defined objectives and annual work programs and budgets. The functions are resourced at both the national and Turkana levels. The Turkana-based team holds primary responsibility for the delivery of the EOPS ESIA SEP.

The ESIA is managed by Golder Associates and they therefore work closely with TKBV managers to shape and explain impact analysis, mitigation measures and management plans. Golder or sub-consultants working under Golder, have conducted the majority of ESIA engagements to date as it relates to information disclosure during baseline studies.

In Turkana, TKBV engagement functions are distributed between several teams:

- The Stakeholder Engagement team comprises Field Supervisor Stakeholder Engagement (FSSE) and Field Stakeholder Engagement Officers (FSEOs);
- Village Socialisation Officers (VSOs) are also hired from settlements across the Project Area of Influence. These community members are asked to help FSEOs in distribution of information and reporting back when issues or questions arise among the population;
- Grievances are managed by a dedicated Grievance Officer, responsible for implementation of the Grievance Management Procedure;
- The Government and Public Affairs team comprises a GPA Coordinator and GPA Advisor;
- The Communications function comprises a field-based Communications Coordinator and Communication Officers located in the three TKBV Community Resource Centres (TCRC) in Lodwar/Turkana Central, Lokichar/Turkana South and Lokori/Turkana East respectively; and
- The National Content function comprises a Field National Content Advisor.

Key contact information:

- Development Team TKBV Kenya BV
  - P.O. Box 63298-00619 Nairobi, Kenya
  - +254 20 428 6000
  - infokenya@TKBV oil.com
- Communications Team/Community Resource Offices
  - Lodwar: +254 701 482948
  - Lokichar: +254 701 483763
  - Lokori: +254 701 483740
  - Kenya.fieldcommunications@TKBV oil.com
- Grievance Officer
  - Kenya.Grievance1@TKBV oil.com
  - +254 708 95 95 95

7.0 GRIEVANCE MECHANISM

During the exploration phase, TKBV operated an informal project-based grievance management system. While not guided by a defined procedure, this system allowed for the capture and resolution of grievances registered by impacted people within the area of operations.

In 2014 a formal Grievance Management Procedure was developed and a dedicated Grievance Officer was recruited. In 2015 a field-level Grievance Management Committee (internal committee chaired by the Field Operations Manager) was established to ensure appropriate levels of project management and clarity on functional roles and responsibilities for investigation and resolution of grievances where necessary, and also as second tier level for review and resolution of registered grievances which require a review or have failed to be resolved at first order review.

The Grievance Management Procedure aims to ensure that individuals, families, groups, communities and other stakeholders within the project affected area are able to raise concerns, complaints or grievances; and that the company is able to effectively acknowledge, record, review and formally respond to grievances before they escalate into serious disputes.

7.1 Multi-tier system for review and resolution of registered grievances

TKBV use a multi-tier system in which a grievance that is not resolved in a first order review is considered again in a second order review (Figure 3). Data collated through this procedure is analysed on a monthly basis and assists in the identification of emerging and current social trends and risks for TKBV, lessons learnt and the company's impacts on the communities and how to improve outcomes and accountability.

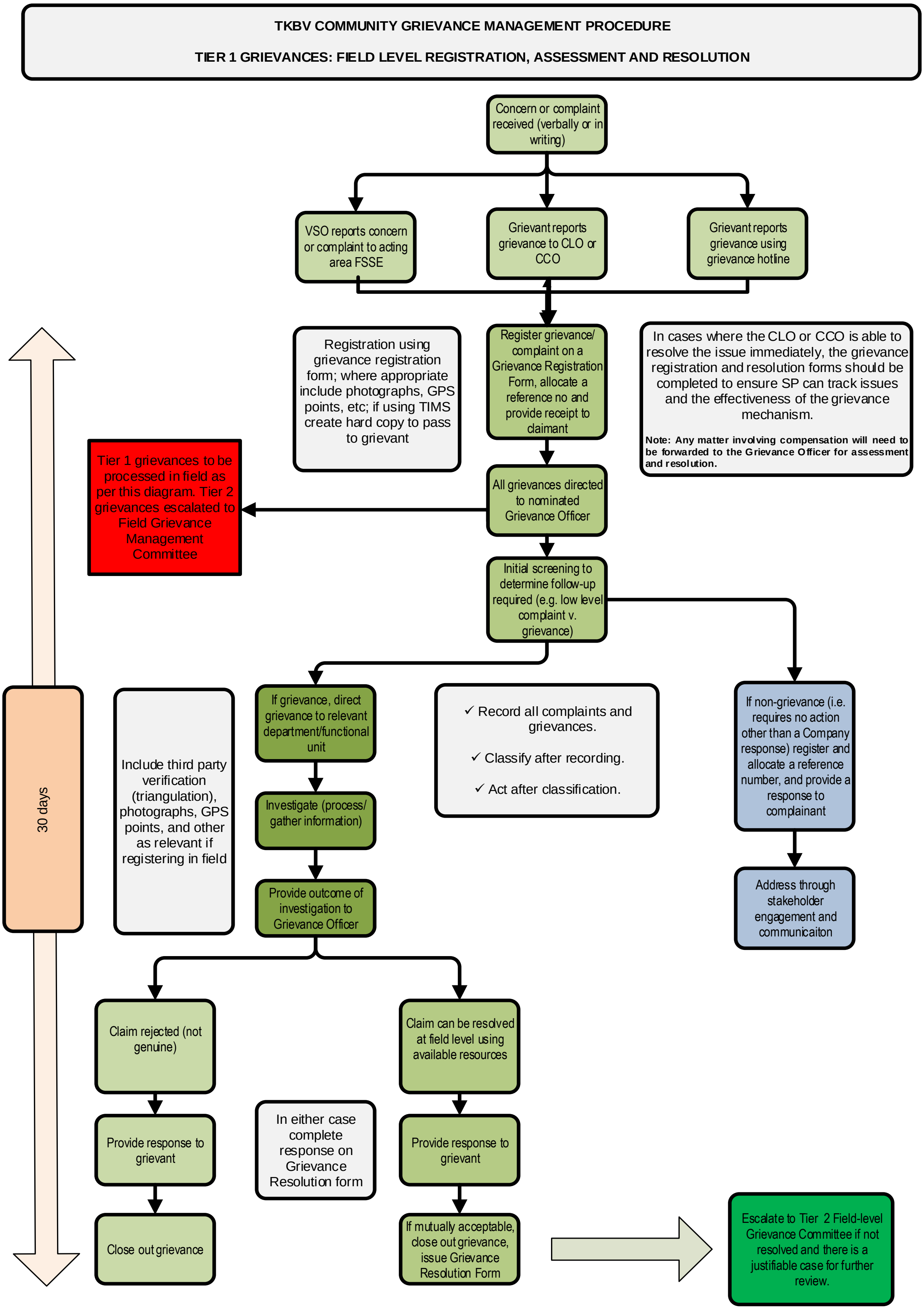


Figure 3: TKBV Community Grievance Management Procedure

The Grievance Mechanism seeks to:

- Provide an equitable and context-specific process which respects the confidentiality of all parties, protects all parties from retaliation and builds trust as an integral component of broader community relations activities;
- Provide a predictable, accessible, transparent, and legitimate process to all parties, resulting in outcomes that are seen as fair, rights compatible effective, and lasting; and
- Enable more systematic identification of emerging issues and trends, facilitating corrective action and pro-active engagement.

The procedure governs how TKBV will receive grievances pertaining to project activities. It will capture grievances arising from actual project impacts, as well as issues that are simply perceived to be related to TKBV, irrespective of whether they derive directly from TKBV or contractor activities.

Grievances shall be investigated and resolved through a defined series of steps as outlined in this procedure. This process allows for three stages of resolution. Specifically: Tier 1 (Entry level) procedures define the means through which community-level grievances may be (i) received, acknowledged and registered by the Project; and (ii) how field-level investigation and resolution of grievances will occur. Tier 2 procedures allows for unresolved grievances to be escalated for further review at the field level. Tier 3 grievance management, which allows for the grievant to proceed to court in the event that the grievance cannot be resolved to the satisfaction of the grievant and the Project, will remain outside the scope of this procedure.

7.2 Definitions

In addition to the definitions provided directly below the contents page of this document, additional definitions are provided in management of grievances.

- **Concerns/Issues:** Questions, requests for information, or general perceptions not necessarily related to a specific impact or incident caused by project activity. If not addressed, concerns and issues can become grievances. Concerns/issues will be recorded as part of the grievance mechanism and resolution procedure but will not be processed as a grievance.
- **Grievance/complaint:** This procedure will utilise the terms 'grievance' and 'complaint' interchangeably. Typically grievances are related to a specific and identifiable impact caused by a project activity, which is raised by an affected individual, family, group or community of stakeholders with the intent of bringing the impact to the attention of the company or contractor seeking that the impact be mitigated (e.g. dust, noise or vibration). More specific grievances raised by an individual, family, group or community of stakeholders who claim to be affected by real or perceived impacts of a company's operations will require specific, targeted corrective actions, which may include compensation. These complaints will be handled by the TKBV Grievance Officer.
- **Grievance Mechanism Tiers:**
  - Entry Level (First Tier) refers to a process through which a grievance is received, acknowledged and registered and subsequently may be investigated and resolved directly between the grievant and the Project through a process of direct or mediated dialogue either by the Grievance Officer (in collaboration with the relevant department) or by site management.
  - Second Tier refers to the process that needs to be followed when an Entry Level (Tier 1) grievance cannot be resolved directly between the grievant and the Project (i.e. at the Tier 1 level) and is thus escalated to Tier 2, involving adjudication by a TKBV Field Operations Grievance Committee, which may include appropriate external representation as required. The need to involve appropriate third party representation will be determined in line with the nature of the grievance, and in collaboration with field operational managers and the community to ensure transparency and adequate

independence. Should the Tier 2 dispute resolution process fail to satisfy the grievant and close the grievance, the complainant can access judicial channels to try and gain resolution.[2]

8.0 MONITORING, EVALUATION AND REPORTING

Recording, monitoring, evaluating, and reporting upon TKBV Kenya's EOPS ESIA Stakeholder Engagement program are critical for ensuring that stakeholder engagement activities do not simply occur in isolation, but that they support business objectives and occur in an on-going coordinated manner across and between functions with responsibility for stakeholder engagement.

The objectives of the company's recording, monitoring, evaluation and reporting efforts are to:

- *Record stakeholder engagement efforts and identify potential impacts and risks;*
- *Assess risks and impacts and their consequences on project-affected peoples;*
- *Consult on new impacts and risks that are identified during the planning and assessment process;*
- *Provide input into proposed mitigation measures, as well as the opportunities for sharing of community benefits;*
- *Ensure compliance with Project commitments that have been made;*
- *Verify the effectiveness of the resolution of community grievances relating to the company operations; and*
- *Manage and track the degree to which the company has been able to gain social acceptance.*

The monitoring, evaluation and reporting of stakeholder engagement will build upon the issue identification done during the scoping consultation. Stakeholder issues and questions collected during other phases will be summarised to highlight the most common topics among consulted groups.

The results of baseline studies will be presented in the draft ESIA. All issues will be shared among the ESIA specialists to ensure that stakeholder questions are considered in the development of impact analysis and mitigation. The goal of this internal process is to ensure that questions about impact management are sufficiently understood and addressed.

A summary of the draft ESIA and associated management plans will be used to solicit another round of comments during the disclosure of the draft ESIA results. Stakeholder issues collected during previous phases will be important in generating non-technical summary documents. These simplified versions of the full ESIA will seek to answer all key issues and questions in language that is understandable for all stakeholders.

Finally, a summary of all stakeholder issues will be included in the final ESIA report. This final report will highlight any critical questions or areas of disagreement identified during the disclosure and discussions around impact analysis and mitigation.

[2] The process of going through the formal judicial channels of the host country (or other applicable judicial or non-judicial systems outside of the host country) will be referred to as the 'Third Tier' of community grievance resolution; however, for the purpose of this document it is considered to be outside the scope of the non-judicial community grievance mechanism. It is the responsibility of TKBV staff members and the Grievance Officer to alert grievants to this potential avenue of redress should they not be satisfied by the Tier 2 resolution process.

Signature Page

Golder Associates (UK) Ltd

Andrew Morsley
Associate/Project Manager

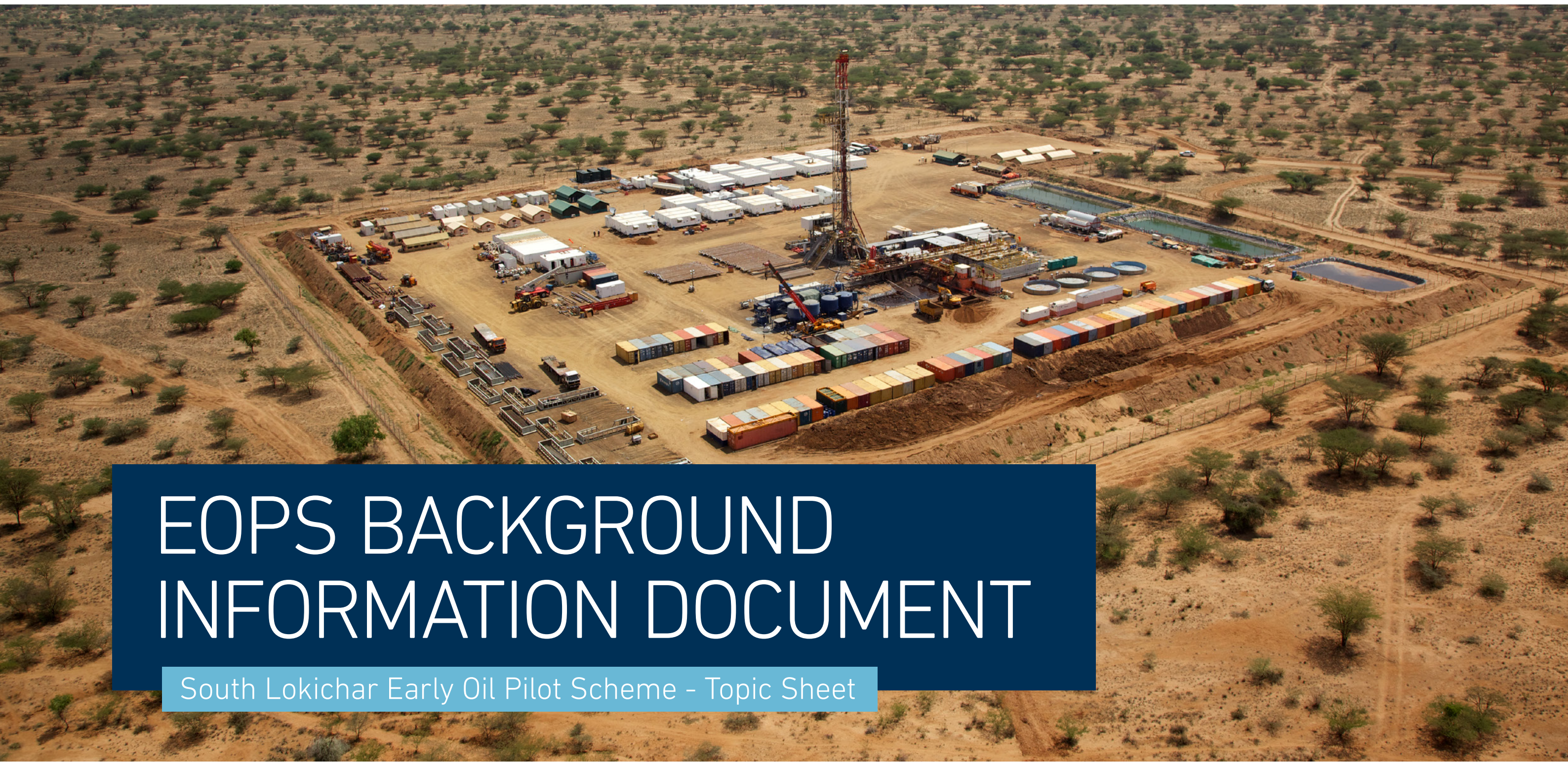
Date: 28 June 2018

PL/AM/cr

APPENDIX A

Background Information Document

Kenya Development - Early Oil Pilot Scheme



EOPS BACKGROUND INFORMATION DOCUMENT

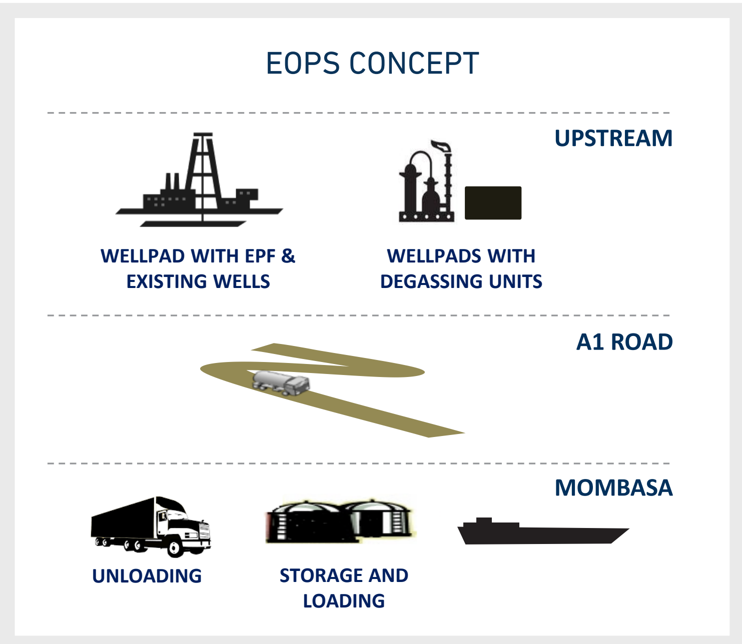
South Lokichar Early Oil Pilot Scheme - Topic Sheet

INTRODUCTION

In 2012, Tullow Oil Kenya B.V. (Tullow) and its partner Africa Oil Corporation, discovered oil in the north western region of Kenya (Turkana County). In 2015, Maersk Oil joined the group by acquiring part of Africa Oil's interest. In March 2018 Total S.A. completed the acquisition of Maersk's oil and gas assets. Tullow remains as Operator. The initial exploration success was followed up by a number of other discovery wells with the result that enough oil has been found to start planning for an oil production scheme known as the South Lokichar Full Field Development (FFD) Project.

EARLY OIL PILOT SCHEME (EOPS)

However, before the South Lokichar Full Field Development Project begins, Government Ministries and Tullow are undertaking an Early Oil Pilot Scheme (EOPS). This will allow comparatively small quantities of oil to be delivered to Mombasa. The pilot scheme is not an alternative to the South Lokichar FFD Project, rather it represents an intermediate step on the journey to full development of the discovered resources. Within Turkana, EOPS involves the use of existing well pads and wells. The oil from these will be transported via current, but upgraded, road infrastructure, to oil storage tanks in Mombasa.



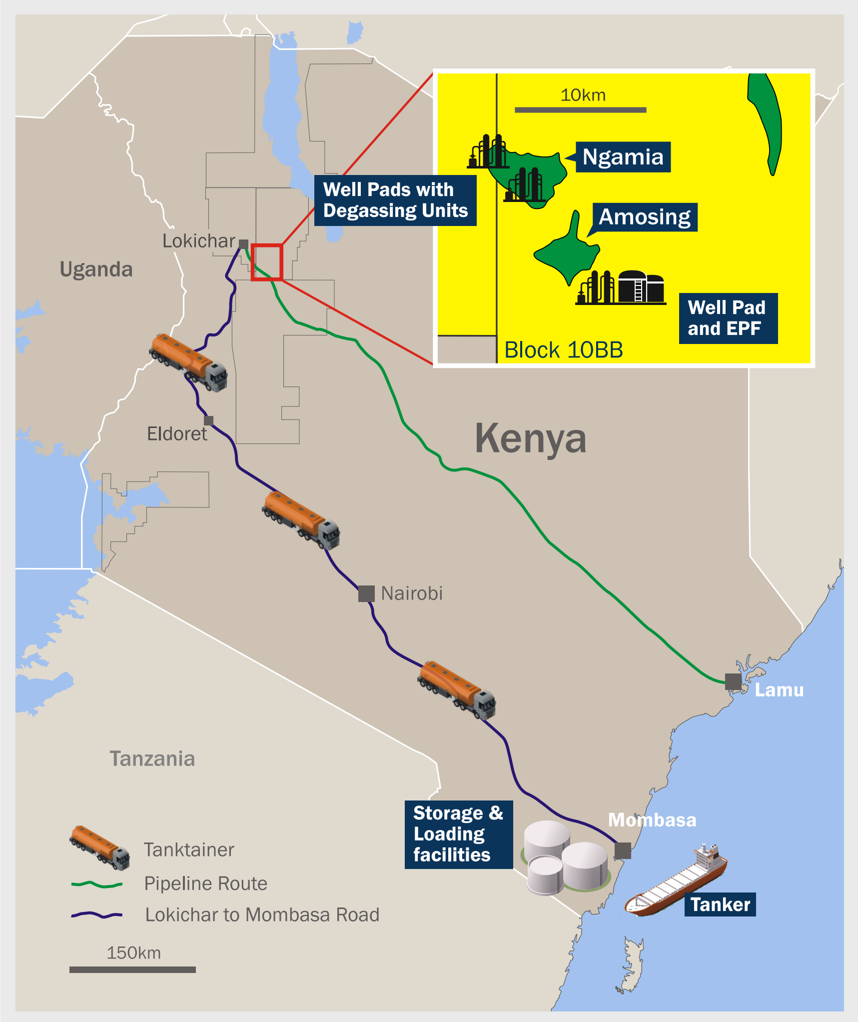
WHY EOPS ?

EOPS is an important step towards Full Field Development (FFD). EOPS specifically supports FFD by:

- Establishing logistical infrastructure (e.g. A1 & C46 road upgrades)
- Providing important technical well data
- Enabling National and County governments to gain more technical experience and capabilities, as the Kenya Joint Venture transitions from exploration and appraisal, to development and production

EOPS KEY FACTS

- Target production of 2,000 barrels of oil equivalent per day from Amosing and Ngamia fields in South Lokichar
- Crude oil will be trucked from three Ngamia well pads to the Amosing-1 well pad
- A single Early Production Facility (EPF) will be constructed at Amosing-1 well pad
- No additional land will be required
- A tank loading facility will be located inside the existing Amosing-1 well pad boundary
- Crude oil will be trucked by road from Amosing-1 to Mombasa using tanktainers
- Trucks will pass through Lokichar
- In Mombasa oil will be transferred into large storage tanks at the KPRL refinery
- As part of EOPS, Government Ministries and Tullow will export via trucks the existing crude oil flowed to the surface during Extended Well Testing activities in 2015 to the KPRL Refinery in Mombasa



Typical production units to be installed on well pads

Crude will be transported via truck using Tanktainers

Storage tanks and piping at KPRL refinery in Mombasa

WHO IS DOING WHAT ?

- Tullow is the Operator, and is supported by partners Africa Oil and Total
- Kenya National Highways Authority (KENHA) is responsible for upgrading the A1 and C46 roads and all associated permits
- Kenya Petroleum Refineries Ltd (KPRL) is refurbishing existing facilities near Mombasa in order to accommodate fuel storage
- Government of Kenya – overall project sponsor

LEGISLATION AND INTERNATIONAL STANDARDS

EOPS will comply with applicable Kenyan legislation and follow the International Finance Corporation (IFC) Performance Standards (2012).

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) PROCESS

An Environmental and Social Impact Assessment (ESIA) is a process that is undertaken before a project starts, which evaluates possible impacts on people and the surrounding environment.

The ESIA process fulfils two key objectives: Firstly, it enables the project partners and stakeholders to understand the environmental, social and health risks and impacts associated with the project, also how the project proposes to manage or mitigate such impacts and risks. Secondly, it forms part of an application to the environmental regulator for an Environmental Impact Assessment (EIA) licence, which is required under applicable legislation.

In Kenya, an EIA licence is a regulatory requirement for all major infrastructure projects and these are issued by the Kenyan National Environmental Management Authority (NEMA). The ESIA process has various stages and requires engagements with stakeholders who may be directly, or indirectly, impacted by the project. All key stakeholders to the project will be consulted during the ESIA process and their concerns will be logged and addressed in the ESIA.

As a result of the engagement process, issues are identified along with suitable measures to mitigate or manage any impacts. Once the ESIA is complete, an Environmental and Social Management Plan (ESMP) is prepared that describes the way in which environmental and social issues are to be managed during implementation of the project.

The ESIA for EOPS is being conducted by Golder Associates (UK) Limited and EMC Consultants Limited, a licensed ESIA provider in Kenya. As far as possible, Golder and EMC have sought to maximise the participation of Kenyan and Turkana specialists in the ESIA process.

Key topics for the ESIA include:

- Socio-economics;
- Land tenure and use;
- Community health and safety;
- Cultural heritage;
- Biodiversity;
- Ecosystem Services;
- Soil;
- Geology and seismicity;
- Water;
- Air Quality and climate;
- Noise and vibration; and
- Landscape and visual

There are three main stages in the ESIA process

1 **Scoping Phase** (complete)	**2** **Baseline Studies** (complete)	**3** **Impact analysis and mitigation** (in progress)

The National Environmental Management Authority (NEMA) has accepted the Terms of Reference (ToR) for the ESIA which were completed in Stage 1. This ToR outlines the work plan for the next phases of the project which are now underway.

STAKEHOLDER ENGAGEMENT

The objective of stakeholder engagement is to establish and maintain constructive relationships with external stakeholders over the life of Tullow's operations. The ESIA process is underpinned by engagement with all stakeholders, defined as persons, groups or communities that may be affected, or have the ability to affect (positively or negatively) Tullow's and its contractors' activities, or have interest in it.

Tullow has been active in Kenya since 2010 and oil exploration activities have been occurring within the area of operations (North West Kenya) since 2011. During this period, the extent and complexity of stakeholder engagement activities, which has been focused on FFD related activities, at a national, county and community level has increased substantially. The ESIA consultants began formal consultation on EOPS in 2016. Further project disclosure and consultation is planned with stakeholders for late 2017 and early 2018.

The stakeholder engagement process for the ESIA will be outlined in a publically available Stakeholder Engagement Plan (SEP). The overall objective of the SEP is to explain how TKBV will engage with stakeholders throughout the course of the project. As part of the ESIA, stakeholder engagement will capture issues, comments and questions accurately and in a meaningful manner.

GRIEVANCE MECHANISM

The Tullow Grievance Mechanism aims to ensure that stakeholders within the project affected area are able to raise concerns, complaints or grievances; and that the company is able to effectively acknowledge, record, review and formally respond to grievances before they escalate into serious disputes. The Grievance Mechanism is free to use and is promoted widely in the project area.

CONTACT INFORMATION

For more information on EOPS or the ESIA, residents in the project area may visit Community Resource Offices in Turkana:

Lodwar - +254 (0)701 482948;

Lokichar- +254 (0)701 483763; or

Lokori - +254 (0)701 483740.

Email: Kenya.fieldcommunications@tullowoil.com

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Tullow Kenya BV
P.O. Box 63298-00619
Nairobi, Kenya
Tel: +254 (0) 20 428 6000
Email: infokenya@tullowoil.com

Maendeleo Kenya - Lokichar Kusini mradi tangulizi wa mafuta

MAELEZO MUHIMU KUHUSU MRADI YA MAFUTA YA EOPS

Lokichar Kusini mradi tangulizi wa mafuta

KITAMBULISHO

Mnamo mwaka 2012, kampuni ya kuchimba mafuta ya Tullow ikishirikiana na, kampuni ya mafuta ya Africa Oil, waligundua mafuta katika eneo ilioko Kusini magharibi katika Kaunti ya Turkana. Mnamo mwaka wa 2015, kampuni ya mafuta ya Maersk ilijiunga na mradi huo kwa kununua faida katika kampuni ya Afrika Oil.

Kampuni ya Maersk Oil walikamilisha uuzaji wa hisa zao kwa kampuni ya Total S.A mwezi wa tatu mwaka wa 2018. Kampuni ya Tullow itabaki kuwa kiongozi kwa biashara ya mafuta nchini Kenya. Tangu kufanikiwa kupata mafuta, kampuni ya Tullow imechimba visima vingine na kugundua mafuta zaidi. Kwa hivi sasa mradi huo utaendeleza hatua za operesheni zake zaidi,kwa awamu iitwayo 'Full Field Development – FFD'.

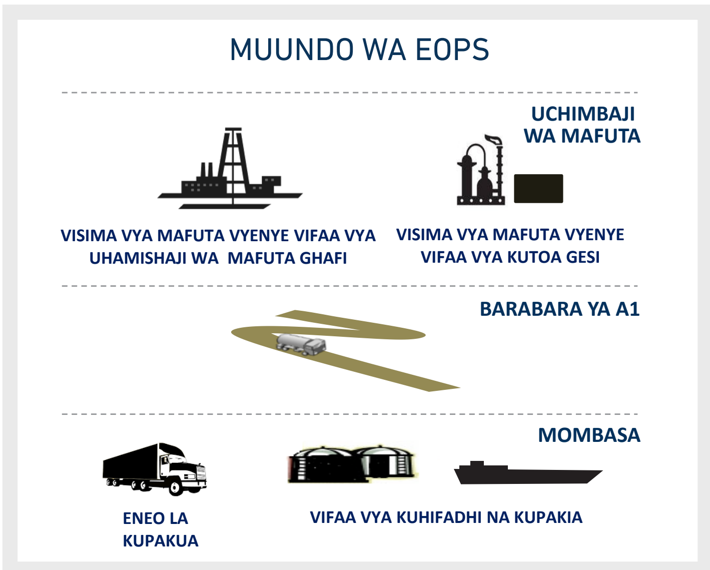
LOKICHAR KUSINI MRADI TANGULIZI WA MAFUTA (EOPS)

Hata hivyo kabla ya mradi huo wa 'FFD' kuanza kutekelezwa, wizara husika za Serikali na kampuni ya mafuta ya Tullow, zitafanya utafiti maalum kuhusu mradi wa EOPS. Hii itawezesha kiasi ndogo ya mafuta kusafirishwa hadi sokoni. Mradi huu ni jaribio tu na wala sio mradi mbadala wa South Lokichar, 'Full Field Development – FFD'. Mradi huu wa EOPS utahusisha matumizi ya visima vilivyoko kufikia sasa, huku mafuta yakisafirishwa kwa barabara hadi kwenye matenki ya kuhifadhi mafuta huko Mombasa kabla ya kusafirishwa kwenye soko ughaibuni.

KWA NINI EOPS

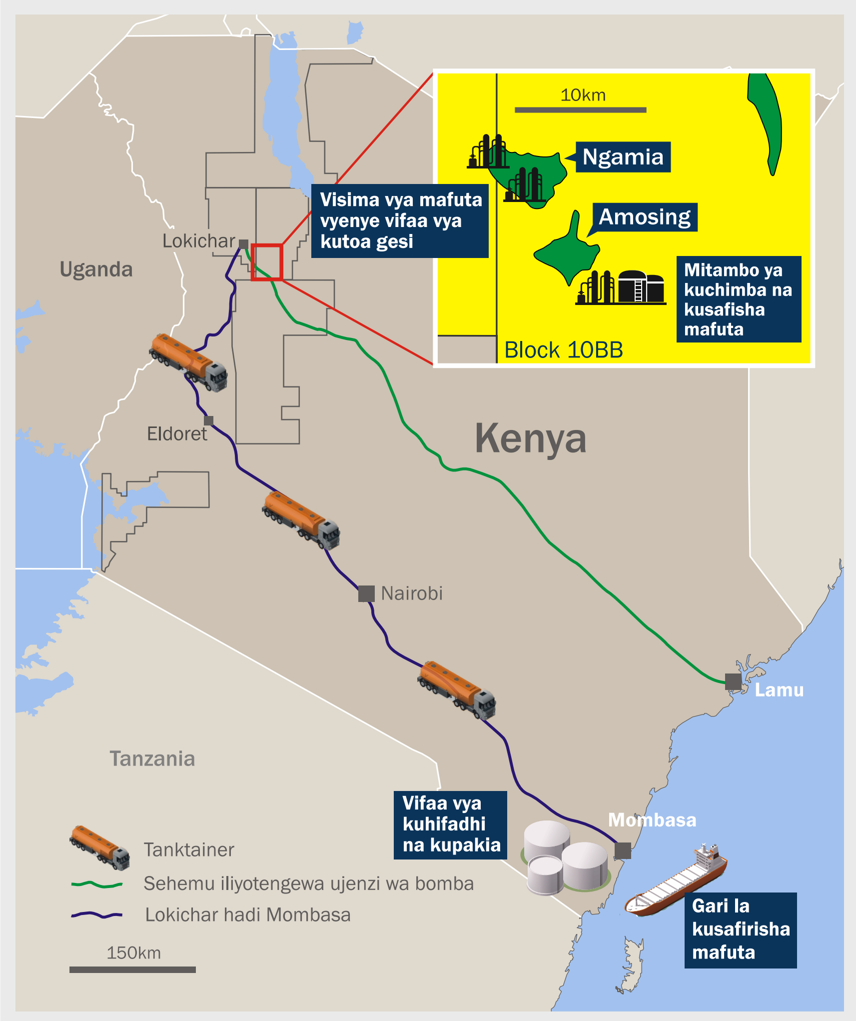
EOPS ni hatua muhimu katika utekelezaji kamili wa mradi, wa FFD. EOPS, unapania kufanikisha:

- Kubaini miundo msingi na tekelezi, kwa mfano kukarabati barabara za A1na C46.
- Kubaini habari za kiufundi za visima.
- Kuwezesha Serikali ya taifa na Kaunti kujifahamisha na taratibu za utekelezaji wa operesheni ya aina hii - kuanzia utafutaji,uchimbaji na uzalishaji wa mafuta.
- Kuiwezesha taifa la Kenya kuwa miongoni mwa nchi zinazosafirisha mafuta ughaibuni na pia kutupa maelezo Zaidi kuhusu soko ya mafuta ya Kenya.



HABARI SAHIHI ZA EOPS

- Inalenga kutoa mapipa 2,000 ya mafuta kwa siku kutoka visima vya Amosing na Ngamia katika eneo la Lokichar Kusini.
- Mafuta ghafi yatasafirishwa kwa malori kutoka visima vitatu vya Ngamia hadi kisima cha Amosing 1.
- Kituo cha kuvuta na kutayarisha mafuta kitajengwa katika eneo la Amosing 1.
- Ardhi nyingine haitahitajika.
- Mtambo wa kupakia mafuta kwenye tangi za lori kujengwa katika eneo la kisima cha Amosing.
- Mafuta ghafi yatasafirishwa kwa barabara kutoka Amosing-1 hadi Mombasa.
- Malori yanayosafirisha mafuta yatapitia Lokichar.
- Katika kituo cha Mombasa mafuta ghafi yatahifadhiwa kwenye matenki yakingoja kusafirishwa kwenye soko ughaibuni.
- Kama sehemu ya EOPS, Wizara husika katika serikali ya Kenya na Kampuni ya Tullow, watasafirisha mafuta ghafi yaliyotokana na operesheni ya 'Extended Well Testing (EWT)' iliyo anza mwaka wa 2015. Msafara ya haya malori yataelekea hadi kiwanda cha kusafishia mafuta ghafi 'KPRL' Mombasa.




Vyombo vya utoaji mafuta vitakavyo jengwa katika eneo la visima


Mafuta ghafi yakisafirishwa kwa malori


Matenki ya kuhifadhi matufa na bomba katika kiwanda cha kprl mombasa

WAHUSIKA

- Kampuni ya Tullow Kenya, ndiyo kampuni kuu tekelezi, ikishirikiana na kampuni ya Africa Oil na Total.
- 'KENHA' wanaotengeneza barabara za taifa wanawajibikia ukarabati wa barabara za A1na C46 na vibali vyote husika.
- KPRL - Kukarabati matenki ya kuhifadhi mafuta na mitambo ya kusafarisha na kuweka mafuta huko Mombasa.
- Serikali ya Kenya - Mfadhili mkuu wa mradi

SHERIA NA VIWANGO VYA KIMATAIFA

EOPS kuzingatia sheria zote husika hapa nchini na na zile za Shirika la Fedha la Kimataifa (IFC 2012).

UNCHUNGUZI WA ADHARI ZA KIMAZINGIRA NA KIJAMII (ESIA)

Uchunguzi wa Athari za Kimazingira na Kijamii (ESIA) ni utafiti ambayo hutekelezwa kuchunguza kama mradi huu unaweza kuwa na athari kwa binadamu na mazingira. Utafiti wa ESIA hutimiza malengo mawili makuu: Kwanza, huwezesha Washirika wa Mradi kuelewa na kupima, kwa njia huru, hatari na athari zinazohusiana na mradi huo kwa mazingira, kwa jamii na afya. Pili, huwa ni hatua ya lazima ili uweze kutuma maombi kwa halmashauri ya mazingira (NEMA) ili kupata leseni ya Uchunguzi wa Athari za Kimazingira (EIA) ambazo huhitajika kwa mujibu wa sheria.

Nchini Kenya, leseni ya EIA ni moja wapo za sheria kwa miradi yote mikubwa ya kimiundomsingi na hii hutolewa na Halmashauri ya Kusimamia Mazingira Kenya (NEMA). Harakati ya ESIA hujumuisha hatua mbalimbali na huhitaji kuwahusisha wadau ambao wanaweza kuathiriwa na mradi huo moja kwa moja au vinginevyo. Kuwahusisha wadau kunaweza kuchukua miezi kadhaa kukamilika na kutokana na shughuli hizi, masuala na hatua za kupunguza na kukabiliana na athari hutambuliwa kabla ya mradi kuanza. Baada ya ESIA kukamilika, ripoti ambayo hueleza jinsi ambavyo masuala ya kimazingira na kijamii vinavyofaa kusimamiwa wakati wa utekelezaji wa miradi, huandaliwa. Leseni ya EIA hutolewa na NEMA na uruhusu mradi kuanza kulingana na idadi ya masharti yaliyoelezwa kwenye ESIA.

Ili kuendeleza mradi huu Kampuni ya Golder Associates kutoka Uingereza na Kampuni ya EMC Consultants Kutoka Kenya, (kampuni zenye uzoefu katika shughuli za ESIA) watatekeleza mradi huu.

Maswala muhimu ya ESIA ni;

- Athari kwa jamii na uchumi,
- Umiliki wa ardhi na matumizi
- Afya ya jamii na usalama
- Turathi za kitamaduni
- Mazingira na viumbe hai
- Hali ya mazingira
- Mchanga
- Jiolojia na unchunguzi wa ardhi
- Maji
- Ubora wa hewa na hali ya anga
- Kelele na mitetemeko,na
- Mwelekezo wa ardhi na mazingira

ESIA ina hatua tatu muhimu

1 **Hatua ya 1;** Uchunguzi tangulizi (Umekamilika)	**2** **Hatua ya 2:** Utafiti wa kimsingi (Unaendelea)	**3** **Hatua ya 3;** Uchambuzi wa athari na suluhisho (Unaendelea)

NEMA imekubaliana na mwongozo wa-ESIA zilizo kamilishwa katika hatua ya 1. Kanuni hizo zinatoa ratiba za kutekeleza awamu zifuatazo ambazo zimeratibiwa hivi sasa.

UHUSIANO NA WADAU

Sababu kuu ya kutafuta maoni ya wadau ni kuanzisha na kudumisha uhusiano mwema katika kipindi chote cha operesheni za kampuni ya Tullow katika maeneo ya kazi. Utaratibu wa ESIA unafuata kanuni za kushauriana na wadau wote,wakiwemo watu binafsi, makundi au jamii ambayo huenda ikaathirika au ikaathiri shughuli za kampuni ya Tullow na wanakandarasi wake.

Kampuni ya Tullow Kenya B.V imekuwa ikiendesha shughuli zake hapa nchini tangu mwaka 2010. Ilianza utafutaji wa mafuta mwaka wa 2011, kaskazini magharibi mwa Kenya. Katika kipindi hicho, Tullow iliweka utaratibu mathubuti za kushauriana na wadau wote, katika ngazi ya kitaifa, kaunti na hata jamii, kwa lengo la kufanikisha shughuli zetu nyanjani. Watafiti wetu walianza mashauriano kuhusu EOPS mwaka 2016. Mashauriano zaidi baina ya watafiti wetu na wakazi wa maeneo ya operesheni na mradi huo yamepangiwa mwishoni mwa mwaka wa 2017.

Utaratibu wa mashauriano na wadau kuhusu ESIA yataangaziwa kwenye mpango maalumu unaojulikana kama 'Stakeholder Engagement Plan (SEP)'. Madhumuni ya mpango huo ni kuwafahamisha wadau jinsi kampuni ya TKBV itashirikiana nao katika kipindi cha utekelezaji wa mradi huo. Mashauriano na wadau huwapa watekelezaji fursa ya kusikiza, moja kwa moja maoni na maswali ya wadau.

UTARATIBU WA KUWASILISHA MALALAMIKO

Mfumo rasmi wa kupokea malalamishi kutoka jamii uliratibiwa. Madhumuni ya kubuni mfumo huo ni kuhakikisha kuwa wadau katika maeneo tunayotekeleza miradi wanapata fursa ya kuwasilisha kwa kampuni maoni na malalamiko kwa njia inayofaa. Baada ya Kampuni kuyapokea na kuyanakili basi huyachunguza na kisha kuyajibu kwa wakati na kwa njia inayofaa, ili kuepusha migogoro wakati wa utekelezaji wa operesheni. Haulipishwi chochote kwa kuwasilisha maoni au malalamiko kupitia mfumo huu.

ANWANI YETU

Kwa maelezo zaidi kuhusu EOPS au ESIA,wakazi wa maeneo ya utekelezaji mradi wanaweza kutembelea ofisi zetu huko Turkana:

Lodwar - +254 (0)701 482948;

Lokichar- +254 (0)701 483763; or

Lokori - +254 (0)701 483740.

Email: Kenya.fieldcommunications@tullowoil.com

Nairobi, wasiliana kutumia barua pepe infokenya@tullowoil.com ama anwani ifuatayo:

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Email: infokenya@tullowoil.com

APPENDIX B

Stakeholder List in Receipt of EOPS Update Letters (October 2016)

EOPS Stakeholder Register		
Stakeholder	**Designation**	**Organisation**
UN Agencies		
Mr. Ronald Sibanda	Country Representative	World Food Programme
Stephen Munyao	Sub-Regional Manager	Water Resources Management Authority
Henry Ndede	Country Coordinator	United Nations Environment Programme (UNEP
Ms. Amanda Serumaga	Country Director	United Nations Development Programme (UNDP)
Mr. Mohamed Djelid	Director	UNESCO Regional Office for Eastern Africa
Zebib S. Kavuma	Country Director	UN Women
Mr. Robert Allport	Country Representative	Food and Agriculture Organisation (FAO) of the United Nations
Turkana		
Hon. Rhoda Arupe Loyor	CEC Energy	Turkana County
Hon. Peter Ekai Lokoel	Deputy Governor	Turkana County
Stella Opakas	Director of Energy & Petroleum	Turkana County
Clement Nadio	Director of Environment	Turkana County
H.E. Josephat Nanok	Governor	Turkana County
NGOs		
Bijay Kumar	Executive Director	Action Aid
Dr. Meshack Ndirangu	Country Director	AMREF Health Africa in Kenya
Beatrice Karanja	Partner Relations Manager	African Wildlife Foundation
Julius Arinaitwe	Regional Director	Bird Life International
Victor Koi	Kenya National Director	ChildFund
Hadley Becha	Director	Community Action for Nature Conservation (CANCO)
Mads Frilander	Country Director	Danish Demining Group
Jarso Mokku	Programme Co-ordinator	Drylands Learning and Capacity Building Initiative (DLCI)
Dr. Richard Lamprey	East Africa Technical Specialist	Fauna & Flora International
Ms. Ikal Ang'elei	Executive Director	Friends of Lake Turkana
Daniel Bekele	Executive Director, Africa Division	Human Rights Watch
Rose Kimotho	Programme Manager - East Africa	Institute of Human Rights & Business
Ms. Eunice Mwende	Country Coordinator- Kenya and Somalia	International Alert
Jimmy Smith	Director General	International Livestock Research Institute (ILRI)
Rudo Angela Sanyanga	Africa Program Director	International Rivers

EOPS Stakeholder Register		
Stakeholder	**Designation**	**Organisation**
Leo Niskanen	Technical Coordinator - Conservation Areas and Species Diversity Programme	International Union for Conservation of Nature
Charles Wanguhu	Coordinator	Kenya Civil Society Platform on Oil & Gas (KCSPOG)
Odenda Lumumba	National Coordinator	Kenya Land Alliance
Zila Mwajuma	Coordinator and Program Manager	Kenya Oil & Gas Working Group (KOGW)
Keiko Sano	Chief Representative	Japan International Cooperation Agency Kenya Office
George Kegoro	Executive Director	Kenyan Human Rights Commission
Gertrude Angote	Executive Director	Kituo Cha Sheria
Hussein Adan Isack	Executive Director	Kivulini Trust
Mwenda Makathimo	Executive Director	Land Development and Governance Institute
Shalom Ndiku	Project Manager - Kenya, Infrastructure and Extractive Industries	Natural Justice: Lawyers for Communities and the Environment
Simon Addison	National Programmes Coordinator	Oxfam
Yolanda Weldring	Interim Eastern Africa Director	Practical Action
Shadrack Omondi	Executive Director	Resource Conflict Institute (RECONCILE)
Mr. Duncan Harvey	Country Director	Save the Children International - Kenya Programme
Dr. Iain Douglas-Hamilton, CBE	Founder & Chief Executive Officer	Save the Elephants
Dr. Abbas Gullet	The Secretary General	The Kenya Red Cross Society
Charles Oluchina	Director of Field Programs, Africa Region	The Nature Conservancy
Samuel Kimeu	Executive Director	Transparency International
Eliud Wamwangi	Chairman	Water and Environmental Sanitation Coordination Secretariat
Julie Mulonga	Program Manager	Wetlands International
Paula Kahumbu	Chief Executive Officer	Wildlife Direct (Kenya)
Dickens Thunde	National Director	World Vision Kenya
Mr. Mohamed Awer	Country Director	WWF Regional Office for Africa
National Government		
Amina Abdalla	Chairperson	National Assembly committee on Environment and Natural Resources
Mr. Emilio Mugo	Director	Kenya Forestry Service
Eng. Peter M. Mundinia	Director General	Kenya National Highways Authority (KeNHA)
Kitili Mbathi	Director	Kenya Wildlife Service

EOPS Stakeholder Register		
Stakeholder	**Designation**	**Organisation**
Kagwiria Mbogori	Commissioner and Chairperson	Kenyan National Commission on Human Rights
Mr. Willy Bett	Cabinet Secretary	Ministry of Agriculture, Livestock and Fisheries
Festus Mwangi Kiunjuri	Cabinet Secretary	Ministry of Devolution and Planning
Dr. Fred O. Matiang'i	Cabinet Secretary	Ministry of Education, Science and Technology
Hon. Charles Keter	Cabinet Secretary	Ministry of Energy and Petroleum
Prof. Judy Wakhungu	Cabinet Secretary	Ministry of Environment, Natural Resources and Regional Development Authorities
Ambassador Amina Mohamed	Cabinet Secretary	Ministry of Foreign Affairs
Dr. Cleopa Mailu	Cabinet Secretary	Ministry of Health
Adan Mohamed	Cabinet Secretary	Ministry of Industrialisation and Enterprise Development
Mrs. Phyllis Kandie	Cabinet Secretary	Ministry of Labour and East African Affairs
Prof. Jacob T. Kaimenyi	Cabinet Secretary	Ministry of Land, Housing and Urban Development
Dan Kazungu	Cabinet Secretary	Ministry of Mining
Dr. Hassan Wario Arero, (PhD)	Cabinet Secretary	Ministry of Sports, Culture and the Arts
James Wainaina Macharia	Cabinet Secretary	Ministry of Transport and Infrastructure
Eugene Wamalwa	Cabinet Secretary	Ministry of Water and Irrigation
Dr. T. Konyimbih – Mboya	Commissioner	National Land Commission
Dr. Mzalendo Kibunjia	Director General	National Museums of Kenya
Mr. Henry Rotich	Cabinet Secretary	The National Treasury
Eng. John Phillip Olum	Chief Executive Officer	Water Resources Management Authority
Eldoret NGOs		
Philip Barno	Chairperson	NGO network, Eldoret

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2.0 EOPS PHASE II ESIA STAKEHOLDER ENGAGEMENT CONSULTATION ISSUES AND RESPONSES REPORT

REPORT

South Lokichar Basin: Early Oil Pilot Scheme Phase II (EOPS)

ESIA Stakeholder Engagement Consultation Issues and Responses

Submitted to:

Tullow Kenya B.V.

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Distribution List

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1.0 INTRODUCTION

This issues and responses stakeholder engagement consultation report provides a comprehensive review of the key points and topics relating to EOPS Phase 2 raised during the ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018.

Key issues / questions described in the sections below are itemised with corresponding responses; the responses provided at the meeting – “Response provided”, and where relevant a “Post meeting response”, which are provided by Golder to ensure the issue has been adequately responded to.

1.1 Project Description

- When you are doing your surveys, do you find other natural resources other than Oil and Gas?
  - *Response provided*: We do not extract any other resource other than Oil and Gas. There are those natural resources that we are measuring for ecosystem services – e.g. firewood, medicinal plants.
  - *No Post meeting response required.*
- Is it possible to re-inject the gas as opposed to flaring?
  - *Post meeting response*: Re-injection would not be possible as no appropriate horizon has been identified in the Amosing or Ngamia field.
- Are the chemicals used to drill oil making the ecosystem dry?
  - *Post meeting response*: There is no drilling associated with EOPS Phase 2.
- How well are drill cuttings protected in a liner?
  - *Post meeting response*: There is no production of cuttings associated with EOPS Phase 2.
- How much produced water are you expecting? How do you stop communities taking this evaporation water?
  - *Response provided*: The ratio is about 5:1 or 4:1. The ponds will be fenced-off as they are not fit for human consumption. Potable water system points have been provided, for example at Nakukulas.
  - *No Post meeting response required.*
- Given that during oil production, there is also water separated from the wells, is there potential for this water to be contaminated and can it affect the community in any way?
  - *Response provided*: The water is evaporated using evaporation ponds. The water is not fit for human consumption and is therefore not released to the community. There are no expected impacts on the community.
  - *No Post meeting response required.*
- Does the water and gas being produced (together with the oil) have any effect or impact on the communities living around the well pads?
  - *Response provided*: It is important to note that the water being produced is not fit for human consumption. Additionally, the volumes of water being produced at the start of production are very minimal and will be subjected to evaporation – which will not affect the community in any way. The gas produced will be subjected to flaring, which has no effect on the communities around the well pads. At Amosing, the gas produced is enough to produce electricity which will be used for power at the WP.

  - *No Post meeting response required*.

- Has Tullow trained communities, transporters, drivers etc on safety and procurement standards?

  - *Response provided*: Discussions have been held with the administration to determine how the various 28 trucks will be shared – such as 10 each across the existing wards. What is important to leadership is to provide proper direction in the tendering process. Currently, minimum processes, procedures and certifications are required for drivers. Some drivers are already trained to have capacity for this, where other driver associations exist which cannot all be reached. Therefore, TKBV deals with drivers as individuals to avoid conflict.

  - *No Post meeting response required*.

- Why are we exporting the crude as opposed to building a refinery at Changamwe? Won't all the profit go to other countries as opposed to Kenya, where the oil is being produced?

  - *Response provided*: The facility at Changamwe has not been operational for some time and lacks the capacity to refine the crude oil. A reminder on the EOPS drivers which stipulate that it is being used to test different properties of the crude and at the same time to determine whether we have a market for the Kenya crude.

  - *No Post meeting response required.*

- Why is Tullow keeping people at Kapese camp? They should live with the community to help grow the economy.

  - *Post meeting response*: There is no appropriate accommodation of the scale required in the area and it could encourage commercial sex workers and other undesirable consequences.

- Why does the oil need to be transported to Mombasa? Can it not be processed in Turkana and so avoid risks to other counties? Why can't the oil be provided for use in Kenya, rather than exported?

  - *Response provided*: With regards to the refinery of the location, that decision is a geopolitical one for the Kenyan Government to make, not Tullow. Although, Turkana would not be an ideal location for the refinery as the product would still need to be transported to Mombasa (as refined oil, not crude). Whether the oil is used in Kenya or exported is partly determined by the qualities of the oil and its intended use. Turkana oil is waxy, with low sulphur. Depending upon what oil is being used for, this oil might not be correct for Kenyan market (e.g. boilers and generators). The export of oil is also driven by the international market.

  - *No Post meeting response required.*

- What is the link between EOPS and FFD? What is the storage capacity at Mombasa? What are the implications of EOPS oil and imported oil exceeding capacity? There could be adverse impacts on the port of Mombasa as a result of the EOPS with respecting to port management.

  - *Response provided*: The EOPS project is limited to two years, and FFD will not use Mombasa. A pipeline directly to Lamu will be developed for FFD. Oil from EOPS Phase 1 is going to Changamwe where there is currently one tank. Two additional tanks will be added to increase capacity to 300,000 barrels. This means there is plenty of storage at Changamwe and there is an appropriate parcel size for selling to international markets – there will only need to be 1 ship per quarter. To scale up EOPS at Mombasa would result in too large an increase in shipping traffic.

- Has the waste management issue following drilling been resolved? Which company will be doing the waste management?
  - *Post meeting response*: Regarding waste, we face a challenge with historic drilling waste. Tullow is working with NEMA and the local government to resolve the issue, but it is not relevant for EOPS Phase 2 as there is no drilling associated with EOPS Phase 2. EOPS Phase 2 waste will be managed through existing waste contracts. Current waste management handles waste of 250 people from Kapese camp and is considered appropriate for managing waste of additional 61 workers.

1.2 Community Engagement and Grievance

- Information dissemination – what is the plan to reach those who are primarily pastoralist and move around a lot but most likely to be impacted? How are the venues for the meetings chosen?
  - *Response provided*: The approach used in engagement is to use communication pathways already existing within the communities – oral communication, public meetings, local chiefs, leaders in the community to act as information transfer mechanism. A tiered stakeholder engagement plan is in place and is considered comprehensive enough to reach out to people based within and without the South – Lokichar Basin.
  - *Post meeting response*: Tullow and Golder are working together to keep improving engagement, including trying to identify more effective ways to disclose information to mobile pastoralists and understand their concern. Given the small scale of the EOPS, the existing methods have been sufficient. However, Golder is in the process of conducting more detailed stakeholder mapping on traditional leadership which will lead to a more substantial level of engagement on the FFD project.
- How is the information packaged to suit the pastoralists who are unable to read and write since the presentation that has just been made as well as the information currently on social media are presented in English.
  - *Post meeting response*: When needed or requested, key messages are translated into Turkana language. Tullow Field Social Performance and Golder work closely with native speaking Turkana staff to increase the ability to communicate with those who can't speak English or read.
- Who is disclosing the information (conducting EOPS ESIA Consultations) to the community? The community does not trust Tullow given past experiences. Considering this, is Tullow the right person to conduct the consultation meetings with the community?
  - *Response provided*: Golder, with support from Tullow will have consultations with the community. There is a 3-tier engagement process i.e. National Government, Turkana County Government/ Sub-County administration, Community (CSOs, FBOs, host communities). The EOPS Phase 2 ESIA process is being driven by Golder and EMC with support from Tullow.
  - *No Post meeting response required.*
- Is Tullow considering the use of theatre groups in Lokori to pass information to the community?
  - *Post meeting response*: Yes, this could potentially be an option, if the local community support this type of communication.
  - *No Post meeting response required.*
- Who is the intermediary between Government of Kenya, Tullow and the Community? How do we pass along our concerns? Tullow and the government make decisions in Nairobi and then they come to tell us here.

  - *Post meeting response*: The Field SP team are the mechanism of communication. Tullow has four Community Resource Centres (Lodwar, Lokichar, Nakukulas, and Lokori) where stakeholders are welcome to pass along their concerns. Tullow also has an active stakeholder engagement team that regularly visits communities within the project area.

- There has been a Tullow-led grievance mechanism and most recently, the government has gazetted a county led grievance mechanism. Why not have a community led grievance mechanism as well?
  - *Response provided*: Even with the Tullow grievance mechanism in place, there are some issues that cannot be addressed by Tullow and need Government's intervention e.g. security. Following discussions between Tullow and the government, a gap was identified, and this is what brought national and county government together to form the gazetted county grievance mechanism.
  - *No Post meeting response required.*

- Where should the community complain if their livestock is hit by trucks during EOPS? Is there a local Golder contact person? Do they have to go to Nairobi?
  - *Response provided*: In terms of raising issues about livestock incidences, there is going to be response centres along the route for grievances raised by the community. Additionally, the community can use the Tullow grievance mechanism as well as the gazetted grievance committee.
  - *No Post meeting response required*.

- Consultations can be misleading. Can a local contact, who speaks Turkana, be available and can their contact details be provided?
  - *Response provided*: Agree that consultation is not easy. We will be working with mid to high level government officials and using the Tullow social performance team (e.g. CLOs, Village Socialisation Officers) to liaise with the community. The SP team has a large number of Turkana-speaking people who can act as a route of communication about technical/non-technical issues, including translation from English to Swahili and Turkana.
  - *No Post meeting response required.*

1.3 Project Benefits

- EOPS grievances indicate lack of benefits from Tullow exploration e.g. water was still being transported by bowsers. There is a chance that post exploration, Tullow will leave. How will the communities benefit post Tullow?
  - *Response provided*: Tullow is committed to shared prosperity – what is in place for each of the parties – Tullow, the community and the government. Local policy content governs what the company does for the community over and above provision of jobs. Trucking of water was initially a stop-gap measure to help the migrating communities. The communities have now settled around those water points. There is now a move towards sustainable development by working with the county through the CIDP. The TKBV water department is also working on a permanent water solution for the community. WRUAs have been put in place to directly manage the supply of water as opposed to tracking.
  - *No Post meeting response required*.

- When something is given in Nakukulas, they say it is theirs alone. Others will say you are now trucking through our area and we will want something. How can opportunities be shared in communities?

- *Post meeting response*: Socio-economic investments are guided by Tullow Group policies to make sure that projects are strategic and make a real difference to local people. Project are developed closely with host communities and their leadership. As the activities transition from EOPS to Full Field Development, additional support will be considered to in Turkana and other areas of Kenya where the Project will be operating.

- How many jobs and what kind of jobs are available during EOPS?
  - *Response provided*: EOPS Phase 2 is expected to have about 61 job opportunities for a period of 2 years.
  - *Post meeting response*: Section 4.4 of the ESIA describes the workforce requirements for EOPS Phase 2.
- Is Tullow considering setting up more health centres in the area?
  - *Response provided*: There is need to remember that both the National and County government are responsible for provision of the amenities listed. Tullow is open to collaborations with other stakeholders.
  - *No Post meeting response required*.
- What benefits will the community get from EOPS Phase II?
  - *Post meeting response*: Commitments by TKBV as an outcome of this ESIA process are presented in Section 9 of this ESIA. Benefits will be managed by the Tullow Field Social Performance team. For specific details on social investment programmes and summary reports on community benefits, please contact the Community Resources Offices in Turkana:
    - Lodwar: +254 (0)701 482948;
    - Lokichar +254 (0)701 483763; and
    - Lokori: +254 (0)701 483740.

    The overall benefits will expand and develop in accordance with Tullow's Group policies as Tullow activities expand into FFD.
- How can communities' benefit from the gas being produced? Can it be used for cooking? This would reduce deforestation brought about by charcoal burning.
  - *Post meeting response*: The volumes of gas produced at Ngamia are minimal and there is no infrastructure to enable domestic use. The gas produced at Amosing will be used for power generation requirements for the project.
- Is the 5% stipulated for the community in the Petroleum Bill operational? Is there a specific percentage allocated to the people living with disability?
  - *Post meeting response*: The distribution of revenue from EOPS will be subject to the terms of the Petroleum Act, which is currently pending in the Senate following Presidential amendments to the revenue sharing formula in 2016. It is the responsibility of the central and county Governments to agree the allocations of revenue to be shared with stakeholders. Note that this is a relatively small pilot scheme that is not expected to generate profits, above project costs (e.g. equipment and infrastructure upgrades required). Material revenues will be generated once the Full Field Development project is commenced.

- What benefits will Turkana East get from the project?
  - *Response provided*: In terms of capacity building, Tullow recognises that there is a need to train drivers to meet expected standards to drive the EOPS Phase 2 trucks. Oil Movers Limited (OML) and Multiple Hauliers are currently recruiting drivers. There are 28 truck positions already advertised.
  - *Post meeting response:* As stated above, reports on past socio-economic investments, including those provided in Turkana East are available from the Tullow Community Resource Centres. The overall benefits will expand and develop in accordance with Tullow's Group policies as Tullow activities expand into FFD.
- Social investment- what happened to bursary and scholarship programmes that used to support host community students access education.
  - *Response provided*: Tullow supported more than 6000 secondary and college students, 31 master's students through the bursary and scholarships. However, Tullow discontinued the bursary programmes and shifted its focus to supporting skills development and business capacity building initiatives. Tullow currently supports TVET scholarships.
  - *No Post meeting response required*.
- What will happen to the benefit of Early Oil Pilot Scheme that is currently trucked?
  - *Post meeting response*: Tullow has a contract with the Kenyan Government and it will be up to them to decide how benefits will be distributed. EOPS Phase 2 is a relatively small pilot scheme that is not expected to generate profits, above project costs (e.g. equipment and infrastructure upgrades required). Material revenues/benefits will be generated once the Full Field Development project is completed.
  - *No Post meeting response required*.
- The Lokori community has been left out in as lot of local content opportunities e.g. jobs. This is increasing conflict between communities.
  - *Response provided*: Tullow seeks to maintain peaceful operations. They are working with the county government officials to help in the determination of opportunity sharing in Tullow's areas of operation.
  - *No Post meeting response required*.

1.4 Traffic

The following text describes issues / questions raised during EOPS Phase 2 ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018. It also indicates the responses provided at the meeting – "Response provided", and where relevant a "Post meeting response" provided by Golder to ensure the issue has been adequately responded to.

The following text describes issues / questions raised during EOPS Phase 2 ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018. It also indicates the responses provided at the meeting – "Response provided", and where relevant a "Post meeting response" provided by Golder to ensure the issue has been adequately responded to.

- There is no stopover for the trucks in Kainuk, which is one of the areas where there might be cases of commercial sex workers. Can Tullow get a yard where trucks can have a stopover/layover?

  - *Post meeting response:* There is no plan to overnight at Kainuk. Trucks will either stay at South Lokichar or at Kapenguria.

- Where should the community complain if their livestock is hit by trucks during EOPS? Is there a local Golder contact person? Do they have to go to Nairobi?

  - *Response provided*: In terms of raising issues about livestock incidences, there is going to be response centres along the route and they will look into some of the grievances raised by the community. Additionally, the community can use the Tullow grievance mechanism as well as the gazetted grievance committee.

  - *No Post meeting response required*.

- Are the C46 & A1 roads being worked on by the Chinese? The Lokichar-Amosing road is being done by sub-standard contractors. Can Tullow intervene to see if the Chinese can be awarded the tender?

  - *Response provided*: Roads are a responsibility of the National and County Government. EOPS will reveal any gaps that exist in terms of the road conditions and best routes as well as the effect of the trucks on the roads. However, the community recommendations have been noted and will be documented.

  - *No Post meeting response required.*

- While acknowledging that the issue of roads is a government mandate, Tullow needs to ensure that roads are well maintained and are of quality standards.

  - *Post meeting response:* For national highways such as the C46, this is not Tullow's responsibility. Infield access roads to Ngamia and Amosing will be suitably maintained.

- Say something about the increased traffic expected due to EOPS Phase 2 and what mitigation measures are there for this.

  - *Post meeting response:* The Traffic Impact Assessment is included in Volume IV of the ESIA, this has been used to inform the ESIA. The resultant effects due to any change in traffic due to EOPS are negligible for the Fugitive dust qualitative assessment (Section 5.3.6.4.3 and in Volume IV). Furthermore, speed limits will be enforced on all internal roads to help reduce potential dust generation (see section 4.3.10.4).

- Traffic management – How is Tullow going to manage the movement of 100 trucks expected to transport the crude oil during EOPS phase 2. Is the movement of passenger and supplies vehicles not going to be affected and is the congestion in the highway not likely to cause accidents?

  - *Response provided*: Tullow will ensure convoys are being escorted, implement safety measures including creating road safety awareness to truck drivers, journey movement plan, reduce trucks speed limits, introduce signs, introduce resting places along the roads and trucks will be moving during day time only.

  - *No Post meeting response required*.

- The increase in trucks will pose a danger to the people and livestock. Consider employing road marshals to manage the route.

  - *Post meeting response*: Tullow does not intend to engage road marshals as only 14 trucks per day will be leaving from Amosing early every morning with appropriate speed restrictions in place.

- How will road traffic incidents be managed (both minor and major)? How will oil spills be recovered? Who manages an incident when it happens? Regular trucking traffic will be different to current situation in Turkana and local people may not be used to it. How will stakeholders be managed in relation to traffic, incidents etc.?
  - *Response provided*: Tullow recognises road transport is a major project risk and Tullow will put measures in place, but accidents can be caused by third parties. In context of EOPS, there will be a few trucks a week for Phase 1/EWT to develop understanding of how things operate in practice, before Phase 2 trucking commences. This can inform managements measures, which already include: driver training; driver licensing; monitoring of vehicles; cages to prevent movement of tank; Tier 1 spills kits in every truck; Tier 2 spill kits at every rest stop along the route; and a coordination crew at each rest stop if a vehicle needs to be extracted. An Incident management plan is in place, but it is a live document and will be informed by EOPS as it progresses.
  - *No Post meeting response required*.

1.5 Soils, Geology and Seismicity

The following text describes issues / questions raised during EOPS Phase 2 ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018. It also indicates the responses provided at the meeting – "Response provided", and where relevant a "Post meeting response" provided by Golder to ensure the issue has been adequately responded to.

- Will Tullow operations cause vibrations and interfere with the soil?
  - *Post meeting response*: EOPS Phase 2 will cause vibrations both from oil production and from transport, however vibrations will be so minor that they would cause negligible impact on soil.
- In case of earthquakes/tremors, would the communities near the wells be affected/swallowed up?
  - *Response provided*: There are studies done regularly on the wells to assess the status. In case any problems are noted, action is taken immediately to ensure limited and no impacts.
  - *No Post meeting response required.*

1.6 Air Quality

The following text describes issues / questions raised during EOPS Phase 2 ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018. It also indicates the responses provided at the meeting – "Response provided", and where relevant a "Post meeting response" provided by Golder to ensure the issue has been adequately responded to.

- Does the gas flaring have any negative impacts to the community?
  - *Response provided*: Studies have been conducted that show that the amount of gas produced is not significantly high to impact on the safety of the community. It can be contained in the well pad area. Additionally, the flaring is done in line with Tullow's specific safety management protocols.
  - *No Post meeting response required.*
- What exactly does minimal/small effect of gas flaring on the community mean?
  - *Post meeting response:* The magnitude of the effect on air quality is defined as part of the impact assessment methodology in Section 5.3.7.1. A low effect is defined as a change in emissions which does not exceed the air quality standards, as defined in Section 5.3.5.

- Do Tullow operations have any impact on the ozone layer? Turkana has become hotter than it previously was. Can the climate change in Turkana be linked to the oil operations happening?
  - *Post meeting response:* Climate change is not considered in relation to any aspects of the EOPS Phase 2 ESIA as the Project has a two-year lifespan. It is therefore considered that no changes in climate could affect the outcome of the assessment during this short period.
- The community is "aware" that gas flaring emits smoke which affects the community. This gas flaring causes miscarriages, chest problems etc. There is a report available for this detailing the miscarriages caused by the gas flaring.
  - *Response provided*: In EOPS Phase 2, gas flaring will be very minimal. We are making sure that we are doing studies to the highest regards and community communication on what flaring means and what it is happening. It is something we have seen consistently among the different stakeholders and we will investigate it in more details. Tullow requested that the elders share the said report.
  - *No Post meeting response required.*
- According to the presentation, dust will not have impact on the community. However, given the fact that roads are poor and due to the number of trucks, dust must be a problem for EOPS Phase 2.
  - *Response provided*: Tullow and NEMA should look into mitigation measures for the above.
  - *Post meeting response:* In Section 5.3.6.4.3 and in Volume IV, Golder states that all resultant effects are negligible for the Fugitive dust qualitative assessment, except for dust from the access roads between the wellpads, which is predicted to be a low magnitude effect. Therefore, no additional mitigation is required, other than water spray and dust suppressant on unsealed access roads, as per the incorporated environmental measures (Section 5.3.2). Furthermore, speed limits will be enforced on all internal roads to help reduce potential dust generation (see section 4.3.10.4).
- Given that the C46 road is very close to communities, what will be done about the dust expected to be experienced, especially with the increase in the number of trucks?
  - *Post meeting response:* The C46 is a sealed road, following recent maintenance work by KenHA. The resultant effects due to any change in traffic associated with EOPS Phase 2 are negligible for the Fugitive dust qualitative assessment (Section 5.3.6.4.3 and in Volume IV). Furthermore, speed limits will be enforced on all internal roads to help reduce potential dust generation (see section 4.3.10.4).
- Instead of flaring the gas, can the gas be converted to electricity?
  - *Response provided*: Every crude has its own qualities and the crude at Ngamia has very little gas which cannot be used to generate electricity.
  - *No Post meeting response required.*
- The additional trucks will increase dust, and this will affect livestock.
  - *Post meeting response:* Cattle, and wildlife would preferentially avoid dust-covered vegetation because such vegetation of known to have lower photosynthetic capacity, and hence decreased productivity and nutrient value (Farmer AM (1993). Therefore, unless during times of severe forage shortage, the livestock would not forage close to the roads. In times of such shortage, herds would move to areas with better forage value.
- How is dust going to be minimised during the EOPS Phase 2 activities? Especially from vehicles travelling on the C46 which an impact will be.

- *Response provided*: Dust will be reduced by ensuring that water is sprayed along the roads during trucking of oil and the tarmacking of A1, C46 roads is on-going and this is a measure in place to reduce dust.
- *No Post meeting response required.*

- The issue of air which ESIA findings had revealed were within acceptable standards. They argued Turkana was windy thus emissions could travel far, and any interference of air could also be spread widely.
  - *Post meeting response*: The air emission modelling takes into account local meteorological data. Therefore, the modelling described in Volume IV takes account for such windy conditions and the resultant movement and dispersion of emissions.
- There are air quality and climate change impacts from the extraction process – what mitigation measures are you proposing?
  - *Response provided*: the alternative to flaring is to simply vent the gas, which has a higher greenhouse gas impact on global warming.
  - *Post meeting response*: This ESIA concludes that no additional mitigation is required, other than water spray and dust suppressant on unsealed access roads, as per the incorporated environmental measures (Section 5.3.2).

1.7 Noise and Vibration

The following text describes issues / questions raised during EOPS Phase 2 ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018. It also indicates the responses provided at the meeting – "Response provided", and where relevant a "Post meeting response" provided by Golder to ensure the issue has been adequately responded to.

- According to the presentation, noise and vibrations will not have impact on the community. In terms of vibrations, the trucks passing are bound to cause some form of vibrations. Will these affect the community?
  - *Response provided*: Tullow and NEMA should look into mitigation measures for the above.
  - *Post meeting response*: In Section 5.4.6.2, Golder states that the effect of project traffic on the roads will result in less than 1 dB change in the noise level. Truck movements will therefore have a negligible impact on traffic noise levels. Furthermore, speed limits will be enforced on all internal roads to help reduce noise and vibrations (see section 4.3.10.4).
- What mitigation measures have been put in place to address noise pollution?
  - *Post meeting response*: Section 5.4.2 describes the incorporated environmental measures in the design and Section 6.3 presents the measures which will go into a mitigation and monitoring plan.
- Clarity on the issue of noise which ESIA findings had revealed were within acceptable standards. They argued Turkana was windy thus sound could travel far, and any interference of air could also be spread widely.
  - *Post meeting response*: The predictive analysis was carried out in accordance with ISO 9613 (part 2), which is a standard used for outdoor sound propagation predictions. This standard makes provisions to include a correction to address for downwind or ground-based temperature inversion conditions. Noise predictions have been made assuming a downwind or moderate temperature inversion conditions.

1.8 Water Resources

No issues / questions were raised during EOPS Phase 2 ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018 related specifically to potential impacts of EOPS Phase 2 on water resources.

1.9 Water Quality

The following text describes issues / questions raised during EOPS Phase 2 ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018. It also indicates the responses provided at the meeting – "Response provided", and where relevant a "Post meeting response" provided by Golder to ensure the issue has been adequately responded to.

- Concerned with pollution to water from water, gas and oil released by the project. The water cut from the oil is not part of the project – when disposing of it will it pollute water? How will it be disposed of?
  - *Response provided*: Acknowledge that groundwater is an important resource in Turkana that needs to be protected. Water cut will be put into settlement tanks but will still contain low levels of hydrocarbons and so cannot be released to environment. Evaporation ponds will be used to evaporate water away. These are designed with a HDPE liner which means there is no mechanism for discharge to the environment.
  - *No Post meeting response required.*

1.10 Landscape and Visual

The following text describes issues / questions raised during EOPS Phase 2 ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018. It also indicates the responses provided at the meeting – "Response provided", and where relevant a "Post meeting response" provided by Golder to ensure the issue has been adequately responded to.

- Will the light from the project affect communities?
  - *Response provided*: In the Golder presentation, light was identified as something that may cause impact and there is a proposed light management plan. Additionally, while designing well pads, Tullow has ensured that the lights face the direction of the well pads and not towards the community to avoid disturbance. It is worth noting however, that due to security issues, more community members have moved closer to the well pads.
  - *No Post meeting response required.*

1.11 Biodiversity

The following text describes issues / questions raised during EOPS Phase 2 ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018. It also indicates the responses provided at the meeting – "Response provided", and where relevant a "Post meeting response" provided by Golder to ensure the issue has been adequately responded to.

- Biodiversity and Ecosystem services does not consider the issues with salt licks, resins and gum trees – important to be incorporated.
  - *Response provided*: A lot of the comments raised are relevant for the FFD conversation. Ecosystem services are very tricky as different communities use natural products for different uses. Concede that Salt licks and resin have not been mapped and the point is noted.

  - *Post meeting response:* No additional land take will be undertaken for the development. All infrastructure will be placed in already-disturbed areas, and no new project roads will be developed, apart from the improvements to the access road from C46 to Amosing. Therefore, there will be no anticipated loss or disturbance of salt licks, resin and/or gum trees. Furthermore, the social impact assessment identified that the potential influx of opportunity seekers would be very small. Hence, the potential for increased pressure on these resources is potentially negligible. See Section 5.9.3; resin/gum trees were captured under the medicinal plants and wood and fibre categories of services that could be affected by the project's activities. Section 5.10.5.5 discusses aspects of land use and the potential for influx. Section 6.7 presents the mitigation measures.

- Given the influx of people and consequent depletion of resources, will Tullow have any plans to plant more trees to replace those that have been cut?
  - *Response provided*: As part of the mitigation, Tullow has a monitoring system and has an inventory of the natural resources in the area and monitors the impact on those natural resources. Tullow is also ensuring they leave the environment as they found it or better. For EOPS Phase 2, no impact is anticipated however, Tullow will reinstate any impacted regions if any.
  - *No Post meeting response required.*

1.12 Ecosystem Services

No issues / questions were raised during EOPS Phase 2 ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018 related specifically to potential impacts of EOPS Phase 2 on Ecosystem Services.

1.13 Social

The following text describes issues / questions raised during EOPS Phase 2 ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018. It also indicates the responses provided at the meeting – "Response provided", and where relevant a "Post meeting response" provided by Golder to ensure the issue has been adequately responded to.

1.13.1 Employment

- The presentation indicates that local companies have been hired to provide trucking services for the project. In reality, no local companies have been hired. Explain this difference.
  - *Response provided*: OML and Multiple Hauliers were selected during the contracting process, these companied have been given conditions that they must subcontract vehicle supply to local contractors – about 28 trucks. Also, the drivers being used are from the local area (44) whose capacity will also be built through further training.
  - *No Post meeting response required.*

1.13.2 Land use and Ownership

- Constitution recognises Turkana land as community land. What is the plan of compensation to these persons?
  - *Response provided*: No resettlement is required in this project because the well pads being used are already in place. During FFD, there is a possibility that there is resettlement and a framework agreed with the government will be used to prepare RAPs.

  - *Post meeting response*: There is no additional land take for EOPS Phase 2 beyond that already consented to under existing agreements, therefore no compensation for impacts to livelihoods, land or resettlement is relevant to EOPS Phase 2.
- Gender impacts, land use and land use cover – need to be incorporated in the ESIA.
  - *Post meeting response*: Gender is a cross-cutting issues that is considered in all social impact. Where there are expected to be different or disproportionate impacts upon women, additional mitigation will be suggested. For EOPS, there are no stand-alone mitigation measures, but some commitments have considered impacts on women. For example, HIV information campaigns will target communities and specifically women that are at risk of the disease. There is no additional land take for EOPS beyond that already consented to under existing agreements, therefore no compensation for impacts to livelihoods, land or resettlement is relevant to EOPS.
- Tullow has indicated that they will be drilling more wells, does this mean that more land will be required?
  - *Response provided*: The consultations are focused on EOPS Phase 2 and the results shared are focused on that as well. There is no additional land required for EOPS Phase 2.
  - *No Post meeting response required.*
- Need to include livestock insurance in the final report as a mitigation measure.
  - *Post meeting response:* With no additional land take, there are no expected impact of the EOPS project on animals. However, this will be monitored through the grievance mechanism. The FFD will do further research on livelihoods related to livestock and will consider such mitigations through the course of the associated impact analysis.
- Will there be displacement of communities from their land? How will compensation be carried out? Is there a policy on compensation?
  - *Response provided*: EOPS Phase 2 will not require any additional land from the community. When Tullow gets to FFD, there could be a possibility of more land being acquired, however, a separate ESIA will be conducted for the same and the community will be involved. Discussion with the National and County governments are ongoing on development of a Land Access and Resettlement Framework.
  - *No Post meeting response required.*
- In terms of compensation, the chief has compiled a list of land owners who live near the wells. Needs advice on when the national government will come to review the list to ensure that every land owner is compensated.
  - *Post meeting response*: The consultations are focused on EOPS Phase 2 and the results shared are focused on that as well. There is no additional land required for EOPS Phase 2. However, Golder would be very interested in receiving this list to assist with identification of stakeholders.
- Given that the land in Turkana is mostly ancestral and community owned, how can Tullow ensure that they get Title deeds?
  - *Post meeting response*: The consultations are focused on EOPS Phase 2 and the results shared are focused on that as well. There is no additional land required for EOPS Phase 2.
- Is the company planning to compensate host community residing proximal to oil wells during implementation of early oil pilot scheme?

- *Response provided*: This is not the case, Early Oil Pilot Scheme will not require additional land as it will utilize the existing well pads and facilities. However, its anticipated additional land could be required during development to set up production infrastructure hence they will be a likelihood of conversations around compensation framework in future.
- *No Post meeting response required.*

- Will people be moved 50km away? In the past they have been disappointed with National and County government giving out land.
  - *Response provided*: There is no new land required for EOPS Phase 2. For FFD there is a process to study the land area and avoid moving anyone. If anyone moves, our goal is to make sure they have conditions as good or better than the place which is lost. In cases where land (Ere) are lost, there will be compensation and that procedure will be transparent.
  - *No Post meeting response required.*

1.13.3 Community Health and Safety

- Will the water evaporation impact communities living around the well pads? E.g. does it cause skin diseases?
  - *Response provided*: During evaporation, only the water is evaporated. Other impurities remain in the lining of the evaporation tank.
  - *No post meeting response required.*
- What long lasting solution is Tullow putting in place to address the issue of water shortage?
  - *Response provided:* Tullow acknowledges the short-term nature of some of the projects, especially as seen during the EOPS blockade which saw the community go without water for some time. Tullow is working with the county government, having already disbursed in-excess of KES 30 million to the county government to carry out a permanent water project. Additionally, some of the water points will be handed over to the community to ensure sustainability.
  - *No Post meeting response required.*
- Is Tullow considering setting up more health centres in the area?
  - *Response provided*: Tullow acknowledges that they have a role to play in the questions raised. However, there is need to remember that both the National and County government are responsible for provision of the amenities listed. Tullow is open to collaborations with other stakeholders.
  - *No Post meeting response required.*
- Tullow should consider conducting awareness campaigns and trainings to help curb Commercial Sex Work.
  - *Post meeting response*: This will likely be relevant for FFD but EOPS Phase 2 is not considered a project of sufficient scale to consider this at this time.
- Is the community safe, are their livelihoods and environment safe from impacts of the project?
  - *Response provided*: Tullow is an international company that adheres strictly to international (IFC) standards as well as its own policies. Our aim is to ensure the community is not impacted negatively by the operations.

  - *No Post meeting response required.*

- There have been claims that the gas flaring has caused miscarriages, early deaths and multiple births (twins and triplets) among communities near the well pads. How true is this? What is Tullow doing about it?

  - *Response provided*: Tullow is very aware and follows up on every complaint raised. So far, no one responded to Tullow's call to conduct tests to see whether illnesses are caused by Tullow's operations. The community were urged to document happenings and share them with Tullow for ease of follow up.

  - *No Post meeting response required.*

- We have heard that the oil "breathes" at night, does this affect the community around the well pads?

  - *Response provided:* Our operations have no negative impact on the community around the well pads. We have even observed people moving closer to the wells due to the improved amenities like water and security.

  - *No Post meeting response required.*

- What mitigation plans does Tullow have in place to guard against the spread of STDs brought about by the population influx?

  - *Response provided:* Tullow is working has set out policies (in the Kapese Camp) and is working on mitigation measures focusing on the same. A recent report shows that Turkana is among the leading counties in terms of spread of HIV/AIDS, Tullow is having discussions on what can be implemented, in collaboration with other stakeholders, in the county.

  - *No Post meeting response required.*

- Will communities living near the wells be affected by diseases esp. respiratory diseases? What is the health policy for Tullow in relation to ensuring the wellbeing of those near the wells?

  - *Post meeting response*: Tullow operations are in line with Kenya legislative requirements and NEMA licence. Baseline air quality data has not shown any evidence of elevated pollutant levels near existing facilities.

- What distance are people expected to stay away from oil wells.

  - *Response provided*: No standard distance people are required to stay away from oil wells. People are currently staying close to well sites. Tullow is continuing to assess and monitor the likely impacts associated with operations area of influence and would advise if the need arises to have people stay beyond distance from operations. close to well sites.

  - *No Post meeting response required*.

1.13.4 Social Maladies

- Child protection policy: studies show that children are exploited in areas where oil exploration is ongoing. What is Tullow doing about this?

  - *Response provided*: Important to remember that the oil industry is a very technologically sophisticated industry and unlikely that children would be used. This is opposed to mining of minerals like gold which are prone to artisanal mining. However, the Tullow Supply chain policy is very clear to contractors that these practices are not tolerated. As a company, there are labour laws – Kenya, International, UK – that prohibit employment of persons below the age of 18.

It is noted that there are instances where community members have passed on their duties to their minors for example, to work as road marshals, when the parents are away. These persons are usually strongly reprimanded and informed that the company policy does not allow this.

As part of reporting stipulated by the UK – Anti slavery Act, UN principals of labour and human rights, the company is mandated to track its corporate and employee behaviour illustrating compliance.

- *No Post meeting response required.*

- What about HIV? Could you use Mobile VCT in your HIV policy? We have seen an increase recently in HIV statistics in the county which has increased to 13%.
  - *Response provided*: We are thinking about including this in the HIV policy. Truck drivers can often be associated with STI transmission, so we are thinking about this.
  - *No Post meeting response required.*
- In relation to the spread of HIV/AIDS, can infected people be identified and isolated especially the truck drivers?
  - *Response provided:* Tullow recognises that everyone has an equal right to employment. They do not discriminate against anyone.
  - *No Post meeting response required.*
- HIV data is the highest in the Country, however the impact is being considered as low in the presentation and low is a bit of a concern.
  - *Response provided:* Health baseline to start in the next few months in collaboration with the Turkana County Health Department. Mitigation required to be built synergistically to fit into the efforts of the County as the stipulations of the CIDP.
  - *Post meeting response:* As part of the mitigation commitments, Tullow already has and will follow its HIV Policy. Tullow runs a closed camp and maintains a Code of Conduct for all employees and contractors. In addition, there will be an information campaign for workers and communities. The residual impact (i.e., impact after mitigation) is considered low as it takes into consideration Tullow fulfilling all of its mitigation commitments.
- In terms of social impacts like HIV/AIDs what is the target population for the awareness?
  - *Response provided*: Tullow has internal policies which guide how to distribute awareness campaigns. We are now considering how to carry out awareness externally to the community. There is also a need to include this in the truck driver's education programme particularly given that they will be passing through areas where HIV prevalence is relatively high, for example Salgaa.
  - *No Post meeting response required.*
- Will Tullow link the community with different government agencies to address issues like influx of people, robbery, HIV/AIDS? The council of elders has their own rules on how they deal with issues e.g. theft; they would like to hear how the government intends to address that and how the two can work together.
  - *Post meeting response:* Influx is an identified impact. The first step to manage it will be an information campaign on employment, reducing the risk that people will move to the local area. The second step is to monitor population data. If there are signs of in-flux, Tullow will work with the government to identify solutions to solve the given problem.

- The crime rate has risen in Lokichar because now people are more conscious about money and are moving away from the pastoralist kind of life. E.g. when operations stop, people who were employed and lose their jobs end up being a problem to the communities. What is Tullow doing to address this?
  - *Response provided*: Tullow acknowledges that they have a role to play in the questions raised. However, there is need to remember that both the National and County government are responsible for provision of the amenities listed. Tullow is open to collaborations with other stakeholders.
  - *No Post meeting response required.*
- How will Tullow address the issue of children born from “illicit” relationships with foreigners working on the oil project?
  - *Post meeting response*: Tullow staff and contractors have a set of contractual conditions to adhere to which means they should not engage in ‘illicit’ relationships. Kapese camp is closed to non-workers or authorised visitors as a measure of controlling ‘illicit’ relationships.
- What plans has Tullow put in place to address insecurity especially terrorism to ensure communities in Turkana are not affected?
  - *Response provided*: The terrorism risk rating in Turkana at the moment is low. However, Tullow, Turkana County Government and the National Government constantly monitor the situation. For EOPS Phase 2, the terrorism threats are relatively low.
  - *No Post meeting response required.*
- In other countries, sick people are discriminated against and set aside but not in Kenya. What is Tullow’s plan to address or help with this issue?
  - *Post meeting response*: Within the Tullow Code of Ethical Conduct is the corporate commitment to equal opportunities. The Code states that TKBV aims “to create an inclusive environment, free from discrimination, where individual differences and the contributions of all our staff are recognised and valued and everybody is treated fairly”. The document emphasises that the company has “zero tolerance” for any form of discrimination and decisions related to recruitment selection, development or promotion are based upon aptitude and ability only.

1.13.5 Security

- Impact to community and the environment: Anywhere oil is being extracted, there is potential to have social strife. How is Tullow prepared to deal with this even after ESIA approval?
  - *Post meeting response*: Tullow has a Security Policy designed to minimise social strife associated with its operations. It also continuously engages with stakeholder groups to raise awareness and manage safe operations. Tullow is also a signatory of the Voluntary Principles on Security and Human Rights (VPSHR) initiative
- Insecurity: since extraction began boundaries have been lost within Turkana County. There is perceived undue conflict.
  - *Response provided*: The TKBV security team works with existing security apparatus and County authorities. What Tullow can do as a private entity is limited, it however works synergistically with the County and national governments.
  - *Post meeting response*: Tullow are committed to continue managing security as they have been over the past several years.

- Insecurity is a pertinent issue in Turkana County given the historical clashes between the Turkana and her neighbours the Pokot. It is possible that if these matters escalate, TKBV staff may also be affected. There's therefore need for joint efforts to find an appropriate solution.
    - *Response provided*: It is also widely known (not only in Kenya but throughout the world) that extractive and mining industries can provoke conflict. The MOU with the national government encourages communication and human rights training in government human rights courses – about 1,100 police personnel have been taken through this. It is however recognised that TKBV needs assistance in this area.
    - *Post meeting response*: Tullow continue to work with the National and county governments to support their efforts in this regard.
- Why not have the EOPS trucking route pass through Lokori? The route would be shorter, and it would also reduce insecurity in the region.
    - *Response provided*: Good comment. Route determined by National Government and Tullow working with GoK through KeNHA.
    - *No Post meeting response required*.
- Pokot have been attacking Lokori and Nakukulas, the areas where Tullow operates, what measures will be put in place to prevent impact on the trucking?
    - *Post meeting response*: Convoys are escorted by security as far as Kainuk. Tullow is continually monitoring the security situation.
- Turkana County Government should have structures to train young people on matters related to security. Could also consider equipping "Ngoroko's" to be peace agents in the region. Tullow can donate some amount e.g. in excess of 30 million to oversee their capacity building. This can later be extended to other regions.
    - *Post meeting response*: Tullow is a partner to the County Government, but this is a TCG/GoK responsibility.
- Other than the dialogues, what other measures is Tullow putting in place to ensure peace is maintained?
    - *Response provided*: Tullow has been engaging different stakeholders on this. Community policing is an option that can be pursued. Referred to the solutions provided by the sub-county administrators in the earlier meeting.
    - *No Post meeting response required.*
- Intra-ethnic conflict is something beyond Tullow so how would you mitigate this security issue when it should also be government that would have to regulate this.
    - *Post meeting response*: Tullow is a partner to the County Government, but this is a TCG/GoK responsibility.

1.14 Cultural Heritage

The following text describes issues / questions raised during EOPS ESIA Phase 2 consultation meetings in July (Nairobi) and September/October (Turkana) 2018. It also indicates the responses provided at the meeting – "Response provided", and where relevant a "Post meeting response" provided by Golder to ensure the issue has been adequately responded to.

- Prayer sites as well as the more than 12 archaeological sites within the County should be respected. The elders and traditional leaders like rainmakers should have been consulted as they know where all these are located.
  - *Post meeting response*: Field work was completed by Golder and NMK (as subcontractors to EMC) to survey archaeological sites and living cultural heritage that could be affected by EOPS Phase 2. The entire footprint of the wellpads associated with EOPS Phase 2 and the surrounding potentially affected area was surveyed. Traditional community leaders, including elders and seers, from 14 settlements in proximity of the EOPS Phase 2 wellpads and transport route were consulted as part of this baseline work.
- There is need for more education like this going forward. Has the county and Tullow considered setting aside an area for a graveyard given the expected influx of people?
  - *Response provided*: Tullow was referring to safeguarding the existing graves. However, suggestion on setting aside a graveyard has been taken and the council working with the county can identify this need. Tullow respects the culture of the community.
  - *No Post meeting response required.*
- What is Tullow doing to restore culture which has been lost due to the project activities? E.g. Turkana was heavily pastoralists and more and more people are now abandoning that practice for business opportunities in the settlements.
  - *Post meeting response:* Tullow seeks to create an environment where pastoralism can be maintained next to the Project. It seeks to understand the needs of pastoralists and work to mitigate impacts in the ESIA process and to enhance benefits through its social investment. Inevitably the development of infrastructure will cause some to choose salaried employment or to seek business opportunities. However, Tullow will work to support those who wish to continue with their pastoralist livelihood.

1.15 Environmental Risks and Accidents

The following text describes issues / questions raised during EOPS Phase 2 ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018. It also indicates the responses provided at the meeting – "Response provided", and where relevant a "Post meeting response" provided by Golder to ensure the issue has been adequately responded to.

- What are the safety measures put in place when the oil is being transported – in case of oil spill on the way.
  - *Response provided*: All the vehicles have been equipped with vehicle monitoring systems to ensure that the location of vehicles is known always. Oil spill contingency plans are in place at two levels:
    - Tier 1 emergency spill kit -all vehicle equipped, and the drivers trained on how to use equipment; and
    - Tier 2 emergency kit as project progresses will be put in place along the project route/road at strategic locations from Lokichar to Mombasa as a secondary response measure.
  - *No Post meeting response required.*
- Although Tullow subscribes to all International Laws, civic education to communities not well taken care of. There is a chance of community ignorance being taken advantage of. Is there awareness to communities that these trucks will be passing through? Is there emergency preparedness?

- *Response provided*: Outreach planned to schools along the route before EOPS Phase 2 starts. Civic education could also be looked at as public participation. A community grievance management mechanism is also in place. In addition
- *No Post meeting response required.*

- Why are there no road signs clearly indicating speed bumps on the road? This is a hazard. Why is the oil being trucked while the C46 road and the Kainuk bridge have not been completed? Won't this cause danger to the community in case of any accidents?
  - *Post meeting response*: Road maintenance and furniture is the responsibility of KenHA and not Tullow. Tullow has vehicle speed restrictions in place of 40kmh for infield vehicles which is strictly enforced.
  - *No Post meeting response required*.
- In terms of human rights and protection, is Tullow going to protect the community or contractors especially in incidents where we have accidents along the road?
  - *Response provided*: Tullow adheres to international standards and expects its contractors to adhere to the same. Tullow seeks to avoid causing harm and avoid accidents at all costs. Every accident is treated on a case-to-case basis. The following plans help manage incidents: EOPS Phase 1 Oil Spill Response Contingency Plan (T-KE-HSS-PLN-0114) and EOPS Phase 1 Emergency Response Plan (T-KE-HSS-PLN-0113).
  - *No Post meeting response required*.
- Given that the roads to Kitale are very poor, what preparation is being made to minimise impacts when a truck gets into an accident along this road? How do we expect to handle spills that may occur?
  - *Post meeting response*: The A1 is now passable (as illustrated by EOPS Phase I trucking movements). Tullow has Emergency Response Plan (T-KE-HSS-PLN-0113) in place for trucking.
  - *No Post meeting response required*.
- Regarding contingency plans and oil spills, what capacity do Tullow have to deliver a plan at the local level? There is a Maritime plan, how does this apply to incidents on land?
  - *Response provided*. There is Tier 2 spill equipment in the upstream area, Tier 1 on each tanktainer (the drivers are also trained in how to deal with spills). Each of the three rest stops will also have Tier 2 spill equipment to react to Tier 2 spills along route.
  - *No Post meeting response required*.

Signature Page

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3.0 EOPS PHASE II ESIA BASELINE

September 2017

TULLOW KENYA B.V

Environmental and Social Impact Assessment Baseline: Early Oil Pilot Scheme Volume II (Main document without Appendices)

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REPORT

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1.0 ESIA BASELINE INTRODUCTION

Environmental and social baseline data gathering provides a characterisation of the existing situation for the biophysical and social environment. This characterisation provides a baseline from which the ESIA can be used to predict potential environmental and social changes as a result of the Early Oil Pilot Scheme (EOPS). The baseline also provides a benchmark against which any future changes can be monitored and managed.

Environmental and social baseline data gathering was completed as part of the Environmental and Social Impact Assessment (ESIA) for EOPS.

Baseline studies were conducted by teams from Golder Associates (Golder) and Kenyan partners EMC consultants (EMC). Baseline data gathering for the EOPS ESIA draws heavily upon baseline data gathering completed for the South Lokichar Basin Phase 1 Development Project Full Field Development (FFD), which is presented in the South Lokichar Basin Upstream Component ESIA Baseline (Stage 2) Work Plan (1451410360.513_A.5, dated March 2016). Baseline data gathering commenced in October 2015 and concluded for the purposes of EOPS in October 2016.

The Environmental and Social baseline is characterised by the following technical areas:

- Traffic;
- Geology and Seismicity;
- Soils;
- Meteorology;
- Air Quality;
- Noise and Vibration;
- Water Quality;
- Water Quantity;
- Biodiversity;
- Ecosystem Services;
- Landscape and Visual
- Social; and
- Cultural Heritage.

Baseline study areas for each of the technical discipline areas are presented in Volume I (in Drawing 1.5-1). These study areas are defined by the technical discipline teams, based on the area in which gathering data gathering was required to inform the effects analysis completed by each technical area.

2.0 TRAFFIC

2.1 Baseline data gathering

Further details are presented in Traffic Impact Analysis document which is presented in Volume IV.

2.1.1 Secondary data

Existing background traffic data was obtained from the Kenya National Highways Authority (KeNHA) at the locations presented in Figure 2.1. Along with primary data presented in Section 2.1.2, this data was used to evaluate existing and future LOS for the designated route within the study area.

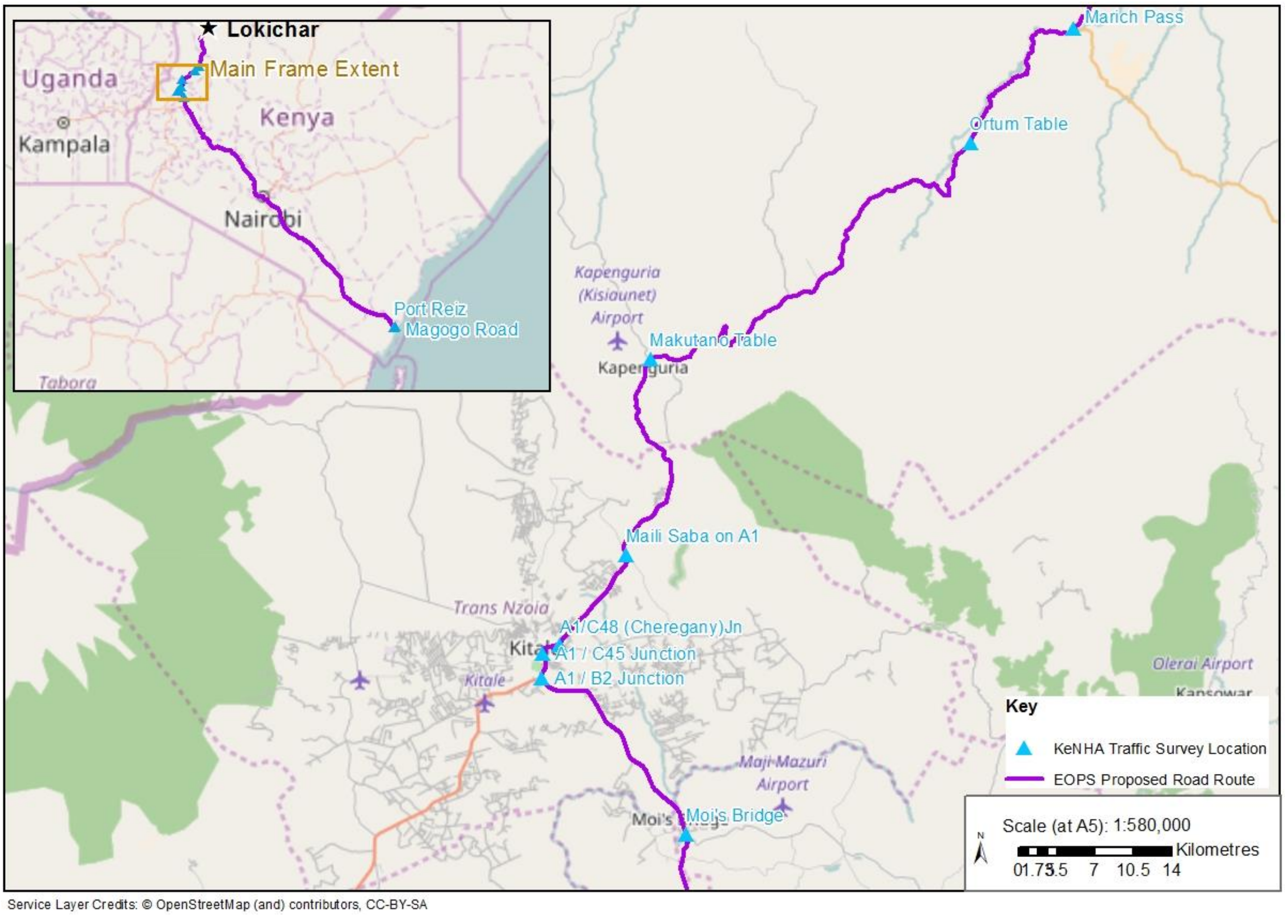

Figure 2.1: Known KeNHA traffic data locations (inset shows location of main image within Kenya), (Source: KeNHA)

2.1.2 Primary data

Data collected by the Kenya Institute of Safety and Health (KIOSH) along the road route (Appendix A) and data was gathered in Lokichar by EMC on behalf of Golder (Appendix A).

The Lokichar data was evaluated for each direction of traffic for daytime hours only (due to the commitment of TKBV to limit use of public right-of-way to daylight hours). Traffic count data was taken and evaluated by vehicle type and hourly increments. A preliminary traffic count was undertaken in the vicinity of Lokichar during August 2016. A 12 hour daytime count was undertaken at two locations, along C46 between Lokichar and Amosing-1 and on A1 approximately 0.5 km south of the A1/C46 junction. Motorised trips during the 12 hour count duration are summarised below:

- C46 toward Amosing 1 - 1,338 vehicles;

- C46 toward Lokichar/A1 - 919 vehicles;
- A1 toward Lodwar - 341 vehicles; and
- A1 toward Kapenguria - 767 vehicles.

Background traffic on C46 is comprised of local traffic. Background traffic on A1 is largely comprised of traffic transiting between Lodwar and Kapenguria.

KIOSH completed preliminary traffic surveys during Q4 2016 at nine locations along the EOPS designated route (clustered at four strategic positions) in order to inform the approach to the TIA and ultimately the ESIA (Appendix A). The total volume of traffic, including articulated vehicles, identified in the KIOSH survey is presented in Table 2.-1. Figure 2.2 identifies the traffic survey locations.

Table 2-1: Total Daily Traffic Count—Project Section from Marich Pass to Mau Summit

Location	Direction	
	Nairobi-Eldoret	**Eldoret-Nairobi**
Mau Summit, South of A104/B1 Junction	3,503	3,010
Mau Summit, North of A104/B1 Junction	1,979	1,838
	Eldoret-Kitale/Malaba	**Kitale/Malaba-Eldoret**
Eldoret, East of A104/B2 Junction	3,981	3,858
	Eldoret-Kitale	**Kitale-Eldoret**
Eldoret, North of A104/B2 Junction	1,887	2,053
Kitale, South of A1/B2 Junction	4,927	4,382
Kitale, Along A1, East of A1/Suam Rd Junction	11,263	9,099
Kitale, Along A1, West of A1/C48 Kapenguria-Chereganyi Junction	9,250	10,128
	Kapenguria-Lodwar	**Lodwar-Kapenguria**
Marich Pass, Along A1, South of A1/B4 Junction	169	196
Marich Pass, Along A1, North of A1/B4 Junction	165	154

Note: Daytime counts taken 6 am through 6 pm Monday, Tuesday, Wednesday, or Friday.
Source: KIOSH, 2016.

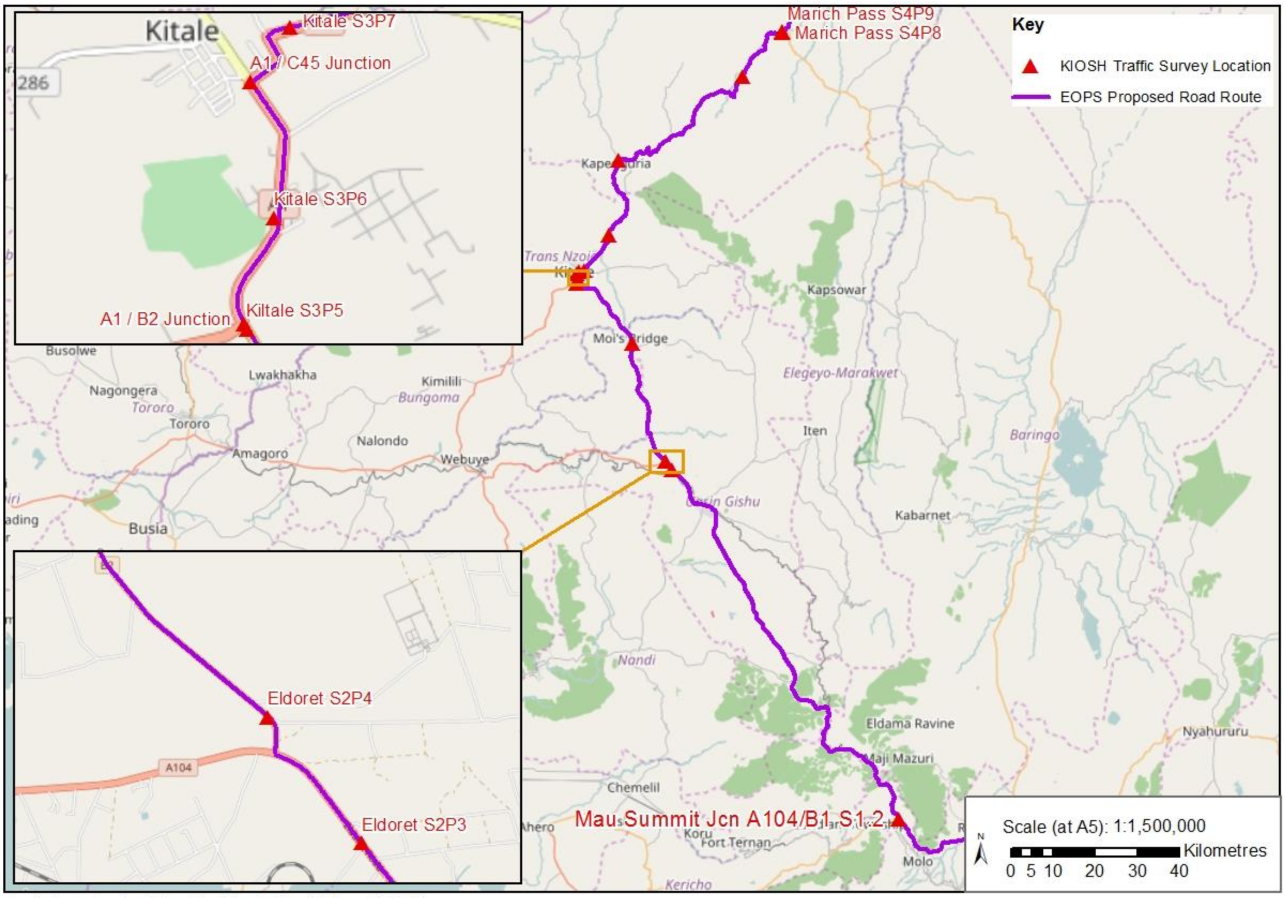

Figure 2-2: Location of KIOSH traffic survey locations

2.2 Discussion

Discussion of the primary and secondary data and the estimation of incremental increase throughout the project are presented in the TIA.

3.0 GEOLOGY AND SEISMICITY

3.1 Baseline Data Gathering

3.1.1 Secondary Data

Existing reports have been used as secondary sources of information to prepare a summary of the geological setting of the region. These sources include the following:

- Geology of the Loperot Area. Ministry of Natural Resources Geological Survey of Kenya Report No. 74, 1966.
- Conceptual Hydrology of the Lake Turkana Basin. Mike Price, June 2016.
- South Lockichar Geological Summary. Tullow Oil, January 2016.

3.1.1.1 Regional Geological History

The basement rocks in the area are of Precambrian age and comprise gneisses, schists and granulites. These metamorphic rocks were subject to periods of intense deformation around the beginning of the Cambrian Period. From the early Cambrian until the Jurassic or Cretaceous periods the area formed part of the Pangaea 'supercontinent', which then broke apart during the Middle Jurassic and led to the development of a series of rifts running roughly east-west across Africa with the Anza Graben running northwest-southeast across what is now northern Kenya. During that time, the areas was above sea level and the land was subject to erosion and continental deposition. During the Eocene epoch (part of the Tertiary period), further rifting occurred in a roughly north-south direction and cut across the earlier rifting.

Later in the Tertiary period (late Oligocene to early Miocene epochs) a series of half grabens began to develop west and south-west of the current position of Lake Turkana. The rifting was preceded and accompanied by volcanism. Towards the middle Miocene a new series of inner half-grabens began to develop, which include the North Lokichar, Turkana and Kerio Basins.

The basins that resulted from the development of the grabens now contain Tertiary and Quaternary material that comprises volcanic rocks (predominantly alkaline lavas and tuffs) and a series of predominantly fluvial and lacustrine sediments that are up to 7 km thick. Unconsolidated alluvial material is also present in the valleys.

3.1.1.2 Geology of the Study Area

An extract from the local geological map (Ministry of Natural Resources Geological Survey of Kenya, 1966) is presented in Appendix B. The regional and local study areas are located within a basin, which has been formed by rifting of basement rocks and is now partially infilled with superficial (drift) deposits. The South Lokichar basin is a NNW – SSE trending asymmetric half graben within the Turkana Rift, which is at its maximum approximately 70 km long and 30 km wide.

To the west of the valley the Precambrian basement rocks are exposed at the surface and comprise intensely folder gneisses and migmatites (a rock that has a banded appearance and comprises a mixture of granitic material and high-grade metamorphic material). To the east of the rift the Precambrian basement rocks are overlain unconformably by the Tertiary Turkana Grits, Tertiary sedimentary deposits and a Tertiary volcanic succession. The Turkana Grits are mapped as comprising grits, sandstones, silts and sandy limestones and are derived from the erosion of the Precambrian basement rocks. The Tertiary sedimentary deposits were deposited by rivers or in ephemeral lakes and comprise sandstones (including the Lower and Upper Auwerwer Sandstones) separated by shales. The volcanic sequence includes basalts of various composition and phonolites, which are fine grained extrusive rocks.

The superficial geology that underlies the positions of the Ngamia and Amosing well fields, and dominates the area between the Kalabata River to the east and the ridge of Archaean basement to the west, is mapped as Alluvium. The alluvial material comprises Plio-Holocene unconsolidated alluvial fan material that have in places been redistributed by ephemeral stream, and fluvial sediments. There are localised outcrops within the Alluvium of Archaean basement rock and Tertiary volcanics.

3.1.2 Seismicity

Turkana, and Kenya as a whole, is vulnerable to seismic activity associated with the presence of the active East African Rift System, which runs north to south through Kenya. The East African Rift is prone to earthquakes and associated volcanicity. However, the frequency of earthquakes within the Turkana basin is relatively low. A map showing earthquakes in Kenya recorded in the past 100 years (Untied States Geological Service) is shown in Appendix B. A map showing the intensity of earthquakes (United Nations Office for the coordination of Humanitarian affairs, 2007) is also presented in Appendix B. The map indicates the intensity of earthquakes in the region of the study area is degree VI (strong) or degree VII (very strong) on a scales of I (instrumental) to XII (catastrophic).

The overall earthquake hazard level is considered low in Kenya compared to neighbouring countries and the highest hazard levels within Kenya are in the northwest and southwest of Kenya (GSDRC, 2013). In the study area the natural earthquake hazard is rated by the WHO (2010) as low to medium with peak ground acceleration is the region of 0.2 m/s^2 -2.4 m/s^2 (see Appendix B). It is noted that relatively infrequent, but significant, events do occur and an event of magnitude 7 has been recorded with an epicentre 300 km south of the development.

4.0 SOILS

This section presents a summary of the available baseline information on soil characteristics within the upstream study area. This baseline information will be used to inform the assessment of impacts of the development of the EOPS Project at the Amosing and Ngamia well fields in the Turkana region.

4.1 Baseline Data Gathering

4.1.1 Secondary Data

The Ngamia & Amosing Extended Well Test (EWT) ESIA Scoping Reports (Xodus, 2014 & 2015) describe the regional landscape as predominantly flat and low lying but with isolated steep-sided hills and ridges associated with rift valley geomorphology. The soils are typical of desert-like environments, which are generally nutrient-poor, high pH, low in organic matter and clay content, and prone to rapid erosion by wind and water (RSK, 2014), as a result of the arid climate and general lack of vegetation.

The Ngamia and Amosing well fields are in an area bound by mountains on one side and plains on the other. The soils are moderately well drained, moderately saline and strongly sodic (disproportionately high concentration of sodium). The surface consists of sealed and crusted sandy clay loam to sandy clay textured soils with low soil organic matter content, overlain by surface pebbles.

Information on the local landforms and soils in the Turkana region has also been studied by the German Agency for Technical Cooperation (GTZ) in collaboration with Kenya Ministry of Livestock Development in 2002. The upstream study area is shown to be situated in area predominantly comprised of very deep, well drained soils of a yellow-brown colour. These were described to be locally saline and containing few rocks or stones and susceptible to moderate sheet erosion from flood events and locally moderate wind erosion.

Soil data was gathered by Worley Parsons in 2014 as part of an infrastructure siting exercise, which shows that soil local to the upstream study area is derived from tertiary volcanic and sedimentary materials, recent alluvial deposits and windblown sands. Soils are generally clay loam to loamy sand textured and include neutral, calcareous, saline and sodic soil reaction.

The Worley Parsons investigation included drilling and test pitting in the upstream study area (Drawing 4-1). Soil samples were taken and sent to a laboratory in Nairobi for testing. Particle size analysis and chemical analysis was conducted on samples taken mostly within the upper 0 - 3 m below (some only in upper 0 to 1.5 m), which are indicative of the soil horizons. Table 4.1 below presents the results from a sub set of the full analysis completed, for sample locations specifically relevant to the EOPS upstream study area.

Table 4-1: Secondary Soil Data Analysis

Location	UTM N	UTM E	Pit Id	Depth (m)	Description	Particle Size Distribution (%)				Chemical Analysis	
						Clay	Silt	Sand	Gravel		
Amosing Infield Access Road	810800	237990	AMO_3	0 – 1.5	Light brown silty gravelly fine to medium grained SAND. Alluvium	11	11	67	22	No sample	
Amosing West Well Pads	809606	238199	AWE5	0 – 3	Brown gravelly silty fine grain SAND. Alluvium	16	16	17	11	No sample	
	809606	236999	AWE7	0 - 3	Reddish brown gravelly medium to coarse grained SAND. Alluvium	12.6	5.2	80.5	1.7	Total Carbon (%): Organic Carbon (%): Inorganic Carbon (%): Total Alkalinity (mg/kg): Carbonate (mg/kg): Chloride (mg/kg): Sulphate (mg/kg): pH:	0.27 0.07 0.20 440 <50 <50 <50 7.9
	810806	235799	AWE10	0 - 3	Brown gravelly silty fine to medium grained SAND. Alluvium	21	21	77	2	No sample	
Amosing Upper & Lower Well Pads	810806	241199	AUL2	0 – 3	Brown slightly gravelly silty fine grained SAND. Alluvium.	17.4	11.3	69.4	1.9	Total Carbon (%): Organic Carbon (%): Inorganic Carbon (%): Total Alkalinity (mg/kg): Carbonate (mg/kg): Chloride (mg/kg): Sulphate (mg/kg): pH:	0.35 0.10 0.24 800 <50 60 100 8.3
	810206	239999	AUL4	0 – 3	Reddish brown gravelly silty fine to medium grained SAND. Alluvium.	14.9	4.3	54.5	26.3	No sample	
	812606	239399	AUL7	0 – 3	Brown slightly gravelly silty fine grained SAND. Alluvium.	8.4	7.7	80.9	2.9	No sample	
	811406	238799	AUL8	0 – 3	Brown gravelly silty fine to medium grained SAND. Alluvium.	15	15	77	8	Total Carbon (%): Organic Carbon (%): Inorganic Carbon (%):	0.18 0.12 0.06

Location	UTM N	UTM E	Pit Id	Depth (m)	Description	Particle Size Distribution (%)				Chemical Analysis	
						Clay	Silt	Sand	Gravel		
										Total Alkalinity (mg/kg): Carbonate (mg/kg): Chloride (mg/kg): Sulphate (mg/kg): pH:	360 <50 <50 <50 7.9
	813206	237599	AUL13	0 – 3	Brown silty gravelly medium grained SAND. Alluvium.	18	18	80	2	No sample	
	812006	236999	AUL15	0 – 3	Brown silty gravelly fine to medium grained SAND. Alluvium.	13	13	83	4	Total Carbon (%): Organic Carbon (%): Inorganic Carbon (%): Total Alkalinity (mg/kg): Carbonate (mg/kg): Chloride (mg/kg): Sulphate (mg/kg): pH:	0.15 0.09 0.06 400 <50 120 70 7.8
	813806	236399	AUL20	0 – 3	Brown slightly gravelly silty fine to medium grained SAND. Alluvium.	18	18	79	3	Total Carbon (%): Organic Carbon (%): Inorganic Carbon (%): Total Alkalinity (mg/kg): Carbonate (mg/kg): Chloride (mg/kg): Sulphate (mg/kg): pH:	0.16 0.07 0.10 1320 <50 130 570 8.5
	813806	234599	AUL22	0 – 3	Brown gravelly silty fine grained SAND. Alluvium.	24	24	73	3	Total Carbon (%): Organic Carbon (%): Inorganic Carbon (%): Total Alkalinity (mg/kg): Carbonate (mg/kg): Chloride (mg/kg): Sulphate (mg/kg): pH:	0.15 0.10 0.06 440 <50 <50 50 8.0

Location	UTM N	UTM E	Pit Id	Depth (m)	Description	Particle Size Distribution (%)				Chemical Analysis	
						Clay	Silt	Sand	Gravel		
	815006	233999	AUL24	0 - 3	Brown slightly silty gravelly medium to coarse grained SAND. Alluvium.	10	10	85	5	No sample	
Ngamia Infield Access Roads	802279	244464	NGA_2	0 – 1.5	Light brown silty gravelly SAND. Alluvium.	17	17	78	5	No sample	
	803667	245900	NGA_6	0 – 1.5	Brown silty gravelly fine to medium grained SAND. Alluvium.	14	14	82	4	No sample	
Ngamia Well Pads	801897	244059	NGA_1	0 - 3	Light brown silty gravelly fine to medium grained SAND. Alluvium.	15.1	6.6	72.0	6.2	Total Carbon (%): Organic Carbon (%): Inorganic Carbon (%): Total Alkalinity (mg/kg): Carbonate (mg/kg): Chloride (mg/kg): Sulphate (mg/kg): pH:	0.24 0.11 0.14 560 <50 340 260 8.0
	805586	247501	NGA_11	0.7 - 3	Purplish dark brown mottled light brown slightly cemented gravelly silty fine to medium grained SAND. Alluvium.	22.3	9.8	67.3	0.6	No sample	
	806987	245519	NGA_15	0 - 3	Light brown silty gravelly fine to medium grained SAND. Alluvium.	7	7	90	3	No sample	
	806157	243981	NGA_16	0 - 3	Light brown silty gravelly fine to medium grained SAND. Alluvium.	18	18	82	0	No sample	

Source: Worley Parsons (2014)

The results presented in Table 4-1 can be summarised as follows:

- The partivle size distribution (PSD) results were conducted for every Amosing and Ngamia test pit. Results show that the superficial samples are largely light brown sands. Sand is the dominant particle size at all test pits across both Amosing and Ngamia well pads and access roads. This coincides with the dominantly sandy characteristics of soil which are typical of this region.
- Alkalinity values across six sites fell within the same order of magnitude with results ranging from 360 mg/kg to 800 mg/kg, with the exception of the test pit at Amosing well pad pit AUL20 which recorded an alkalinity result of 1320 mg/kg.
- Results found levels of carbonate to be less than the limit of detection (50 mg/kg) across all test pits.
- Of the seven samples analysed, four samples had results over the detection limit for chloride (50mg/kg), theses samples ranged from 60 mg/kg to 340 mg/kg.
- Of the seven samples analysed, five samples had results over the detection limit for sulphate (50mg/kg), theses samples ranged from 50 mg/kg to 570 mg/kg.

The pH results for all seven samples ranged from 7.8 to 8.3 indicating a tendency towards alkalinity for soils across all Amosing and Ngamia test pits.

4.2 Primary Data

No primary soil data gathering has been completed by Golder Associates or local partners for the EOPS ESIA. However as part of the baseline water studies infiltration tests were completed.

4.2.1 Infiltration Tests

Infiltration tests[1] were carried out by EMC on behalf of Golder between 29 and 31 May 2016 (full description in Section 9.1.2.1.1). Tests 1 and 5 were undertaken to the north east of the Ngamia well field. Results of the infiltration tests show that the hydraulic conductivity of the area is between 8 – 9 x 10^{-5} m/s, which is indicative of coarse sand material. Test 3 was located to the north east of the Amosing well field, to the south of Tests 1 and 5. Results from test 3 revealed a lower hydraulic conductivity of 2.6 x 10^{-5} m/s which is more indicative of loamy clay soils (Stibinger, 2014).

This variation between these soil types is also seen to be in close proximity to the well fields from data obtained from Kenya Soils (2002). Although in this data both well pads are shown to be comprised of loamy soil, this margin is likely to be variable.

4.3 Discussion

Based on the available data sources presented above, the following characterisation can be made for soil in the upstream study area:

- The climate is hot and arid producing mostly typical desert-like soils with some areas or clay loam;
- Soils are locally saline and containing few rocks or stones and are susceptible to moderate sheet erosion from flood events and locally moderate wind erosion;
- Sand is the dominant particle size at all test pits across both Amosing and Ngamia well pads and access roads, which coincides with the dominantly sandy characteristics of soil which are typical of this region;
- Chemical analysis show that total carbon, organic carbon and inorganic carbon values are low across both Amosing and Ngamia sites which reflects the typical low soils organic matter content of the region; and

[1] Infiltration tests allow a rate of infiltration of surface water into the ground to be estimated based on field test results.

Results from infiltration tests undertaken near to the Ngamia well field are indicative of a fine to medium sand material and results from the infiltration test undertaken near to the Amosing well field is indicative of loamy soils.

5.0 METEOROLOGY

5.1 Baseline Data Gathering

The meteorological conditions were determined with focus on the upstream study area through on-site monitoring (primary data) with reference to existing meteorological data from the wider region (secondary data).

5.1.1 Secondary Data

Table 5-1 presents station details, parameters and period of record for the meteorological stations used as secondary data to develop the baseline characterisation of meteorology for the EOPS ESIA. Secondary data was analysed and used as regional reference for the primary data (see Section 5.1.2) gathered within the EOPS upstream study area. Figure 5-1 shows the locations of the meteorological stations presented in Table 5-2.

Historical data from Lodwar meteorological station was used from 1978 to 2016. Meteorological parameters measured at Lodwar include precipitation, minimum and maximum temperature, wind speed and direction. Lodwar meteorological station is situated approximately 85 km north of Lokichar and is the only source of secondary data within the Turkana region.

Historical data from Kitale meteorological station was used from 1974 to 2014. The meteorological parameters measured at Kitale include precipitation. Kitale meteorological station is situated approximately 180 km south-west of Lokichar in the Trans Nzoia region.

Historical data from Eldoret meteorological station was used from 2011 to 2015. Meteorological parameters measured at Eldoret include temperature, precipitation, wind speed and direction, cloud cover and relative humidity. Eldoret meteorological station is situated approximately 210 km south-west of Lockichar in the Uasin Gishu region.

Table 5-1: Secondary Data Station Details

Name	Station Type	Coordinates		Elevation (masl)	Parameter used	Period of record used
		Latitude	Longitude			
Lodwar	Meteorological Station	3.12	35.61	523	Daily maximum temperature	2008-2013
					Daily minimum temperature	2008-2013
					Daily total precipitation [1]	1978-1988, 2004-2016
					Daily average wind speed	2008-2013
					Daily average wind direction	2008-2013
Kitale	Meteorological Station	0.97	34.96	1850	Daily total precipitation	1974-2014
Eldoret	Meteorological Station	0.48	35.3	2120	Hourly total precipitation[2]	2011-2015
					Hourly average temperature	2011-2015
					Hourly average relative humidity	2011-2015
					Hourly average wind speed	2011-2015

Name	Station Type	Coordinates		Elevation (masl)	Parameter used	Period of record used
		Latitude	Longitude			
					Hourly average wind direction	2011-2015

Note: *[1]1973-1977 and 1989-2003 rainfall data excluded due to missing data.*
[2] Precipitation data was not available for Eldoret and rainfall data for this station has been substituted with data from Lodwar and Kitale. For this reason Eldoret is not included in the rainfall analysis in Section 5.1.2.3.3.

5.1.2 Primary Data

5.1.2.1 Meteorological Station Setup

The following two meteorological stations were supplied by Campbell Scientific and installed by a TKBV contractor between December 2015 and January 2016 within the EOPS upstream study area:

- Kapese met station located at Kapese Integrated Support Base accommodation unit at an altitude of approximately 700 m ASL; and
- Ngamia met station at Ngamia 8 well pad at an altitude of approximately 730 m ASL.

The meteorological stations comprise a general research-grade station mounted on a 10 m mast. Figure 5-2 shows a photograph of the meteorological station located at Ngamia 8. The sensors installed and meteorological parameters recorded on an hourly basis at each on-site station are presented in Table 5-2 Figure 5-1 shows the location of the on-site meteorological stations in relation to the meteorological stations providing secondary data from the wider region.

Table 5-2: Kapese and Ngamia Meteorological Station Details

Component	Model name	Meteorological Parameter Measured	Unit
Temperature and relative humidity probe (air)	CS215-L	Average air temperature	Degrees (°C)
		Relative humidity	Percentage (%)
Barometer	Vaisala PTB110	Barometric pressure	Milibars (mbar)
n/a (calculated)	n/a	Evapotranspiration	Milimetres (mm)
Rain gauge		Precipitation	Milimetres (mm)
n/a (calculated)	n/a	Calculated clear sky solar radiation	Megajoules per meter squared (MJ/m^2)
Pyranometer	Li-200R M200	Solar radiation (total)	Megajoules per meter squared (MJ/m^2)
		Solar radiation (average)	Watts per meter squared (W/m^2)
Temperature probe (soil at 1.5m)	107-L	Soil temperature at 1.5m depth	Degrees (°C)
Temperature probe (soil at 0.5m)	107-L	Soil temperature at 0.5m depth	Degrees (°C)
Wind direction and speed	05103-L RM Young	Wind direction	Degrees (°)
		Wind direction standard deviation	Degrees (°)
		Maximum wind speed	Meters per second (m/s)
		Average wind speed	Meters per second (m/s)

A detailed description of calibration procedures, data logging frequency, quality assurance and control plans as well as inspection and maintenance plans are described in TKBV's Quality Assurance/Quality Control and Maintenance Plan (Appendix C). TKBV has taken responsibility for the provision of meteorological data and the quality assurance of all primary data. Golder has not independently verified the meteorological data supplied.

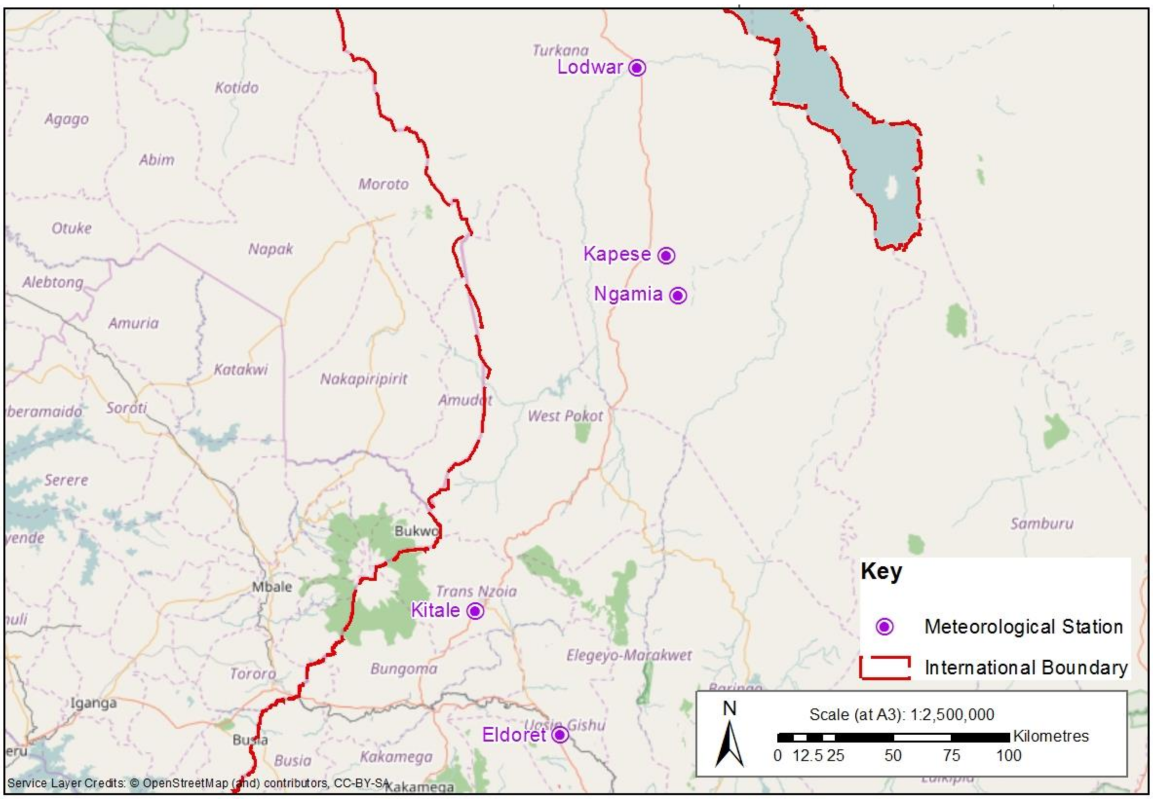

Figure 5-1: Kapese and Ngamia Met Station in relation to Secondary Data Sources

Figure 5-2: Ngamia Met Station

5.1.2.2 Method

The following key meteorological parameters have been considered in this assessment to describe meteorological baseline conditions in the EOPS upstream study area:

- Ambient air temperature (°C);
- Relative humidity (%);
- Total precipitation (mm);
- Wind speed (m/s); and
- Wind direction (°).

For all parameters, with the exception of total precipitation and wind direction, monthly averages as well as monthly minimum and maximum values (based on hourly data) were calculated and plotted. For total precipitation the monthly total sum was calculated and plotted. Wind direction was plotted in conjunction with wind speed as wind roses covering the entire period of data analysis. Analysis results are tabularized in Table E-1 in Appendix C.

For Kapese met station quality assured hourly data was provided by TKBV and analysed for the period of 01/12/2015 to 30/10/2016 with the exception of rainfall data for which quality assured data was provided from 01/01/2016 to 30/10/2016.

For Ngamia met station quality assured hourly data was provided by TKBV and analysed for the period of 22/01/2015 to 30/10/2016.

While the secondary and primary data are not concurrent data sets (i.e. data are recorded during different periods), the monthly average data can provide a defendable comparison between the local and regional characterization of meteorology, which will allow the shorter term local data to be contextualized within a longer regional dataset.

5.1.2.3 Results

5.1.2.3.1 Ambient Air Temperature

Over the course of the monitoring period monthly average temperatures at Kapese met station varied between 27.9°C in May and 31.9°C in March. The lowest temperature recorded was 20.9°C in March and June. The highest temperature recorded was 39.2°C in March.

Monthly average temperatures at Ngamia met station varied between 28.1°C in May and 32.7°C in March. The lowest temperature recorded was 19.9°C in July. The highest temperature recorded was 40.1°C in March.

Figuure 5-3 displays the monthly average ambient temperature as well as the minimum and maximum temperature range recorded in each month for Kapese and Ngamia met stations. Also shown in Figure 5-3 are monthly average ambient temperatures for Eldoret as well as the minimum and maximum temperatures recorded in each month for Eldoret (based on hourly data) and Lodwar (based on daily data).

As shown in Figure 5-3 monthly average, minimum and maximum temperatures are relatively stable lacking strong seasonal variations. Temperatures appear slightly decreased in May, June, July and August compared to the reminder of the year. Temperatures ranges measured at Kapese, Ngamia and Lodwar are very similar. Temperatures at Eldoret are markedly lower compared to the other locations, but follow generally the same pattern.

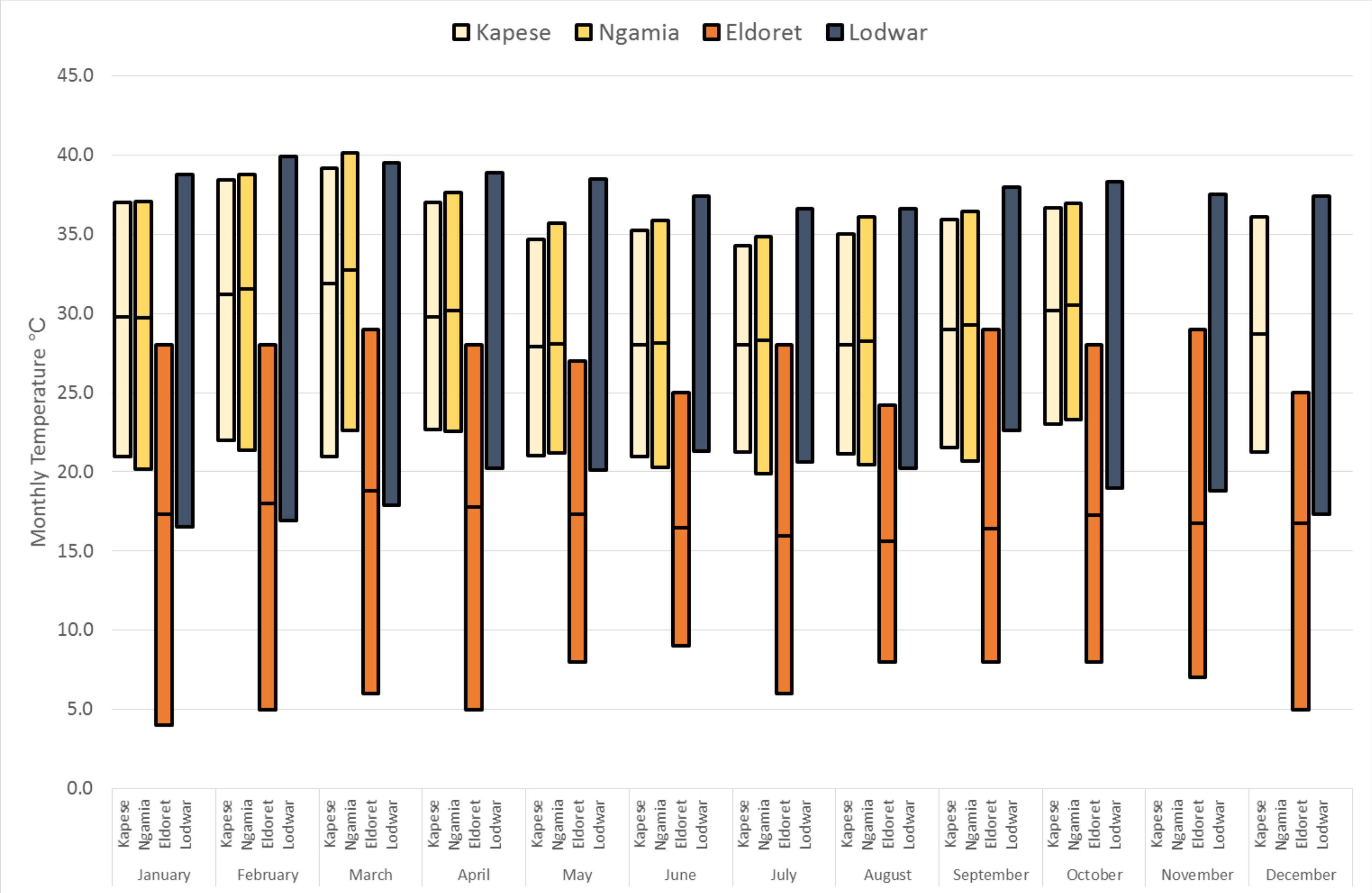

Figure 5-3: Average, Minimum and Maximum Monthly Temperature

5.1.2.3.2 Relative Humidity

Over the course of the monitoring period monthly average relative humidity at Kapese met station varied between 28.9% in February and 57.4% in May. The lowest relative humidity recorded was 12.4% in February. The highest relative humidity recorded was 98.5% in May.

Monthly average relative humidity at Ngamia met station varied between 29.9% in February and 59.8% in May. The lowest relative humidity recorded was 11.4% in February. The highest relative humidity recorded was 98.4% in May.

Figure 5-4 displays the monthly average relative humidity as well as the minimum and maximum relative humidity recorded in each month for Kapese and Ngamia met stations. Also shown in Figure 5-4 are monthly average, minimum and maximum relative humidity for Eldoret met station.

As shown in Figure 5-4 monthly average, minimum and maximum relative humidity is very similar at Kapese and Ngamia met stations. Both stations show increased relative humidity in April and May and decreased relative humidity from January to March. Relative humidity at Eldoret is generally higher than at Kapese and Ngamia, however overall patterns are similar with reduced relative humidity in January to March compared to the other months of the year.

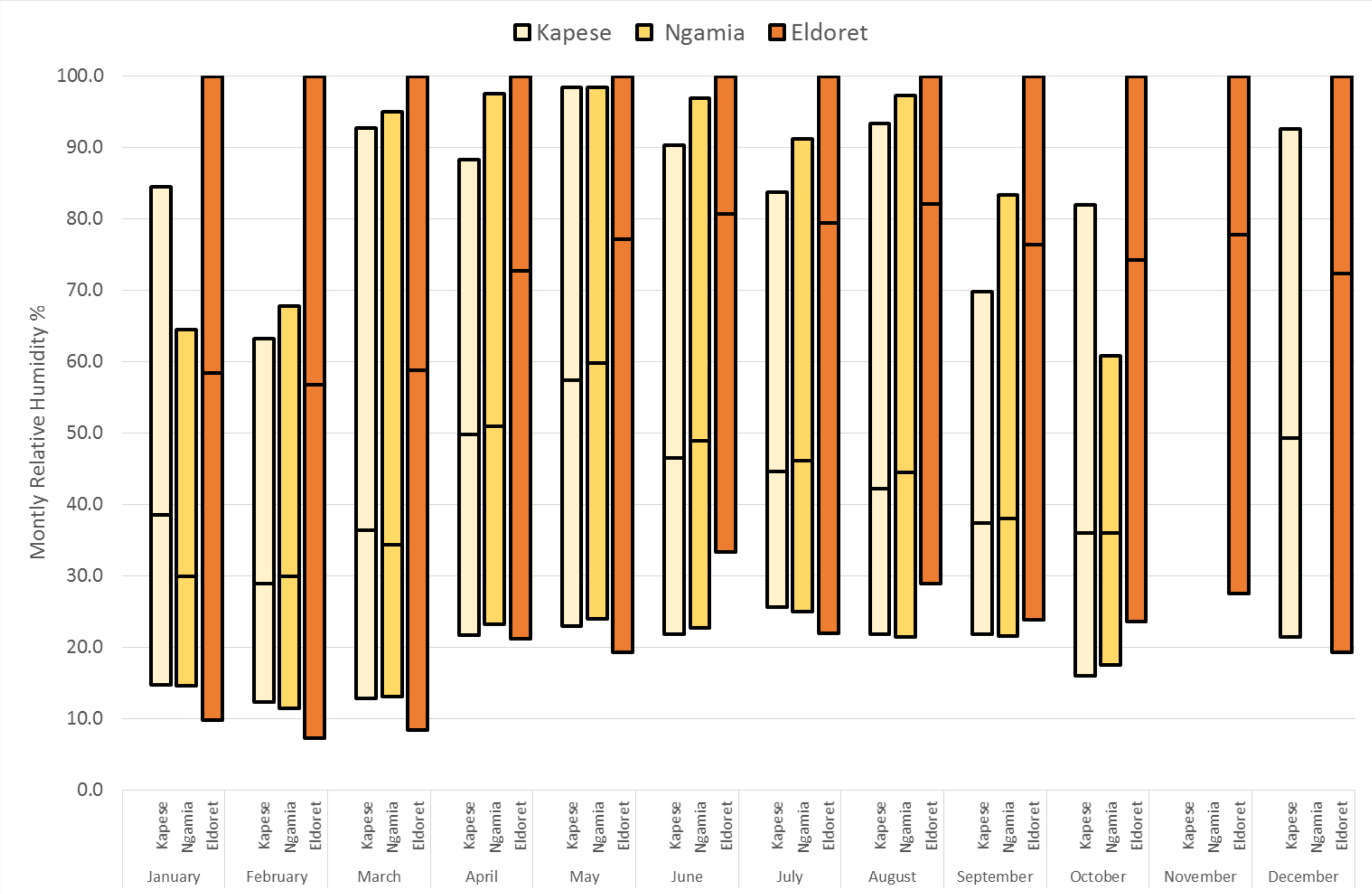

Figure 5-4: Average, Minimum and Maximum Monthly Relative Humidity

5.1.2.3.3 Total Precipitation

Over the course of the monitoring period monthly total precipitation at Kapese met station varied between 0 mm in February and 118.6 mm in May. The maximum daily precipitation was 38.8 mm, recorded on 12/05/2016 and the maximum intensity precipitation (1-hour total) was 34.4 mm/hr, also recorded on 12/05/2016 at 3.00h.

Monthly total precipitation at Ngamia met station varied between 0 mm in January and 110.6 mm in May. The maximum daily precipitation was 41.0 mm, recorded on 21/06/2016 and the maximum intensity precipitation (1-hour total) was 39.8 mm/hr, also recorded on 21/06/2016 at 15.00h.

Figure 5-5 displays the monthly total precipitation recorded in each month for Kapese and Ngamia met stations. Also shown in Figure 5-5 are monthly average and maximum total rainfall at Lodwar and Kitale met stations.

As shown in Figure 5-5 monthly total precipitation strongly varies over the year, within years and between locations. Total precipitation at Kapese and Ngamia follow similar patterns with a distinct peak around April and May. Maximum daily and intensity precipitation events also occur around this time. Lodwar monthly total rainfall averaged over 34 years indicates a similar peak in precipitation as Kapese and Ngamia. The maximum monthly total precipitation at this station as compared to the average shows the variability in monthly rainfall at Lodwar on a year to year basis. The maximum daily precipitation at Lodwar was 182.9 mm on 21/06/1991, once again falling in the month of June.

Kitale receives considerably more precipitation than the other stations and appears to follow a slightly different rainfall pattern. Precipitation is less on average during the months of January, February, March and December. However there is no obvious precipitation peak within the year but rather similar levels of precipitation (average and maximum) from April to November. The maximum monthly total precipitation compared to the average shows again high variability in monthly rainfall on a year to year basis. The maximum daily precipitation was 192 mm on 06/11/1996, 21/08/2000 and 01/10/2005 reflecting the difference in local rainfall patterns compared to Kapese, Ngamia and Lodwar. Due to the air temperatures presented in section 5.1.2.3.1, all precipitation is assumed to be rainfall, i.e. no snow or other types of precipitation.

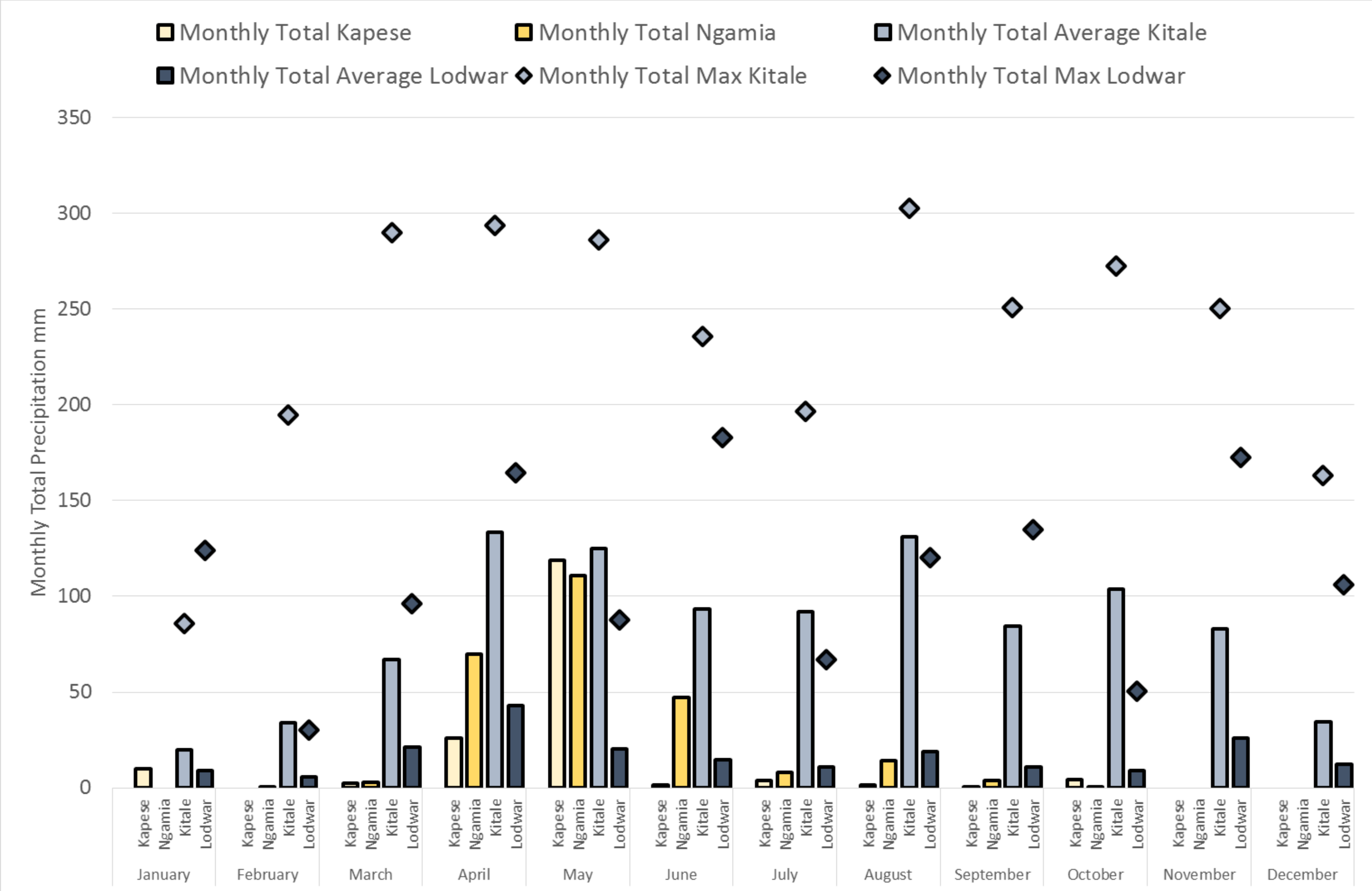

Figure 5-5: Average and Maximum Monthly Total Precipitation

5.1.2.3.4 Wind Speed

Over the course of the monitoring period monthly average wind speed at Kapese met station varied between 2.1 m/s in May and 3.4 m/s in March. The highest average wind speed recorded was 8.7 m/s in April.

Monthly average wind speed at Ngamia met station varied between 1.8 m/s in May and 3.1 m/s in March. The highest average wind speed recorded was 7.4 m/s in March.

Figure 5-6 displays the monthly average wind speed as well as the minimum and maximum wind speed recorded in each month for Kapese and Ngamia met stations. Also shown in Figure 5-6 are monthly average, minimum and maximum wind speed from met stations at Eldoret (based on hourly data) and Lodwar (based on daily data).

According to TKBV's Quality Assurance/Quality Control and Maintenance Plan (Appendix C) wind speed data for Kapese and Ngamia is removed if it is not between 0.5 and 50 m/s as one of the quality assurance clauses to filter out erroneous values. The same wind speed threshold (i.e. removal of data outside of the 0.5 to 50 m/s range) was applied to the Eldoret wind data to render the calculated average wind speeds at all three stations comparable. Minimum wind speed at Lodwar is based on daily rather than hourly averages and is slightly higher for this reason.

As shown in Figure 5-6 both Kapese and Ngamia met station show low average wind speeds of approximately 3m/s or less throughout the year. Maximum average wind speeds are slightly higher at Kapese than at Ngamia.

Monthly average wind speeds are slightly higher and maximum monthly wind speeds are markedly higher at Eldoret compared to Kapese and Ngamia. Average and maximum monthly wind speeds at Lodwar are very similar to Kapese and Ngamia throughout the year.

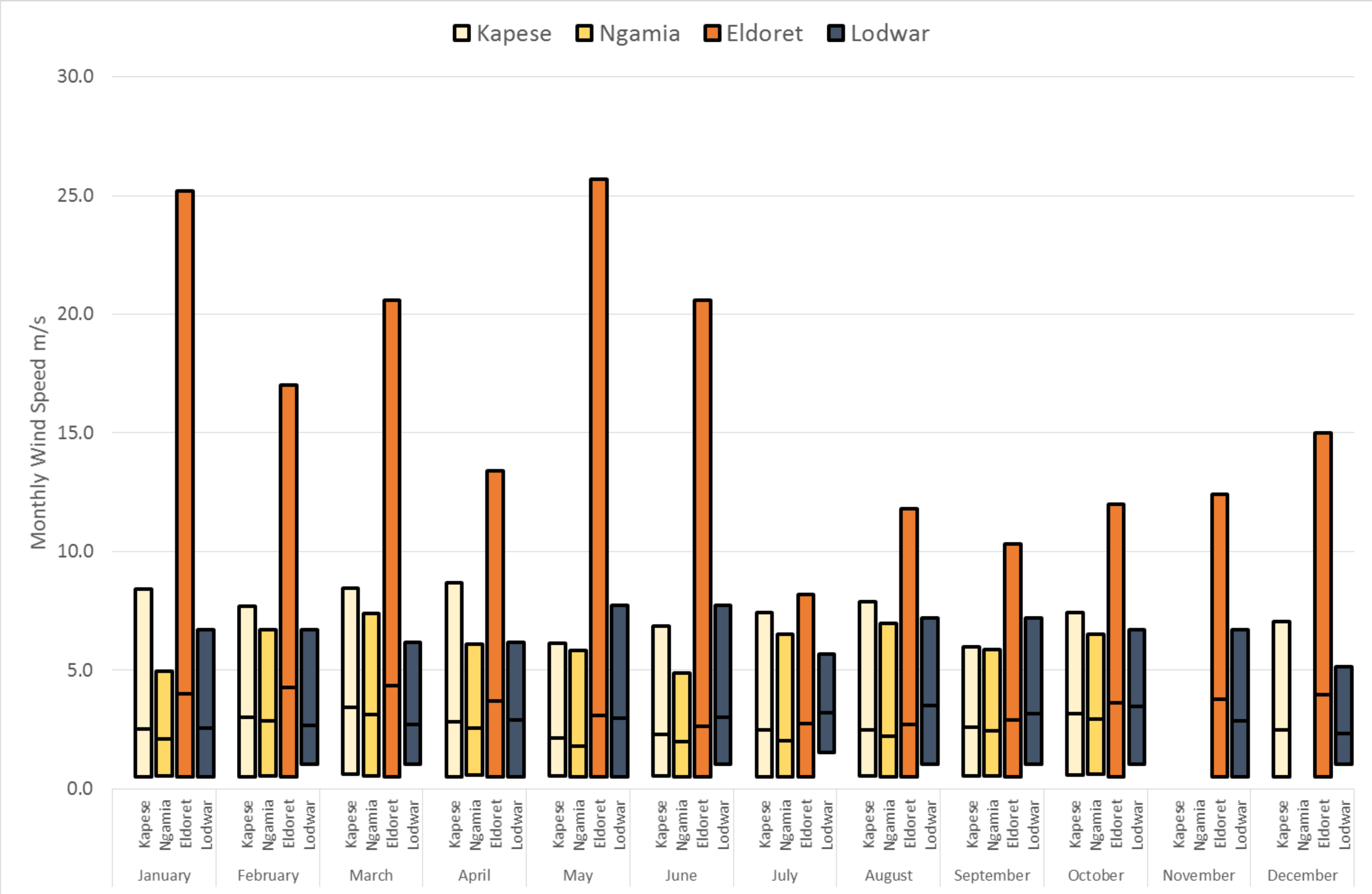

Figure 5-6: Average, Minimum and Maximum Monthly Wind Speed

5.1.2.3.5 Wind Direction

Figure 5-7 displays the annual wind roses for Kapese, Ngamia, Eldoret and Lodwar met station. The windrose for Kapese and Ngamia is based on 11 month and 10 month wind speed and direction data, respectively. The windrose for Eldoret is based on 5 years wind speed and direction data (2011-2015). The windrose for Lodwar is based on 6 years wind speed and direction data (2009 - 2013). At Kapese and Ngamia, winds blow predominantly from north to south-easterly directions. While the prevailing wind direction at Kapese is from the ENE, winds from the NE prevail at Ngamia. Easterly winds also prevail at Eldoret and Lodwar met station.

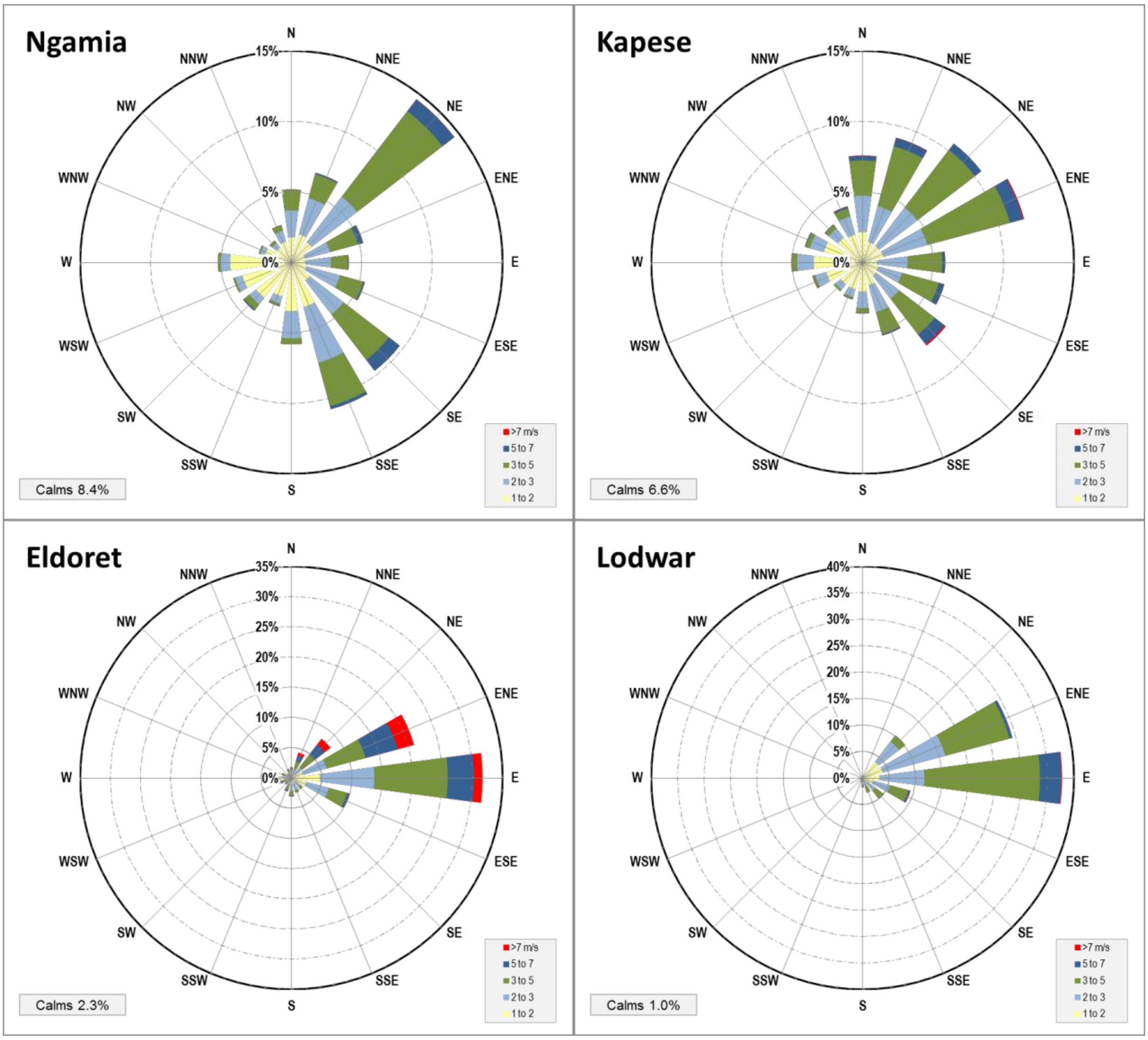

Figure 5-7: Windroses for Kapese, Ngamia, Eldoret and Lodwar

5.2 Discussion

The EOPS upstream study area is located in the Turkana region. On-site met stations at Kapese and Ngamia are located approximately 80-100 km south of Lodwar (Figure 5-1). The area has a warm desert climate with high average temperatures. The equatorial situation means that there is a very little annual variation in temperature. This is reflected in the high (>20°C) and stable monthly average, maximum and minimum temperatures recorded by the on-site meteorological stations in Kapese and Ngamia which are in good agreement with temperature measurements at Lodwar met station (Figure 5-3). The warm desert climate at the EOPS upstream study area is also reflected in low relative humidity encountered in Kapese and Ngamia during the majority of the year (Figure 5-4). Eldoret is located approximately 190-210 km to the south-west of Kapese and Ngamia at a height of over 2000 m asl. Eldoret has a temperate oceanic climate reflected in generally lower temperatures (Figure 5-3) and higher relative humidity (Figure 5-4).

Most areas of equatorial eastern Africa have a double rain season between March and May and October to December as the inter-tropical convergence zone (ITCZ) passes over (Camberlin & Ookala 2003, UK Met Office 2011). The National Drought Management Authority (NDMA, http://www.ndma.go.ke/) classifies the seasons in Kenya as follows:

- January to March – Dry Season;
- April to June – Long Rains;
- July to September – Dry Cool Season; and
- October to December – Short Rains.

Despite the generally dry conditions the ‘long rains’ of the rain season in April to June are well reflected in the peak in total precipitation and relative humidity occurring at Kapese and Ngamia as well as Lodwar in this time period (Figure 5-5 and Figure 5-4). The ‘long rains’ season coincides with the recorded maximum daily precipitation events at Kapese, Ngamia and Lodwar and the 1-hour intensity precipitation events at Kapese and Ngamia. Lodwar. There is also a secondary peak in precipitation in November during the “short rains” (data is not yet available for this month in 2016 for Kapese or Ngamia). The monthly maximum total precipitation compared to the monthly average received at Lodwar over a time period of 34 years indicates significant annual variation in the amount of rainfall received by the area. Kitale is located approximately 180 km south-west Kapese and Ngamia. At a height of 1850 m asl Kitale is classified as temperate oceanic climate and receives significant amounts of precipitation even during the dry seasons which is reflected in the meteorological data (Figure 5-5).

Average and maximum monthly wind speeds at Kapese and Ngamia are low (<3.5 m/s and <9 m/s, respectively) and do not exhibit any distinct seasonal variation. Slightly higher average and markedly higher maximum wind speeds recorded at Eldoret compared to Kapese and Ngamia (Figure 5-6) may be related to the higher altitude of the Eldoret met station (>2000masl) compared to Kapese and Ngamia (700 m asl and 730 m asl, respectively). Average and maximum wind speeds at Lodwar are very similar to Kapese and Ngamia. A previous meteorological study based on Lodwar meteorological data (1957 – 2014, mixed averaging periods of 1-12 hours) concluded that the wind climate at Lodwar is dominated by generally light easterly winds which are less than 4 m/s for approximately 50% of the time (HR Wallingford 2014). Based on the daily wind speed data 2008-2013 analysed for this assessment wind speed is less than 4 m/s for approximately 33% of the time and less than 5 m/s for approximately 50% of the time. As the averaging periods of the wind speed data are different in both assessments the analyses results are not directly comparable. Results however indicate a similar wind speed regime found in both studies.

Over equatorial eastern Africa two distinct monsoons are observed, the northeast and southeast monsoons (Okoola 1999, UK Met Office 2011). The north-east monsoons dominate during the Southern Hemisphere summer (December–February), while the south-east monsoons are observed during the Northern Hemisphere summer (June–August). Wind roses for Kapese, Ngamia, Eldoret and Lodwar all indicate a prevalence of easterly winds (Figure 5-7). A slight shift in prevailing wind direction from ENE at Kapese to NE at Ngamia may be related to local topography and the high grounds located approximately 10 km to the east of Ngamia. The Lodwar windrose is in agreement with a previous meteorological study that concluded that the prevailing wind direction at Lodwar is easterly or north-easterly, with winds from these directions occurring for over 75% of the time (HR Wallingford 2014).

In summary the data provided by the on-site met stations reflect the local warm desert climate and is in general agreement with the secondary data from the Turkana region and beyond. Kitale, located approximately 180 km south-west of Kapese and Ngamia at a height of 1850 m asl, has temperate oceanic climate and receives significant more rainfall than all the other met stations. Higher average and maximum wind speeds recorded at Eldoret compared to Kapese and Ngamia may be related to the altitude of the Eldoret met station at more than 2000 m asl.

6.0 AIR QUALITY

Baseline data gathering is focused on the Upstream Study Area as the likely direct air quality impacts of the Project are focused in this area.

The impact analysis of changes in air quality due to changes in traffic in the Midstream Study Area will be completed as a comparative change based on predicted changes in traffic as a result of EOPS (Section 2) and will not rely on baseline air quality along the road route.

Baseline data gathering related to EOPS has been completed at Kapese Camp (Osiris), Lokichar town (diffusion tube and deposited dust), Amosing 5 wellpad (diffusion tube and deposited dust) and Ngamia 5/6 wellpad (diffusion tube and deposited dust).

6.1 Key pollutants

A summary for each key pollutant, data for which has been gathered during the baseline period, is described in the following sections along with details of the specific risks to human health and the environment. The Project Standards associated to the key pollutants are presented in Volume II. The following presents potential effect of EOPS on these key pollutants and therefore provides the justification for their inclusion in the baseline:

- Key pollutants NO_2, SO_2, PM10 and PM2.5 will be emitted from combustion sources including flares, generators and gas engines associated with the EOPS Project;
- Volatile Organic Compounds (VOCs) are gases emitted from a wide range of solids or liquid materials including crude oil;
- Vehicle emissions reacting with other chemicals such as VOCs could lead to the creation of ozone; and
- Deposited dust can be generated during groundworks, maintenance and traffic on unsealed roads.

6.1.1 Nitrogen dioxide

Nitrogen dioxide (NO_2) typically arises via the oxidation of NO in air. The main effect of breathing NO_2 is the increased likelihood of respiratory problems. NO_2 is found to cause inflammation of the lungs and can reduce immunity to lung infections. This can cause respiratory problems such as wheezing.

Increased levels of NO_2 can affect people with asthma as it can cause more frequent attacks. Children with asthma and older people with heart disease are most at risk. Scientific studies have shown that symptoms of bronchitis and asthma in children increase in association with long-term exposure to NO_2 (WHO, 2005).

6.1.2 Sulphur dioxide

Sulphur dioxide (SO_2) is the by-product of burning fuel that contains sulphur. Excessive exposure to elevated concentrations of SO_2 is known to affect the human respiratory system and inhibit the function of the lungs. Inflammation of the respiratory tract causes coughing, aggravation of asthma, chronic bronchitis, and makes people more prone to infections of the respiratory tract (WHO, 2005).

When SO_2 combines with water, it forms sulphuric acid (H_2SO_4); this is the main component of acid rain which can result in loss of plants and deforestation (WHO, 2005).

6.1.3 Ozone

Excessive or elevated ozone (O_3) levels in the air can have implications for human health. O_3 has the potential to cause breathing problems, trigger asthmatic attacks, reduce lung function, and cause lung diseases. Several European studies have reported that daily mortality rises by 0.3% and likelihood of heart diseases by 0.4%, per 10 $\mu g/m^3$ increase in O_3 exposure (WHO, 2005).

6.1.4 Volatile Organic Compounds

VOCs include a variety of chemicals, some of which may have short and long-term adverse health effects. VOCs have the potential to be emitted from all aspects of oil and gas operations and although no direct assessment standards are available, baseline VOCs are monitored purely to establish baseline (USEPA, 2012). No standards are available for assessing ambient VOCs to establish the quality or condition of a project baseline.

Benzene, Toluene, Ethylbenzene and xylene (BTEX) are the VOC species considered as a standard approach to ESIA baseline. There is an air quality standard for Benzene (Appendix B). As there are not standards for the other VOCs, Data is gathered to provide a baseline against which any change can be monitored during operations.

6.1.5 Deposited dust

Deposited dust is generally not associated with human health issues, but is considered a nuisance due to loss of amenity. Elevated dust levels may, however, affect visibility and thus cause a health and safety issue. Dust can also have effects on plants and their growth patterns. Deposited dust can settle on the surface of leaves and reduce the intake of sunlight, inhibiting the natural process of photosynthesis. This has the potential to result in stunted growth. Dependent on the source and quantity of deposited dust, it is also possible that dust fall can contaminate sensitive environments and affect the chemistry of sensitive soils.

6.1.6 Particulate matter (PM_{10} and $PM_{2.5}$)

The health effects from particulate matter (PM_{10} and $PM_{2.5}$) can occur at levels of exposure currently being experienced by most urban and rural populations in both developed and developing countries. Chronic exposure to particles contributes to the risk of developing cardiovascular and respiratory diseases, as well as lung cancer (WHO, 2005). Particulates are internationally recognised as harmful to human health and the wider environment.

In developing countries, exposure to pollutants from indoor combustion of solid fuels on open fires or in traditional stoves increases the risk of acute lower respiratory tract infections and associated mortality amongst young children. Indoor air pollution from solid fuel use is also a major contributing factor in the development of chronic obstructive pulmonary disease and lung cancer among adults. The mortality in cities with high levels of pollution is greater than that observed in relatively cleaner cities by 15 to 20%. Even in the European Union, average life expectancy is 8.6 months lower due to exposure to $PM_{2.5}$ produced by human activities (WHO, 2000).

6.2 Secondary data

There is no known air quality data in the Study area other than the data gathered as part of the ESIA baseline data gathering associated to the Project and the Full Field Development (FFD) Project.

Due to the lack of industry and sparse populations in the EOPS Study Area, sources of changes to air quality are minimal.

6.3 Primary Data

6.3.1 Methods

Golder gathered air quality data at the following six locations across the FFD study area:

- Twiga-1 wellpad;
- Lokichar town;
- Kapese Camp;
- Amosing-5 wellpad;
- Ngamia-5/6 wellpad; and
- Emong-1 wellpad.

Not all the data is directly relevant to the EOPS Project, therefore data has been presented in this baseline from Lokichar town, Amosing-5, Ngamia 5/6 and Kapese Camp only. These monitoring locations were selected to characterise the baseline air quality environment at all identified sensitive receptors in the Upstream Study area of the EOPS Project. Drawing 6-1 presents these locations.

Data were collected from November 2015 to September 2016 (see Section 6.4 for data acquisition).

6.3.1.1 Diffusion Tubes

Substance specific diffusion tubes for NO_2, SO_2, O_3, Benzene, Toluene, Ethylbenzene and xylene (BTEX) were deployed at the data gathering locations (Drawing 6-1). The tubes were co-located with deposited dust gauges and placed at approximately 1.5 metres (m) above the ground level to sample within the average breathing zone of humans.

Passive diffusion tubes were exposed for approximately one month intervals from November 2015 to September 2016. All samples were analysed by SGS Kenya Limited, which are located in Nairobi.

6.3.1.2 Deposited Dust

Deposited dust samples were collected on a monthly basis alongside the passive air quality tubes using the Frisbee type deposit dust gauge collection method (Figure 6-1) at the monitoring locations. As no international statutory assessment standards are available for this commonly utilised monitoring technique, gauges were deployed in accordance with the manufacturer's recommendations.

The gauges comprise a Frisbee type dust collection plate, connected to a rainwater collection vessel via a small tube. The gauge works by collecting ambient dust, which is deposited on the Frisbee plate and washed by rainwater through the tube into the collection vessel. The gauges were mounted on tripod stands and left at the monitoring locations for a period of approximately one month. Dust deposition analysis was also undertaken by SGS located in Kenya giving an average dust deposition rate in $mg/m^2/day$.

Figure 6-1: Deposited dust gauge, diffusion tubes and noise equipment set up for data gathering at Amosing 5

6.3.1.3 Particulate Matter

Fine particulate monitoring was also undertaken at Kapese using a Turnkey Optical Scattering Instantaneous Respirable Indication Sensor (OSIRIS) particulate monitor. The OSIRIS unit simultaneously measured particulate matter sized from 1 µm (PM_1), 2.5 µm ($PM_{2.5}$) and 10 µm (PM_{10}). Time-averaged results were recorded by the meter every 10 minutes and data was periodically downloaded from the equipment by local field technicians. The measured data covers the period November 2015 to November 2016.

6.4 Data Acquisition

Data capture was generally successful although some data gaps occurred. Table 6-1 below summarises whether data was collected during each month. Where data is missing it is for short periods only and should not impact the analysis of the baseline results.

Table 6-1: Air Quality data collection by month

Pollutant	Location	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016 (a)	Aug 2016	Sept 2016
NO_2	Amosing	Y	N	Y	Y	Y	Y	N	Y	n/a	Y	Y
	Ngamia	Y	N	Y	Y	Y	Y	Y	Y	n/a	Y	Y
	Lokichar	Y	N	Y	Y	Y	Y	Y	Y	n/a	Y	Y
SO_2	Amosing	Y	N	Y	Y	Y	Y	N	Y	n/a	Y	Y
	Ngamia	Y	N	Y	Y	Y	Y	Y	Y	n/a	Y	Y
	Lokichar	Y	N	Y	Y	Y	Y	Y	Y	n/a	Y	Y
O_3	Amosing	Y	N	Y	Y	Y	Y	N	Y	n/a	N	Y
	Ngamia	Y	N	Y	Y	Y	Y	Y	Y	n/a	Y	Y
	Lokichar	Y	N	Y	Y	Y	Y	Y	Y	n/a	Y	Y
Deposited Dust	Amosing	Y	N	Y	Y	N	N	N	N	n/a	N	N
	Ngamia	Y	N	Y	Y	Y	Y	Y	N	n/a	Y	Y
	Lokichar	Y	N	Y	Y	Y	Y	Y	N	n/a	Y	Y
BTEX	Amosing	N	N	Y	N	N	Y	Y	Y	N	Y	Y
	Ngamia	N	N	Y	N	N	Y	Y	Y	N	Y	Y
	Lokichar	N	N	Y	N	N	Y	Y	Y	N	Y	Y
PM10, PM2.5 & TSP	Kapese Camp	Y	Y	Y (b) (until 19th)	Y (b) (from 17th)	Y	Y	Y	N(c)	N(c)	N(c)	N(c)

(a) Samples for June and August were deployed for a slightly extended period from 31 May to 12 July, and from 11 July to 23rd Aug, therefore no data is specific to July.

(b) The OSIRIS unit stopped monitoring on 19th January 2016 due to an airflow error. The unit was fully cleaned and filter changed. Monitoring restarted on 17th February 2016; and

(c) The OSIRIS unit stopped monitoring in June 2016 due to an airflow error which could not be resolved in the field. The unit was then sent for calibration on 24th August 2016 and returned to the field on 30th September 2016

6.5 Results

The short-term air quality concentrations were calculated utilising the conservative Department for Environment, Food & Rural Affairs (DEFRA) and UK Environment Agency (EA) methodology for calculating averaging periods (DEFRA & EA, 2016) and for the 10 minute average utilised by the Ministry of Environment, Ontario, Canada (2008) methodology. In the absence of any international methodology or guidance relating to this, the following assumptions were applied:

- The annual average concentration is taken as the mean of the monitored data;

- Hourly average concentration = the annual average concentration x 2;
- 24 hour average concentration = the hourly average concentration x 0.59;
- 8 hour average concentration = the hourly average concentration x 0.7;
- 15 minute average concentration = the hourly average concentration x 1.34; and
- 10 minute average concentration = the hourly average concentration x 1.65.

As an example, the monitored long-term average SO_2 concentration for the period was 1.1 µg/m³. The hourly average SO_2 concentration was estimated to be 2.2 µg/m³ (i.e. 1.1 µg/m³ x 2). Similarly, the SO_2 concentrations for the other average times were estimated as follows:

- 24 hour average concentration = 1.3 µg/m³ (i.e. 2.2 µg/m³ x 0.59); and
- 10 minute average concentration = 3.6 µg/m³ (i.e. 2.2 µg/m³ x 1.65).

Baseline average air quality concentrations for the monitored pollutants are provided for the Ngamia and Amosing wellpads in Table 6-2, and for Lokichar town in Table 6-3. Concentrations in Table 6-2 are the average results from Ngamia and Amosing which is deemed to be representative of the study area. Data is presented for the VOC species monitored and compared against the relevant AQS where relevant. Baseline data and the associated plots are included in Appendix D.

Table 6-2: Baseline average air quality concentrations for pollutants monitored at Ngamia and Amosing and average particulates monitored at Kapese Camp

	Averaging Period	Concentration (µg/m³, unless stated)	AQS (µg/m³, unless stated)	Concentration as % of AQS
NO_2	Annual	0.8	40	2
	24 hour	0.9	188	1
	1 hour	1.5	200	1
SO_2	Annual	1.1	50	2
	24 hour	1.3	20	6
	10 minute	3.6	500	1
O_3	Annual	28.1	- (a)	-
	8 hour	39.3	100	39
	1 hour	56.1	235	24
Benzene	Annual	2.1	5	42
	1 hour	4.3	- (a)	-
Toluene	Annual	2.3	- (a)	-
	1 hour	4.6	- (a)	-
Ethylbenzene	Annual	2.5	- (a)	-
	1 hour	5.0	- (a)	-
Xylene	Annual	2.4	- (a)	-
	1 hour	4.9	- (a)	-
Total Suspended Particles (TSP)/ Total Particulate Matter (TPM) (b)	Annual	34.5	140	25
	24 hour	40.7	200	20
PM_{10} (b)	Annual	21.7	20	109(c)
	24 hour	25.6	50	51

	Averaging Period	Concentration (µg/m³, unless stated)	AQS (µg/m³, unless stated)	Concentration as % of AQS
$PM_{2.5}$ (b)	Annual	5.0	10	50
	24 hour	5.9	25	24
Deposited Dust	Annual	69.5 mg/m²/day	200 mg/m²/day	35

(a) No relevant AQS

(b) Data from Kapese camp

(c) Discussed in Section 6.6.9

Table 6-3: Baseline average air quality concentrations for pollutants monitored at Lokichar

	Averaging Period	Concentration (µg/m³, unless stated)	AQS (µg/m³, unless stated)	Concentration as % of AQS
NO_2	Annual	2.0	40	5
	24 hour	2.4	188	1
	1 hour	4.0	200	2
SO_2	Annual	1.5	50	3
	24 hour	1.7	20	9
	10 minute	4.8	500	1
O_3	Annual	34.1	- (a)	-
	8 hour	47.8	100	48
	1 hour	68.2	235	29
Benzene	Annual	2.2	5	44
	1 hour	4.3	- (a)	-
Toluene	Annual	2.3	- (a)	-
	1 hour	4.6	- (a)	-
Ethylbenzene	Annual	2.5	- (a)	-
	1 hour	5.0	- (a)	-
Xylene	Annual	2.5	- (a)	-
	1 hour	4.9	- (a)	-
Deposited Dust	Annual	184.6 mg/m²/day	200 mg/m²/day	92

(a) No relevant AQS

6.6 Discussion

6.6.1 NO_2

Concentrations are similar at both the Amosing and Ngamia stations, with an annual average concentration of 0.6 µg/m³ recorded at Amosing and 0.9 µg/m³ at Ngamia. The average of the two monitoring locations is 0.8 µg/m³. The maximum concentration recorded at either of these locations is 3.2 µg/m³ at Ngamia. The minimum concentration recorded at either station was 0.1 µg/m³

The background concentration at Lokichar is slightly higher with an average concentration of 2.0 µg/m³, a maximum concentration of 5.9 µg/m³ and a minimum concentration of 0.7 µg/m³.

The average concentrations recorded at all stations are less than 5% of the standard for any of the relevant averaging periods. A plot of the data is included as Figure 1 in Appendix D.

6.6.2 SO_2

Concentrations are similar at both the Amosing and Ngamia stations, with an annual average concentration of 1.0 µg/m³ recorded at Amosing and 1.2 µg/m³ at Ngamia. The average of the two monitoring locations is 1.1 µg/m³. The maximum concentration recorded at either of these locations is 5.4 µg/m³ at Ngamia. The minimum concentration recorded at either station was 0.6 µg/m³

The background concentration at Lokichar is slightly higher with an average concentration of 1.5 µg/m³, a maximum concentration of 8.1 µg/m³ and a minimum concentration of 0.6 µg/m³.

The average concentrations recorded at all stations are less than 9% of the standard for any of the relevant averaging periods. A plot of the data is included as Figure 2 in Appendix D.

6.6.3 O_3

Concentrations are similar at both the Amosing and Ngamia stations, with an annual average concentration of 29.8 µg/m³ recorded at Amosing and 26.7 µg/m³ at Ngamia. The average of the two monitoring locations is 28.1 µg/m³. The maximum concentration recorded at either of these locations is 73.0 µg/m³ at Amosing. The minimum concentration recorded at either station was 2.5 µg/m³.

The background concentration at Lokichar is similar with an average concentration of 34.1 µg/m³, a maximum concentration of 46.1 µg/m³ and a minimum concentration of 15.0 µg/m³.

The average concentrations recorded at all stations are less than 50% of the standard for any of the relevant averaging periods. A plot of the data is included as Figure 3 in Appendix D.

6.6.4 Benzene

Concentrations are very similar at both the Amosing and Ngamia stations, with an annual average concentration of 2.1 µg/m³ recorded at both Amosing and Ngamia. The average of the two monitoring locations is thus also 2.1 µg/m³. The maximum concentration recorded at both of these locations is 2.4 µg/m³ recorded in both April and May. The minimum concentration recorded at both stations was 1.9 µg/m³ recorded in August.

The background concentration at Lokichar is very similar with an average concentration of 2.2 µg/m³, a maximum concentration of 2.4 µg/m³ in both April and May and a minimum concentration of 2.0 µg/m³ in January, June and August.

The average concentrations recorded at all stations are less than 45% of the annual standard. A plot of the data is included as Figure 4 in Appendix D.

6.6.5 Toluene

Concentrations are very similar at both the Amosing and Ngamia stations, with an annual average concentration of 2.3 µg/m³ recorded at each. The average of the two monitoring locations is thus also 2.3 µg/m³. The maximum concentration recorded at each of these locations is 2.6 µg/m³ in April and May. The minimum concentration recorded at each station was 2.1 µg/m³ in January and August.

The background concentration at Lokichar is very similar with an average concentration of 2.3 µg/m³, a maximum concentration of 2.6 µg/m³ in May and a minimum concentration of 2.1 µg/m³ in January.

There are no Air Quality Standards, defined in the EDC, to compare these concentrations to but these data provide a baseline for concentrations measured during operations to be compared to. A plot of the data is included as Figure 5 in Appendix D.

6.6.6 Ethylbenzene

Concentrations are very similar at both the Amosing and Ngamia stations, with an annual average concentration of 2.5 µg/m³ recorded at each. The average of the two monitoring locations is thus also 2.5 µg/m³. The maximum concentration recorded at each of these locations is 2.9 µg/m³ in May. The minimum concentration recorded at each station was 2.3 µg/m³ in January and August.

The background concentration at Lokichar is very similar with an average concentration of 2.5 µg/m³, a maximum concentration of 2.9 µg/m³ in May and a minimum concentration of 2.3 µg/m³ in January and June.

There are no Air Quality Standards, defined in the EDC, to compare these concentrations to but these data provide a baseline for concentrations measured during operations to be compared to. A plot of the data is included as Figure 6 in Appendix D.

6.6.7 Xylene

Concentrations are very similar at both the Amosing and Ngamia stations, with an annual average concentration of 2.4 µg/m³ recorded at Amosing and 2.5 µg/m³ recorded at Ngamia. The average of the two monitoring locations is 2.4 µg/m³. The maximum concentration recorded at each of these locations is 2.8 µg/m³. The maximum occurred in May for Amosing and April and May for Ngamia. The minimum concentration recorded at each station was 2.2 µg/m³ in January and August.

The background concentration at Lokichar is very similar with an average concentration of 2.5 µg/m³, a maximum concentration of 2.8 µg/m³ in May and a minimum concentration of 2.2 µg/m³ in January.

There are no Air Quality Standards, defined in the EDC, to compare these concentrations to but these data provide a baseline for concentrations measured during operations to be compared to. A plot of the data is included as Figure 7 in Appendix D.

6.6.8 Total Suspended Particles/Total Particulate Matter

Concentrations were recorded at the Kapese Camp with an average concentration of 34.5 µg/m³. The maximum concentration recorded is 1,718 µg/m³ but the high concentrations are generally seen at discrete events, which could include meteorological events, vehicle movements, which do not happen over extended time periods.

The average concentration is less than 30% of the standard for any of the relevant averaging periods. The minimum concentration recorded was 0.1 µg/m³. A plot of the data is included as Figure 8 in Appendix D.

6.6.9 PM_{10}

Concentrations were only recorded at the Kapese Camp with an average concentration of 21.7 µg/m³. The maximum concentration recorded is 967 µg/m³. The annual average concentration is approximately 109% of the AQS, although the 24 hour averaging period is approximately 50% of the AQS. The minimum concentration recorded was 0.1 µg/m³. A plot of the data is included as Figure 9 in Appendix D.

With regard to the baseline for the annual average concentration being greater than the AQS (20 µg/m³), the AQS is the IFC Guideline value, which is most stringent. The IFC also has interim targets 1, 2 and 3 which have standards of 70, 50 and 30 µg/m³ respectively. These targets are seen as incremental steps in a progressive reduction of air pollution and are intended for use in areas where pollution is high (WHO, 2005). Due to the background concentrations being so great, these interim targets could be applicable to this Project. The Kenyan standard for annual PM_{10} is 50 µg/m³ at both the boundary and off site which corresponds with the IFC interim target 2.

Elevated particle concentrations could relate to the dusty environment, meteorological events such as periods of high wind speeds or dry periods. They could also be related to elevated source conditions at the Kapese Camp including burning and exhaust emissions. The camp is well established and has multiple potential emissions sources. The baseline data recorded at Kapese Camp may therefore be an overestimate of the background concentration at Amosing and Ngamia wellpads. This is supported by the deposited dust results discussed in Section 6.7.7 which has a comparison of the results at Kapese Camp, Amosing and Ngamia. PM_{10} baseline data should be regarded as a benchmark for the existing situation at Kapese Camp.

6.6.10 PM2.5

Concentrations were only recorded at the Kapese Camp with an average concentration of 5 µg/m³. The maximum concentration recorded is 208 µg/m³ but the high concentrations are generally seen at discrete events which do not happen over extended time periods. The average concentration is less than 50% of any of the relevant averaging periods. The minimum concentration recorded was 0.1 µg/m^3. A plot of the data is included as Figure 10 in Appendix D.

6.6.11 Deposited Dust

Concentrations are much lower at Amosing than Ngamia, with an average concentration of 6.6 mg/m^2/day recorded at Amosing and 93.1 mg/m^2/day at Ngamia. It should be noted that Amosing only has a limited data set of 3 months which will contribute to the lower concentration. The average of the two monitoring locations is 69.5 mg/m^2/day. The maximum concentration recorded at either of these locations is 469.9 mg/m^2/day at Ngamia. The minimum concentration recorded at either station was 0.3 mg/m^2/day.

The background concentration at Lokichar is much higher with an average concentration of 184.6 mg/m^2/day, a maximum concentration of 491.9 mg/m^2/day and a minimum concentration of 8.5 mg/m^2/day. Monitoring was also undertaken at Kapese Camp, where the average recorded concentration is 178.3 mg/m^2/day. Concentrations at Kapese Camp and Lokichar are approximately 200% of the maximum recorded at either Amosing or Ngamia. This suggests that Kapese Camp and Lokichar are much dustier environments than either Amosing or Ngamia.

Nevertheless, the average concentrations recorded at Amosing, Ngamia, Lokichar and Kapese Camp are less than the relevant standard of 200 mg/m^2/day. The average concentration recorded at both Amosing and Ngamia is less than 35% of the standard.

A plot of the data is included as Figure 11 in Appendix D

7.0 NOISE AND VIBRATION

7.1 Baseline Data Gathering

Baseline data gathering is focused on the Upstream Study Area as the likely direct noise impacts of the Project are focused in this area.

The impact analysis of changes in noise due to changes in traffic in the Midstream Study Area will be completed as a comparative change based on predicted changes in traffic (Section 2) and will not rely on baseline noise along the road route.

No vibration data was gathered as part of the ESIA baseline. Due to the greenfield nature of the Study Area, the baseline vibration is assumed to be negligible. The impact analysis of changes in vibration will be completed as a comparative change based on predicted changes in activity associated to the Project.

7.1.1 Noise Guidelines

Project standards have been derived based upon review of Kenyan regulations and standards, the International Finance Corporation (IFC) Noise Guideline (IFC, 2007), and consideration of the baseline environmental setting. Table 3.1 of The Noise Position Paper presents Kenyan regulations and the IFC Noise Guidelines, and goes on to select IFC Noise Guideline limits as those to be applied to the Project. This approach is presented in a noise position paper (Appendix E), which has been shared with NEMA and the IFC by TKBV.

The receiving environment for the Project is best categorised as Residential under the IFC Noise Guideline. Therefore, the 1-hour L_{eq} limit at the receptors corresponding to the monitoring locations is 55 dBA during the daytime (07:00 to 22:00) and 45 dBA during the nighttime (22:00 to 07:00).

The IFC Noise Guideline allows for either the sound level limits presented or a maximum increase in background levels of 3 dB at the nearest receptor location off-site. Since noise is expressed on a logarithmic scale (i.e. 45 dB + 45 dB = 48 dB), the 3 dB maximum increase in background levels considers the option for one to produce no more noise than already exists at a receptor.

7.1.2 Secondary data

There is no known data for noise or vibration in the Study Area other than the data gathered as part of the ESIA baseline data gathering associated to the Project.

Due to the lack of industry and sparse populations in the EOPS Study Area, sources of anthropogenic noise are minimal. In the absence of anthropogenic noise, natural noise sources such as wildlife noise and wind induced noise through vegetation are typically the main noise sources. In the Study Area the absence of perennial watercourses or vegetation, as well as prolific wildlife (birds or insects particularly) activity indicate that there are limited noise sources.

7.1.3 Primary Data - Noise

7.1.3.1 Methods

Golder measured existing noise levels at the following nine locations across the Full Field Development Study Area:

- Lokichar;
- Twiga-1;
- Amosing-5;
- Ngamia-5/6;
- Emong-1;
- Kapese Camp;

- Lomokamar;
- Ekales 2; and
- Agete 2.

Not all the data is directly relevant to the EOPS Project, therefore data has been presented in this baseline from Lokichar, Amosing-5, Ngamia 5/6, and Kapese Camp only. These noise monitoring locations were selected to characterise the baseline noise environment at all identified sensitive receptors in the Upstream Study Area of the EOPS project.

The noise data gathering was designed to meet the requirements of International Organization for Standardization (ISO) 1996 Parts 1 and 2 (ISO, 2003; ISO, 2007), which provides guidance on the equipment to be used, conditions under which noise measurements should be undertaken, measurement parameters and appropriate siting of monitoring equipment.

The sound level meters (SLMs) were deployed at each measurement location for a minimum 24-hour period, on three separate field visits: October 2015, January 2016, and October 2016. The measurement locations are described in Table 7-1 below.

Table 7-1: Measurement Locations

Monitoring Locations	Measurement Date			Representative Village	Latitude/Longitude
	Oct-15	Jan-16	Oct-16		
Lokichar	√			Lokichar	**N:** 02°23'02.6" **E:** 35°38'41.8"
Amosing-5	√	√	√	Lopuroto	**N:** 02°10'53.7" **E:** 35°47'01.9"
Ngamia-5/6			√	Kodekode	**N:** 02°12'42.0" **E:** 35°45'36.1"
Kapese Camp	√			Kapese Village	**N:** 02°21'51.8" **E:** 35°42'20.4"

The SLMs used for the monitoring program were a Larson Davis environmental noise monitoring system with an integrated SLM and a Norsonic 141 SLM, both of which meet the IEC Type 1 classification. The microphones were protected with an environmental windscreen and mounted at a height of approximately 1.5 m above ground level. The microphone was connected by cable to the SLM which was housed in a weather-protected case. The SLMs were calibrated on-site before and after each measurement with a portable calibrator. The instrument was within its required laboratory calibration period during the survey, as was the field calibrator. After the 24-hour measurements were complete, the equipment was removed from each respective location and the data were downloaded. Meteorological conditions were noted for each monitoring period. The "noise floor" of the SLMs, below which electronic "noise" in the instrument makes accurate measurement impossible, is approximately 20 dB.

The data collected at each location were either 1-minute, 10-minute, or 1-hour energy averaged (L_{Aeq}) and statistical (L_{A90}) levels. The L_{Aeq} is the equivalent continuous sound level, which in a stated time and at a stated location, has the same energy as the time varying noise level. It is common practice to measure L_{Aeq} sound levels in order to obtain a representative average sound level. The L_{A90} is defined as the sound level exceeded for 90% of the time and is used as an indicator of the "ambient" noise level.

For the purposes of the assessment, the 1-minute or 10-minute data were aggregated to give hourly values as well as period averages for daytime and nighttime, for comparison with Project standards (detailed in Volume IV).

7.1.3.2 Results

Throughout the monitoring periods and at all monitoring locations, temperatures were observed to be up to 38°C, and there was no precipitation and very light winds. Therefore, meteorology conditions were not expected to have an impact on measured noise levels.

A summary of the noise monitoring results from the October 2015, January 2016, and October 2016 monitoring programs are provided in Table 7-2 to Table 7-5**Table** . During the monitoring program, noise data was logged continuously on a minute, 10-minute or hourly basis, summarised and reported as statistical (L_{A90}) and energy averaged levels (L_{Aeq}) over a one hour period of time. The noise levels presented in the tables below are for the daytime and nighttime periods, based on the one hour data.

In addition, the raw 1-minute, 10-minute, or 1-hour baseline noise monitoring data are presented in graphical form in Appendix E.

Table 7-2: Lokichar Results (October 2015)

	L_{Aeq} (dBA)		L_{A90} (dBA)	
	Daytime	Nighttime	Daytime	Nighttime
Average (One Hour L_{eq})	65.7	62.3	57.4	45.7
Minimum (One Hour L_{eq})	51.3	42.2	37.5	24.9
Maximum (One Hour L_{eq})	73.6	69.0	65.8	53.2

Table 7-3: Amosing-5 Results

	L_{Aeq} (dBA)		L_{A90} (dBA)	
	Daytime	Nighttime	Daytime	Nighttime
October 2015				
Average (One Hour L_{eq})	65.7	67.8	56.2	53.9
Minimum (One Hour L_{eq})	27.3	59.1	18.6	30.7
Maximum (One Hour L_{eq})	77.1	73.7	67.7	59.8
January 2016 [(a)]				
Average (One Hour L_{eq})	46.2	34.4	—	—
Minimum (One Hour L_{eq})	34.3	34.1	—	—
Maximum (One Hour L_{eq})	53.5	35.1	—	—
October 2016 [(a)]				
Average (One Hour L_{eq})	62.8	40.6	—	—
Minimum (One Hour L_{eq})	34.5	33.4	—	—
Maximum (One Hour L_{eq})	71.9	45.8	—	—

(a) Only equipment used October 2015 had functionality to report both L_{A90} and L_{Aeq}. L_{Aeq} is the unit used to describe the baseline situation.

Table 7-4: Ngamia-5/6 Results (October 2016)

	L_{Aeq} (dBA)		L_{A90} (dBA)	
	Daytime	Nighttime	Daytime	Nighttime
Average (One Hour L_{eq})	59.9	43.4	—	—
Minimum (One Hour L_{eq})	39.3	34.1	—	—
Maximum (One Hour L_{eq})	65.8	47.3	—	—

Note: Only equipment used October 2015 had functionality to report both L_{A90} and L_{Aeq}. L_{Aeq} is the unit used to describe the baseline situation.

Table 7-5: Kapese Camp Results (October 2015)

	L_{Aeq} (dBA)		L_{A90} (dBA)	
	Daytime	Nighttime	Daytime	Nighttime
Average (One Hour L_{eq})	55.0	30.0	32.5	24.3
Minimum (One Hour L_{eq})	24.2	21.6	17.8	18.0
Maximum (One Hour L_{eq})	67.2	33.0	38.5	26.9

7.2 Discussion

The measured hourly minimum and average L_{Aeq}s are summarised in Table 7-6 for all monitoring locations along with the limit values from the IFC guideline for residential receptors. Measured baseline noise levels exceeding the limit values are presented in red text.

In cases where monitoring was repeated for a given monitoring location, the lowest measurement results will be used for the effects analysis and impact assessment to provide a more conservative assessment.

Table 7-6: Summary of Measured Noise Levels

Monitoring Location	Monitoring Period	Minimum One Hour L_{Aeq} (dBA)		Average One Hour L_{Aeq} (dBA)	
		Daytime	Nighttime	Daytime	Nighttime
Limit Value		55	45	55	45
Lokichar	October 2015	51.3	42.2	65.7	62.3
Amosing-5	*October 2015*	*27.3*	*59.1*	*65.7*	*67.8*
	January 2016	34.3	34.1	46.2	34.4
	October 2016	*34.5*	*33.4*	*62.8*	*40.6*
Ngamia-5/6	October 2016	39.3	34.1	59.9	43.4
Kapese Camp	October 2015	24.2	21.6	55.0	30.0

Note: Red text indicates where the measured noise level is greater than the limit value. Italics indicate data that will not be considered in the effects assessment.

The absence of natural noise sources, such as watercourse noise or wind induced vegetation noise, is noticeable in the area and contributes to the low measured levels. Similarly, the dispersed nature of settlements meant that there were few concentrated areas of human noise. Measured noise levels were frequently at or near the theoretical minimum measurement level (~20 dBA) at a number of receptors.

Higher noise levels were recorded in the village of Lokichar, at which noise from human activities, including road traffic, human interaction and light engineering/construction activities, contributed to ambient noise levels.

Ngamia-5/6 is located within 200 m of the Lokichar Lokwamosing Road; traffic from this road contributed to the measured ambient noise levels exceeding the daytime limit value.

High noise levels were measured in October 2015 at the Amosing-5 monitoring location. These were short peaks in measured levels; no apparent source for these high measured levels was identified. However, when monitoring was repeated at Amosing-5 in January and October 2016, the average hourly noise levels were measured to be 27 to 33 dB lower during the nighttime period.

8.0 WATER QUALITY AND SEDIMENT

This section presents the available baseline information on water quality within the study area (Section 1.3). Due to the ephemeral nature of the surface water in the study area, this section largely focusses on the information available on groundwater quality. Information on the hydrological setting within the study area is presented in Section 9 (Water Quantity).

8.1 Baseline data gathering

8.1.1 Secondary data

8.1.1.1 Water Chemistry

The groundwater is unlikely to be saline because, since the onset of formation of the Rift Valley in which the study area is located, the region has been landlocked and sediment deposition has mainly been fluvial or lacustrine in origin, so the water trapped in pore spaces in the rocks is fresh (Price, 2014a). Solute concentrations in groundwater may be higher than expected in pure rainfall due to evaporation from the soil zone concentrating the solid content in the rainfall (and therefore the solid content of aquifer recharge) or by direct evaporation from groundwater where the water table is shallow. Even at low concentrations, sodium chloride can make water taste brackish (Price, 2014b). Most of the groundwater encountered during exploration for sources of injection water has been fresh, although some of the groundwater encountered in the volcanics is slightly brackish (Price, 2014a).

Not all groundwater is chemically safe for human consumption or pleasant to taste. Groundwater in Kenya is known to have, amongst other elements, high concentrations of arsenic, boron and fluoride originating from the natural geology that could be present in concentrations that are unacceptable for human consumption (Price, 2014b).

The results of water sampling and quality analysis have been collected and collated by Tullow for strategic water resources since 2014. These are groundwater wells used to source exploration supplies and supplement the water supply of local residents (see Section 9.1.1.5). The locations within or close to the EOPS study area are Kengomo 1, Kengomo 2, East Lokichar WBHC, Ngamia East, Nakukulas 9, Nakukulas 10, Ewoi, Ekunyuk and Nabolei.

Golder has also taken groundwater samples from some of these locations so the whole water quality dataset has been combined and is presented in Section 8.1.2.2.

8.1.2 Primary Data

8.1.2.1 Methods

8.1.2.1.1 Sampling Locations and Dates

As part of a wider scheme of groundwater monitoring that is undertaken by Tullow, Golder has collected water quality samples from selected groundwater wells. The Golder groundwater monitoring points of most relevance to the study area are as follows:

- GW1 (same as Tullow location East Lokichar WBHC) – down-gradient of the wellfields and within the study area;
- GW2 (same as Tullow location Ngamia East) - down-gradient of the Ngamia wellfield;
- GW3 (same as Tullow location Nakukulas 9) - down-gradient of the Amosing wellfield; and
- GW5 – immediately down-gradient of the study area.

The Golder surface water monitoring points within the study area are as follows:

- SW1 – position on the southern lugga that drains the area of the Ngamia and Amosing wellfields and feeds into the Kalabata River. Downstream of the wellfields;
- SW2 – position on the Kalabata River downstream of the wellfields;

- SW3 - position on the Kalabata River downstream of the wellfields; and
- N1 – located downstream of the Ngamia wellfield. .

The locations of the groundwater and surface water monitoring locations are shown on Drawing 8-1.

Flow in surface watercourses in the study area is ephemeral and watercourses are commonly dry. Therefore, surface water quality sampling has been taken from near-surface groundwater in dry luggas, equivalent to that used as water resources for local communities.

Three field visits were undertaken by Golder and EMC Consultants (23 to 27 November 2015, 25 May 2016 to 1 June 2016, and 24 to 31 August 2016). The two 2016 field surveys were completed to cover the wet season and post-wet season.

8.1.2.1.2 Field Parameter Measurements

The water quality sampling undertaken included recording field parameters (pH, electrical conductivity, total dissolved solids, dissolved oxygen, temperature and oxidation reduction potential) using a handheld multi-parameter water quality meter. Method statements prepared to provide instruction on taking field parameter measurements were original prepared and presented as part of the Work Plan for Baseline Study (Golder, 2015), and a copy is included in Appendix F.

8.1.2.1.3 Laboratory Analysis and Quality Assurance

At the same time as the field parameter measurements were taken, water samples were collected in labelled bottles and stored in dedicated sample refrigerators before being sent to the (ISO accredited) SGS laboratory in Nairobi. Method statements prepared to provide instruction on taking water quality samples were original prepared and presented as part of the Work Plan for Baseline Study (Golder, 2015), and a copy is included in Appendix F.

The analysis parameters and detection limits requested by Golder are included in Appendix F. These included major ions, metals, hydrocarbons and sanitary parameters such as coliforms, all of which were selected in order to characterise the baseline chemistry of the water environment and include indicators that could be at risk of release during accidents during operations.

A combination of field blanks, trip blanks and duplicate samples were used for quality assurance purposes. These samples were also sent to the laboratory for analysis. A field blank is de-ionised water that is exposed to the sampling equipment in the field and handled in the same manner as the actual sample to provide information on the potential for contamination of samples during handling. The trip blank is de-ionised water that is prepared in a bottle at the laboratory and sealed. This sample remains unopened throughout the monitoring visit and is used to understand the potential for contamination of samples resulting from preparation, transport and storage activities. Duplicates are second samples taken from one of the monitoring locations and are used to understand the precision of the field technique and laboratory analysis.

Golder undertook a quality assurance (QA) and quality control (QC) exercise on the laboratory sample results and the follow key observations were made:

- Limits of detection requested were not achieved for some of the parameters - specifically, benzene, toluene, ethylbenzene, xylene, Poly-Aromatic Hydrocarbons (PAHs) and the majority of metals;
- Where limits of detection were not exceeded, the limit of detection achieved was not stated in many cases;
- Some requested analyses were not undertaken;
- The trip blank contained higher concentrations of potassium, sodium, chloride, total alkalinity and silica than would be expected in de-ionised water;
- The duplicate sample showed differences in concentrations when compared to the sample taken from the same location, which suggests there is low reproducibility of analysis in the laboratory; and
- The assessment of ionic balance suggests an imbalance in the laboratory results.

The findings of the QA/QC assessment were communicated to SGS laboratory following the initial results and have been acknowledged for improvements by the laboratory. It is assumed that these quality shortfalls do not have a material difference to the results presented herein.

8.1.2.2 Results

Golder visited water monitoring locations GW1, GW2, GW3, GW5, SW1, SW2, SW3 and N1 on three occasions between November 2015 and August 2016 to take water quality samples. Details of the sampling dates, locations where field parameter measurements could be made and locations where samples could be taken for laboratory analysis are as follows:

- 23 to 27 November 2015 - groundwater sampling was undertaken at GW1, GW2, GW3 and GW5. No surface water was present in the watercourses, so no samples were taken;
- 25 May 2016 to 1 June 2016 - groundwater sampling was undertaken at GW1, GW3 and GW5. No groundwater sample at GW2 was taken as the pump was being removed. A surface water sample was collected from SW3 and also from a hand dug well at SW1, but all other surface water quality monitoring locations were dry; and
- 24 to 31 August 2016 - groundwater sampling was undertaken at GW1, GW3 and GW5. No surface water was present in the watercourses, so no samples were taken.

The laboratory certificates for the analyses undertaken on groundwater and surface water samples taken by Golder are presented in Appendix F. The results of the field parameter measurements are included in Appendix F in the form of a summary document and also in the field reports (Golder, 2016a; Golder, 2016b; and Golder, 2016c).

In order to present summary information on the water quality at key monitoring locations in the study area and compare the results to water quality standards see discussion), a series of data and statistics tables have been prepared and are also presented in Appendix F. Only the results for parameters requested for analysis by Golder are included in the summary tables. Where additional analyses were performed, these data are only included in the laboratory certificates. Where Tullow data are also available for the same location, these data have also been added to the Golder data enhance the dataset. The full results of laboratory analysis undertaken on groundwater samples taken by Tullow at its strategic monitoring locations is presented in Appendix F, as provided to Golder.

8.2 Discussion

8.2.1 Field Parameters

The field parameter measurements indicate that both groundwater and surface water samples have a typical temperature of around 30°C to 35°C.

The pH of both groundwater and surface water is fairly close to neutral. The pH of surface water (from two samples taken in May/June 2016) ranges from 7.37 to 7.85 and the pH of groundwater (12 samples) ranges from 7.34 (GW5, May/June 2016) to 8.92 (GW3 August 2016), but it should be noted that the locations from which measurements at either end of this range were taken also gave pH measurements closer to neutral on other monitoring visits. As the pH of rainwater is typically slightly acidic, the natural pH is likely to be a reflection of contact with soils/sediments.

Electrical conductivity ranges between 0.2735 mS/cm and 0.575 mS/cm in surface water. The lower of the two measurements came from water at the surface, whereas the higher of the two came from a sample taken from just below the surface at SW1. Typically surface water that has come from rainfall will have a lower electrical conductivity that groundwater, which has been in contact with soils/sediments that can increase the presence of dissolved material that conducts electrical current; therefore, these results are as expected. The electrical conductivity of groundwater ranges between 0.721 mS/cm (GW1, August 2016) and 1.663 mS/cm (GW3, November 2015). Where samples have been taken from the same location at different times of the year, there is little similarity in the results indicating this parameter is quite variable. There are no clear temporal trends in electrical conductivity over the three monitoring rounds.

Dissolved oxygen in the surface water samples ranges from 2.02 to 5.02 mg/l (1 ppm = 1 mg/l). The dissolved oxygen concentrations measured in groundwater range from 0.7 mg/l (GW2, November 2015) to 5.51 mg/l (GW1, May/June 2016). The values indicate that the water is not completely saturated, but that the water is also not anoxic[2]. The dissolved oxygen concentrations were higher in May/June during the wet season (3.11 mg/l to 5.51 mg/l) than in November (0.7 mg/l to 2 mg/l).

Oxygen Redox Potential (ORP) was measured in November 2015 and May/June 2016. The results in surface water (May/June 2016 only) range from +62.3 mV to +77.6 mV. The measurements in groundwater range from -203.9 mV (GW2, November 2015) to +149.3 mV (GW5, May/June 2016). The ORP measures the capacity of a solution to either release or accept electrons from chemical reactions. All of the measurements made in November 2015 were negative (i.e. indicate a reducing environment) and all of the measurements in May/June (during the wet season) were positive (i.e. indicating an oxidising environment).

Total Dissolved Solids (TDS) was measured in August 2016. The result range from 263 mg/l (GE4) to 625 mg/l (GW3). These results are within the range expected for fresh water.

8.2.2 Laboratory Analysis

Summary statistics of the laboratory results for each of the monitoring locations are presented in Appendix F. A comparison to the project water quality standards has also been undertaken and values greater than the project standards are highlighted in red in Appendix F. The project standards were developed and presented by Golder (2016d) and presented in Volume IV. National Kenyan standards[3] have been selected, where available; followed by internationally recognized guidelines[4] where national standards are not defined.

In general water quality across the study area can be described as good with no inexplicable exceedances of water quality standards. There are some influences of the natural environment (high concentrations of sodium and fluoride). There is some evidence of sources of human or animal waste.

8.2.2.1 Groundwater

The laboratory water quality analysis results show that groundwater has a pH close to neutral and typically ranges from 7.5 to 8.5. The pH values are mainly within the range of the standard (>6.5 and <8.5), but there are occasional pH values greater than 8.5 measured in samples taken from, GW2 (Ngamia East), GW3, GW5 (Nakukulas 9), and Ewoi.

Electrical conductivity values typically range from 0.6 mS/cm to 1.2 mS/cm at GW1 (East Lokichar WBHC), GW2 (Ngamia East), GW5, and Nakukulas 10. Higher electrical conductivity measurements typically between 1.2 mS/cm and 2 mS/cm (but up to 3.5 mS/cm) were measured in samples taken from GW3 (Nakukulas 9), Kengomo 1, Kengomo 2, Ewoi and Ekunyuk. The higher electrical conductivity measurements are mainly, but not exclusively, from deeper boreholes.

Metal concentrations in groundwater are often below the laboratory limit of detection (LOD). Metals where all concentrations in all samples from all monitoring locations were below the LOD include arsenic, cadmium, chromium, lead, mercury, nickel and selenium. When analysed for, boron, vanadium, zinc and strontium were most commonly detected at concentrations greater than the LOD. Aluminium, barium, copper, manganese and iron were also detected at concentrations greater than the LOD, but in a lower proportion of samples taken. Most metal concentrations are below the selected water quality standards. Of the 13 samples taken from GW1 (East Lokichar WBHC), aluminium concentrations exceed the standard of 0.1 mg/l once, copper concentrations exceed the standard of 0.05 mg/l twice, manganese concentrations exceed the standard of 0.5 mg/l once and zinc concentrations exceed the standard of 1.5 mg/l once. Of the 13 samples taken from GW3 (Nakukulas 9) the aluminium concentrations exceed the standard of 0.1 mg/l twice, copper concentration exceeded the standard of 0.05 mg/l twice and iron concentrations exceed the standard of 0.3 mg/l once. Of the six samples taken from Nakukulas 10 the aluminium concentrations exceed the standard of 0.1 mg/l once.

[2] depleted of dissolved oxygen

[3] Kenyan Government, 2006. Environmental Management and Coordination Act (Water Quality Regulation) Schedule 1: Quality Standards for Sources of Domestic Water

[4] World Health Organization (WHO), 2011. Drinking Water Quality Guidelines – 4th edition

Of the 9 samples taken from Kengomo 1 the copper concentration exceeded the standard of 0.05 mg/l once and the iron standard of 0.3 mg/l once.

The concentrations of major ions are generally below the project water quality standards. Sodium concentrations are commonly elevated compared to project standard of 50 mg/l at all monitoring locations, which is likely to result from natural interactions between water and the geology. Fluoride concentrations are also elevated compared to the project standard of 1.5 mg/l in some samples from most locations, but elevated concentration have been measured most often in samples taken from Kengomo 1, Kengomo 2, Ewoi, Ekunyuk and Nabolei, which are all located to the north and northeast of the study area. Occasional exceedances of the chloride standard are also shown in the results from samples taken from Nakukulas 9, GW5, Kengomo 1, Ekunyuk and Nabolei.

Nitrate (as NO_3) is commonly measured at concentrations above the standard of 10 mg/l. Nitrate may originate from sources such as human or animal waste.

Concentrations of total dissolved solids (TDS) are high compared to the quality standard in samples taken from GW3 (Nakukulas 9), Kengomo 1, Kengomo 2, Ewoi, Ekunyuk and Nabolei.

Poly-aromatic hydrocarbons (PAHs) naphthalene, fluorine and phenanthrene were detected in groundwater occasionally at concentrations above the limit of detection when analysed for in GW1 (Lokichar East WBHC), GW3 (Nakukulas 9) and GW5, but not at GW2 (Ngamia East). The concentrations were typically at or just above the LOD of 0.01 mg/l.

Other hydrocarbon concentrations are also mainly below the LOD. The total petroleum hydrocarbon (TPH) concentration has occasionally been greater than the LOD of 0.01 mg/l. TPH has been detected once out of two samples taken from the boreholes at GW1 (East Lokichar WBHC), GW3 (Nakukulas 9) and GW5. Benzene and toluene have been detected at concentrations greater than the LOD once out of three samples at GW1 (East Lokichar WBHC) and GW3 (Nakukulas 9). Toluene has been detected once out of three samples taken from GW5. All of these detected concentrations occurred as part of the same analysis undertaken on samples from 29 August 2016 and could represent slight contamination during sampling or laboratory analysis.

Total coliform counts, where measured, are usually greater than the LOD and greater than the fecal coliforms count in the sample from the same location at the same time.

8.2.2.2 Surface Water

Due to the ephemeral nature of the watercourses and the opportunistic method of sampling, only two surface water samples were taken; one from SW3 and one from near surface groundwater in a shallow hole dug at SW1.

No concentration above the LODs were detected for aluminium, arsenic, beryllium, cadmium, chromium, copper, iron, lead, mercury, nickel or selenium. Of other metals that have project water quality standards (barium, boron and zinc) the concentrations measured are below the water quality standards.

The laboratory analyses indicate that the water quality standards for ammonia and total suspended solids were exceeded in the sample taken from SW3, and that ammonia and fluoride concentrations were higher than the standards in the sample taken from SW1.

Naphthalene was detected at a concentration of 4 mg/l at SW3 and pyrene was detected at a concentration of 0.03 mg/l at SW1. No other hydrocarbons were detected in either sample.

The coliform count (total and fecal) for surface water is higher than that for groundwater.

9.0 WATER QUANTITY

9.1 Baseline Data Gathering

9.1.1 Secondary Data

9.1.1.1 Hydrological Setting

The study area (Section 1.3) is located in an area where precipitation predominantly occurs in two rainy/wet seasons that are typically during April to June (the long rains) and October to December (the short rains). Much of the rain falls during the long rains. Rainfall for the remainder of the year is typically low and the area is often at risk of serious drought conditions (see further discussion on seasons in Section 5.3).

Precipitation data from a meteorological station location in the study area (Ngamia) has been collected for less than a year, but annual totals are available from a station at Lodwar (approximately 90 km north of the study area). The most complete data from Lodwar is available for the years 1978 to 1998 and 2004 to 2015. Using these years, the annual rainfall ranges between 38.9 mm and 453.5 mm with an average over of 197.8 mm. The average annual rainfall for the last 10 years (2006 to 2015) is 261.1 mm. Precipitation is discussed in more detail in Section 5.

Precipitation increases with altitude by about 60 mm per 100 m altitude gain (Price, 2016). Evapotranspiration decreases with altitude and mean annual evapotranspiration has been measured at Kabarnet as 1,934 mm and at Lokori as 3,999 mm (Price, 2016).

The study area is located in the South Lokichar Basin, which is part of the wider Lake Turkana Drainage Basin (Price, 2016). The study area is also located in the Kalabata sub-catchment of the Kerio basin (Worley Parsons Consulting, 2015a). The majority of the precipitation evaporates from the land surface, vegetation and lake surfaces; however, there is some surface water drainage from the study area that occurs in a generally northward direction towards Lake Turkana.

Drainage in the study area is dominated by a dendritic network of ephemeral streams that converge into larger channels (luggas) and drain towards the northeast. These luggas drain to the Kalabata River (also ephemeral), which then flows to the north along the western edge of an outcrop of Miocene volcanics (the Auwerwer Volcanics). Near Loperot, the Kalabata turns eastwards and exits the South Lokichar Basin flowing towards the Kerio Valley and then northwards towards Lake Turkana.

The drainage luggas in the study area are sandy and shallow, and the main channels are typically clear of vegetation with some vegetation along the banks (Worley Parsons Consulting, 2015a). There is flood attenuation capacity as the channels are shallow and there are wide flat plains with depressions where water can collect (Worley Parsons Consulting, 2015a). No flow records or flood level data were available for the area around the Ngamia well field where some flood risk modelling has been undertaken (Worley Parsons Consulting, 2015b).

Lake Turkana has an area of approximately 7,000 km^2. The Omo River, which flows in from Ethiopia, has a catchment of approximately 74,000 km^2 and provides around 55 % of the drainage basin area that feeds Lake Turkana and around 90 % of the flow into it (Atkins, 2014). The Turkwel River and the Kerio River provide the rest of the flow input to Lake Turkana, and the Kalabata River is a tributary of the Kerio River. On this basis, the inflow from the Kalabata River to Lake Turkana is relatively minor compared to other sources. There are no surface water outflows from Lake Turkana as evaporative losses balance inflow (Atkins, 2014), meaning the entire region forms an endorreic catchment i.e. one which does not ultimately discharge to the sea.

9.1.1.2 Recharge, Aquifers and Aquifer Properties

A study published in 2013 (Radar Technologies International, 2013) looked at the potential groundwater resources in northern and central Turkana County. The findings presented recharge values of 10 % to 20 % of rainfall. However Tullow (2015a) questioned this and proposed literature values for arid and semi-arid regions range from 0.1 % to 5 % of long-term average rainfall to be more appropriate.

During heavy rain storms, large volumes of water fall onto the ground over short periods of time and water input can exceed evapotranspiration and recharge aquifers where the ground is permeable and run-off as drainage where the ground is less permeable (Price, 2016). Recharge to aquifers or extensive surface run-off and drainage does not occur regularly and may only occur every few years or decades (Price, 2016). The average effective precipitation (i.e. the precipitation that is not lost by evaporation or transpiration) is estimated in Price (2016) to be less than 20 mm/yr (which is ~8 % of annual average rainfall).

Water wells have been drilled during the exploration works and the hydraulic property information determined from pumping tests and presented in Price (2016) are summarised in Table 9-1.

Table 9-1: Summary of Aquifer Hydraulic Properties (Source: Price, 2016)

Deposit/Aquifer	Description	Test Location	Transmissivity	Storage Coefficient	Yield
Sediments (Plio-Holocene)	Not provided	Ngamia 4	No data presented	No data presented	<1 m^3/hr
Auwerwer Volcanics (Miocene)	Basalt lava flows with interflow units of clay, silt, sand and occasional gravels and cobbles (water mainly from sedimentary interflow units 5 m to 20 m thick)	East Lokichar	<1 m^2/d	10^{-4}	No data presented
		Lokwii	>750 m^2/d	No data presented	No data presented
		Geometric Mean (excluding Lokwii)	~10 m^2/d	No data presented	No data presented

Wells drilled in the Auwerwer Volcanics as part of a study into water supplies (Unknown, 2014) indicated typical production rates of approximately 8 m^3/hr to 12 m^3/hr with a maximum of 23 m^3/hr. The most productive wells come from those that encounter the sandy sedimentary interflow deposits; those wells that only intersected the lavas have been found to be unproductive (Price, 2016).

Wells drilled into the river gravels of the Kerio Valley indicate the presence of fresh water and had production rates up to 50 m^3/hr. Wells drilled in surface sands encountered little groundwater and the sand was often well cemented reducing its permeability.

Under un-pumped conditions at East Lokichar WBHC a downward hydraulic gradient was measured, indicating that the well is located in a recharge area. During pumping the gradient reversed with upward flow from the deeper units as the water abstraction tapped water storage in deeper units. At East Lokichar WBHA the vertical hydraulic gradient in the un-pumped well was determined to be downwards and the gradient was estimated as 0.035. The vertical conductivity was also estimated to be approximately 0.0001 m/d, which is in the range of published values for basalt flows (Price, 2016).

The rate of groundwater flow in the sedimentary interflow units of the Auwerwer Volcanics has been estimated in Price (2016) to be supported by infiltration of 1 mm/yr to 2 mm/yr.

9.1.1.3 Groundwater Elevations and Flow Direction

Groundwater was typically encountered during water study drilling (Unknown, 2014) at depths between 20 m and 40 m below ground level (m bgl).

From the limited data available, an attempt was made in Price (2016) to contour the water levels in the shallow aquifer units using the maximum levels recorded for each well. The results of that exercise showed that groundwater flow is predominantly north-eastwards towards the Kerio Valley and Lake Turkana, but there was insufficient data to indicate whether there is groundwater discharge to the Kerio River. Measurements of the hydraulic gradient between various locations indicated a range of 0.0026 to 0.0076 (Price, 2016).

Water levels in the units below the Auwerwer Shales were also estimated in Price (2016) using data derived from measurements in oil exploration or appraisal wells. The results indicate that the piezometric head in the central Lokichar area is around 600 m asl. The groundwater flow direction in the deeper volcanic units is also towards the north-east towards the Kerio Valley and Lake Turkana (Price, 2016).

9.1.1.4 Regional Water Use

The National Drought Management Authority (NDMA, 2016) produce monthly drought early warning bulletins that include a summary of water sources in Turkana County. The summaries available for the period between January 2015 and October 2016 indicate that a range of water sources are used for domestic supply and for livestock, including rivers, springs, lakes, pans and dams, river wells, shallow wells and boreholes. The summary reports also indicate that surface water sources are the main source of supply during the rainy season and boreholes are used more when surface supply availability declines.

9.1.1.5 Local Water Use

Historically, the water sources in the local grazing lands were provided by surface water pans and lugga shallow wells during the wet season (Tullow Oil, 2015b). These dried up fairly rapidly after the rains stopped and people had to walk further to access alternative supplies. Between 2012 and 2014, Tullow Kenya, B. V. initiated a regular supply of water for local communities from tanks positioned at 23 locations (Tullow Oil, 2015b), which are used for watering livestock, potable and non-potable supplies. The tanks are mainly filled by tankering water from some of a series of WRMA-permitted abstraction boreholes (Ngamia East, East Lokichar WBHC, Nakukulas 9, Nakukulas 10, Kengomo 1, Kengomo 2, Nabolei, Ekunyuk and Ewoi – see Figire 9-1), although a few tanks are filled by pipe as they are close to the supply well. Not all boreholes have been, or are being used at the same time. Information on the volumes abstracted from the wells and supplied to the communities is presented below. These sources augment supplies from springs, oases, shallow wells and deep wells that are also used by the local population. The distances travelled from the communities to these other sources of water typically range from 0.5 km to 15 km (Tullow, 2015b). Prior to Tullow's provision of water resources to local communities, community water supplies tended to come from hand dug wells in luggas and hand pumped wells installed by NGOs.

In addition to augmenting local water supplies, Tullow uses the water from the boreholes for exploration drilling, civil engineering requirements (e.g. road and wellpad construction), and field camps. The water is mainly piped from the wells; the pipeline network is shown in Figure 9-1. Additional permitted water abstraction for specific exploration operations is occasionally drawn in from other water sources. The source of the water is groundwater from shallow aquifers predominantly along river valleys and the edge of the volcanic deposits.

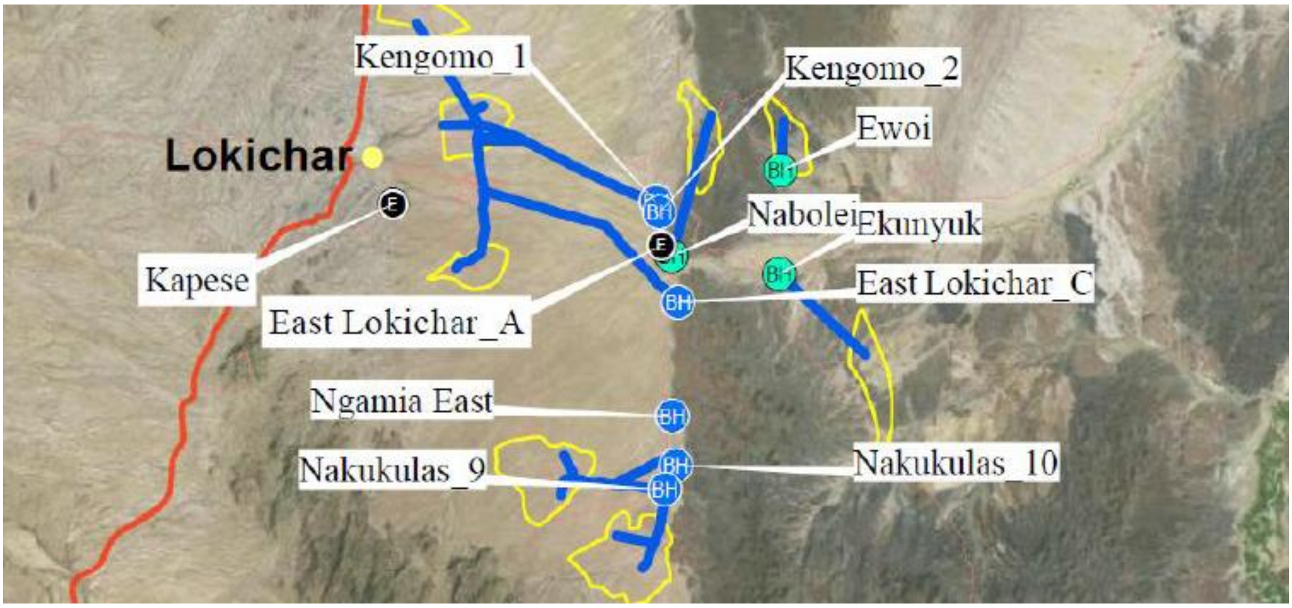

Figure 9-1: Tullow Production Boreholes and Distribution Pipelines (Source: Tullow, 2016)

In 2014 the demand from the supply wells was approximately 650 m^3/d (Tullow, 2014) and in 2015 the demand was approximately 500 m^3/d (Tullow, 2015c). In November 2016, four of the production boreholes were being operated by Tullow for exploration water and community supply; these were East Lokichar WBHC, Nakukulas 9, Nakukulas 10 and Kengomo 1 (Tullow, 2016). The production from the four wells in October 2016 was 430 m^3/d and the production in November 2016 was 389 m^3/d.

Details of the well production, status, use, production volume and potential yield as of November 2016 is presented in Table 9-2 and a profile of water production across the Tullow wells is presented in Figure 9-2. The limit of the output of each of the wells is based on the long-term sustainable yield rather than a specific permitted abstraction rate.

Table 9-2: Summary of Production Well Status, November 2016 (based on Tullow, 2016)

Tullow Production Borehole	Status	Use	Production Volume m^3/d	Potential Yield m^3/d
Kengomo 1	Operational	Supplies Twiga/Etom/Erut area	44	130
Kengomo 2	Being recommissioned	Not producing	0	100
Nabolei	Community	Not producing	0	<50
Ekunyuk	Community	Not producing	0	190
Ewoi	Community	Not producing	0	190
Nakukulas 9	Operational	Supplies Amosing/Ngamia area via pipelines	133	190
Nakukulas 10	Operational	Supply for community in Nakukulas area	99	130
East Lokichar WBHC	Operational	Main supply for Kapese camp. Lagoon also available for loading bowsers	114	240
Ngamia East	Being recommissioned	Not producing	0	190

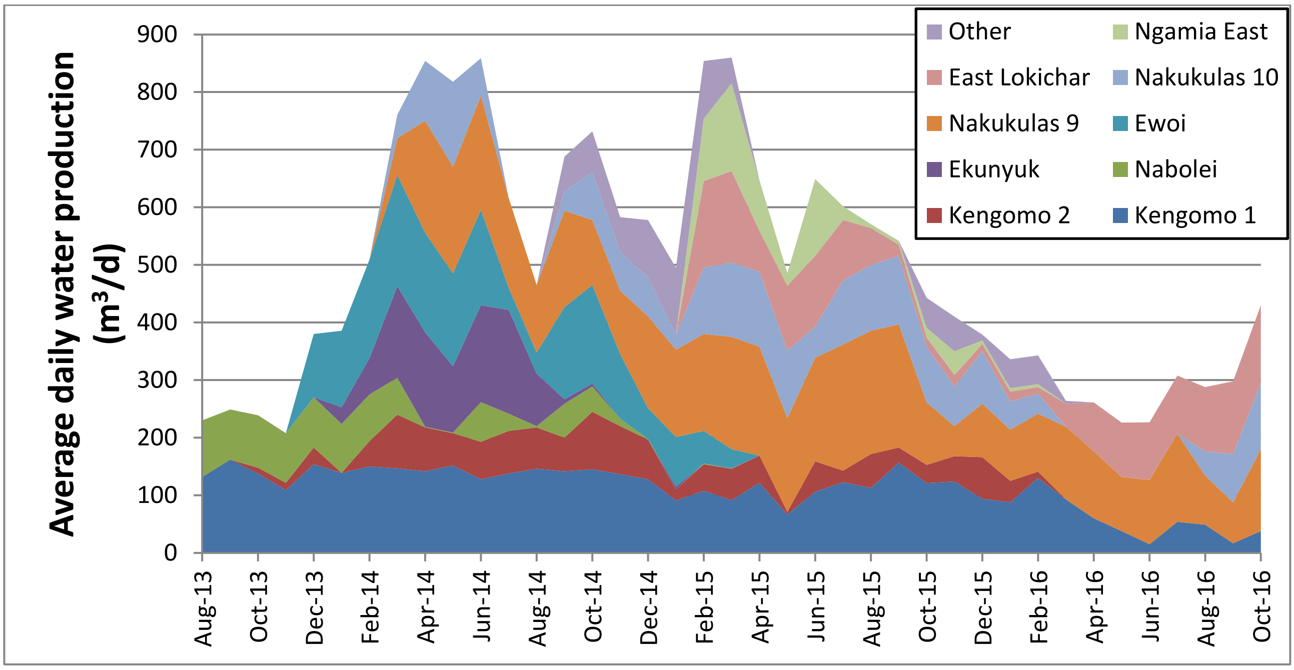

Figure 9-2: Tullow Borehole Production Profile (after Tullow, 2016)

Of the total volume abstracted from the Tullow abstraction wells, the volume that was used to augment the local community supplies was about 70 m^3/d between July 2014 and December 2015 and 100 m^3/d between January 2016 and November 2016.

9.1.2 Primary Data

9.1.2.1 Methods

Primary data to inform the baseline water quantity section has been gathered by Golder and Golder's subcontractors EMC, or provided by Tullow. This includes infiltration tests, groundwater level monitoring and surface water flow monitoring. Details about the method used are presented in the sub-sections below. Results are presented in Section 9.1.2.2.

Field trips by Golder and/or EMC were completed during the following periods:

- 23rd to 27th November 2015;
- 25 May 2016 to 1 June 2016; and
- 24th to 31st August 2016.

9.1.2.1.1 Infiltration Tests

Field infiltration rate tests were undertaken by EMC on behalf of Golder between 29 and 31 May 2016. The infiltration tests were completed using a double open ring infiltrometer and comprised falling head tests where the time taken for the water level within the infiltrometer to drop was recorded until a constant value (or a change of <10%) was measured. Tests were performed at five sites; the locations of which are illustrated in Figure 9-3 and presented in Table 9-3.

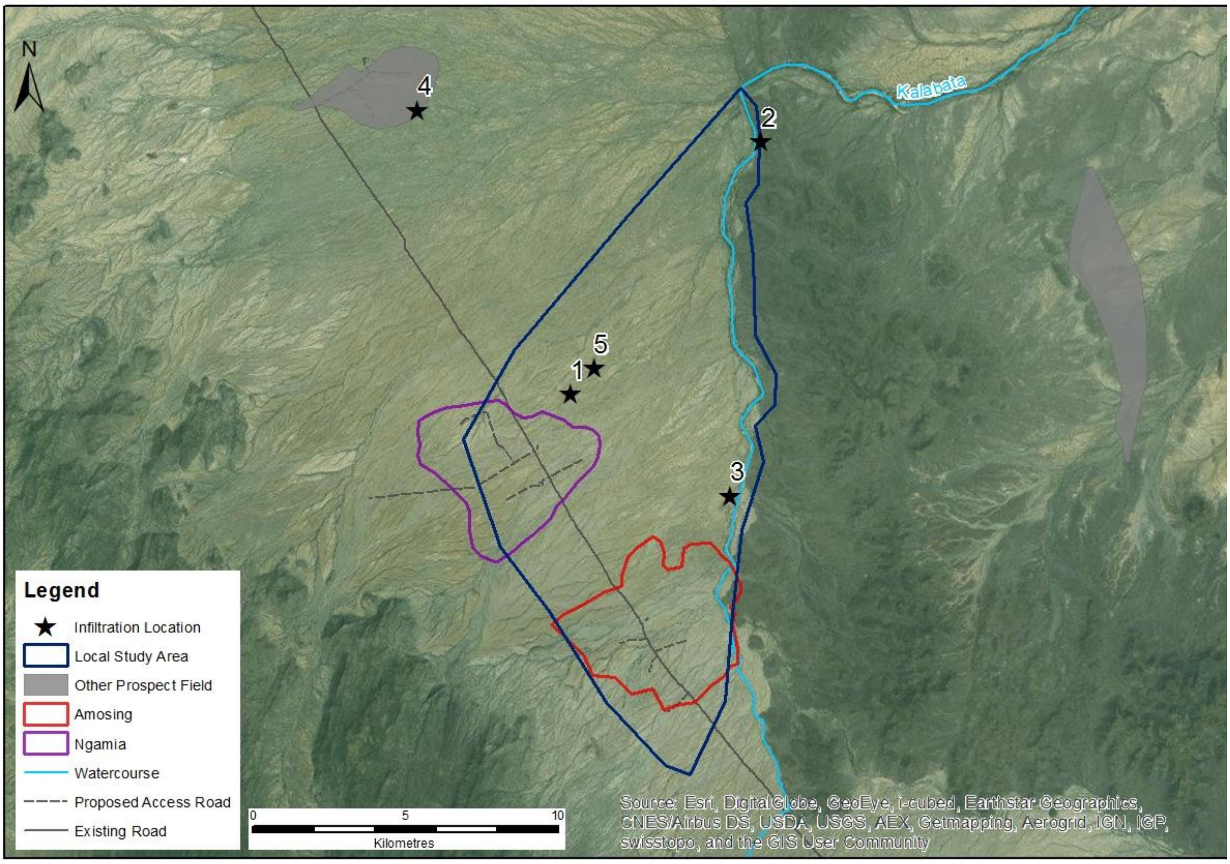

Figure 9-3: Location of Infiltration Test Sites

Table 9-3: Infiltrometer Test Coordinates

Test Location	Latitude	Longitude
Field test 1	2°13'59.91"N	35°46'11.75"E
Field test 2	2°18'28.40"N	35°49'33.90"E
Field test 3	2°12'11.19"N	35°48'59.92"E
Field test 4	2°19'2.93"N	35°43'29.56"E
Field test 5	2°14'27.43"N	35°46'36.29"E

9.1.2.1.2 Groundwater Level Monitoring

Groundwater level data taken from boreholes during 2015 and 2016 are available from Tullow. Measurements of the depth to groundwater have been taken at sporadic intervals and converted to elevations. Some locations have had Troll ® water level monitoring devices placed in them for some of that period to remotely record water levels at specified intervals. A summary of the available data is presented in Table 9-4. Comment is also included in the table as to the selection of data used to inform the EOPS baseline.

Table 9-4: Summary of Available Groundwater Level Monitoring Data (Source: Tullow)

Location	Dip Data Available (date range)	Troll ® Data Available (date range)	Comment
Nakukalas 9 (also referred to as Golder	Yes	Yes (26 June 2016 to 11 October 2016)	Located in EOPS study area. Location included in baseline summary

Location	Dip Data Available (date range)	Troll ® Data Available (date range)	Comment
monitoring location GW3)	(January 2015 to October 2015)		
Nakukulas 10	Yes (January 2015 to October 2015)	No datalogger installed	Located in EOPS study area. Location included in baseline summary
Ngamia East (also referred to as Golder monitoring location GW2)	Yes (January 2015 to October 2015)	Yes (29 September 2005 to 7 November 2015) (26 June 2016 to 31 October 2016)	Located in EOPS study area. Location included in baseline summary
East Lokichar A 1S	Yes (January 2015 to October 2015)	Yes (31 May 2015 to 5 November 2015) (26 June 2016 to 10 October 2016)	A cluster of monitoring locations in the EOPS study area that are referred to with the prefix “East Lokichar”. East Lokichar WBHC has a surveyed location, is a production well and Golder groundwater quality monitoring location GW1 (Section 8). Groundwater elevations in the other wells are similar. Location East Lokichar WBHC only will be included in baseline summary.
East Lokichar A 2A	Yes (May 2015 to September 2015)	Yes (1 June 2015 to 17 June 2015) (26 June 2016 to 9 August 2016)	
East Lokichar WBHC (also referred to as East Lokichar C 2A)	Yes (March 2015 to November 2015) (October 2016)	Yes (26 June 2016 to 10 October 2016)	
East Lokichar Piezo A	Yes (January 2015 to November 2015)	Yes (16 March 2015 to 2 November 2015)	
East Lokichar Piezo B	Yes (January 2015 to November 2015)	Yes (22 March 2015 to 2 November 2015)	
Nabolei	Yes (January 2015 to July 2015)	Yes (23 May 2015 to 21 July 2015)	Located approximately 0.6 km north of the EOPS study area. Location included in baseline summary
Kengomo 1	Yes (January 2015 to October 2015)	Yes (1 June 2015 to 18 September 2015) (26 June 2016 to 9 August 2016)	Located approximately 4 km north of the EOPS study area – dip and logger data available. Location included in baseline summary
Kengomo 2	Yes (January 2015 to October 2015)	No datalogger installed	Located approximately 3.5 km north of the EOPS study area – less data than Kengomo 1 and dip data only. Location not included in baseline summary

Location	Dip Data Available (date range)	Troll ® Data Available (date range)	Comment
Ekunyuk	Yes (January 2015 to June 2015)	Yes (1 June 2015 to 6 July 2015)	Located approximately 5.5 km east of the EOPS study area. Location included in baseline summary
Ewoi	Yes (January 2015 to June 2015)	Yes (2 June 2015 to 15 June 2015)	Located approximately 9 km northeast of the EOPS study area. Location included in baseline summary to enable groundwater flow direction
Lokwii	Yes (September 2015)	Yes (15 September 2015 to 8 August 2016)	Located outside EOPS over 30 km to the south east. Data not included in baseline.
Turkwel East (also referred to as Turkwel Lodwar East, Turkwel East AA or Loreng'elup)	Yes (July 2015 and September 2015)	Yes (27 July 2015 to 30 October 2015) (28 July 2016 to 27 October 2016)	Located outside EOPS over 90 km to the north. Data not included in baseline.
Epir	Yes (January 2015 and September 2015)	Yes (24 September 2015 to 30 October 2015) (27 August 2016 to 27 October 2016)	Located over 70 km northeast of EOPS. Data not included in baseline.
Engomo	Yes (January 2015 to February 2015)	No datalogger installed	Located outside EOPS over 200 km to the north. Limited data availability. Data not included in baseline.
Kapese	Yes (May 2015 to October 2015)	Yes (26 May 2015 to 5 November 2015) (26 June 2016 to 10 October 2016)	Located approximately 10 km northwest of the EOPS study area. Location included in baseline summary to enable groundwater flow direction

9.1.2.1.3 Surface Water Flow Monitoring

Surface water flow monitoring has been undertaken using continuous water level data collection using pressure transducers (level loggers) and estimated ratings relationships based on site observations of watercourse bed properties and surveyed cross sections of the ephemeral watercourse. The continuous monitoring locations were selected based on sites where uniform, in-bank flows could occur and were positioned to provide representative baseline data across the wider development area.

The field teams were prepared for manual surface water flow measurements, however due to the response of the catchments to rainfall and the unpredictable and infrequent rains no opportunistic flow measurements were made during the field visits.

Surface water level loggers were deployed at SW1, SW2 and SW3 in November 2015 with the aim of capturing flows in the March/April 2016 wet season. At the same time as the level loggers were deployed, the channel cross sections were surveyed at these three locations and at N1. The survey cross sections are included in Appendix F.

Level and flow data was acquired, with varying success, within or downstream of the study area at the locations presented in Table 9-5.

Table 9-5: Surface Water Monitoring Locations Relevant to the EOPS Study Area

Location	Latitude	Longitude	Flow Monitoring	Comment
SW1	2° 18' 27.8"" N	35° 49' 27.4"" E	Level Logger (Rugged Troll 200)	Level logger lost - no data available
SW2	2° 19' 43.7"" N	35° 49' 37.3"" E	Level Logger (Rugged Troll 200)	Level logger lost - no data available
SW3	2° 19' 48.6"" N	35° 49' 50.5"" E	Level Logger (Rugged Troll 200)	Some level logger data available
N1	2° 13' 42.8"" N	35° 47' 16.4"" E	Hand measurements	Location dry on all occasions visited
Barometric Logger*	2° 21' 43.7"" N	35° 43' 14.1"" E	Not applicable	-

* The level loggers record pressure. The pressure data was downloaded and corrected for atmospheric changes using data downloaded from a barometric pressure logger installed at a nearby location at a similar altitude. The atmospheric compensated pressure data was then converted to a water level

The surveyed channel sections were used to assess the hydraulic capacity of the channel at the monitoring locations using the U. S. Army Corps of Engineers 'Hydraulic Engineering Center River Analysis System' (HECRAS). The section details were built into a model of the system. The model assumed a Manning's "n" coefficient value of 0.03 for the main lugga channels and 0.045 for the overbank areas. Modelled flow, the level data and surveyed cross section information was then used to develop a rating curve to understand the relationship between water level in the channel and flow to be able to convert the corrected level logger data to channel flows. The HECRAS sections are presented in Appendix F. The ratings curve developed for SW3 is presented in Figure 9-4.

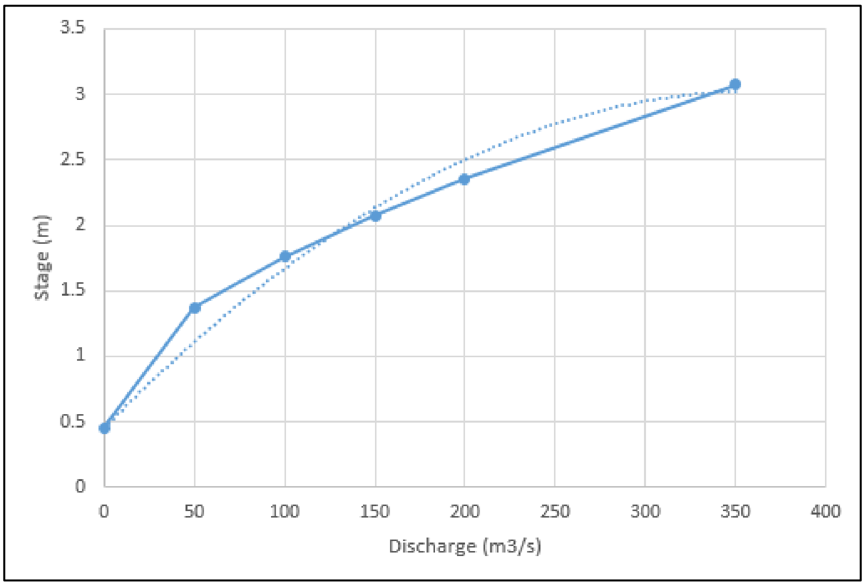

Figure 9-4: SW3 Rating Curve

9.1.2.2 Results

9.1.2.2.1 Infiltration Tests

The infiltration rates obtained by analysing the results of the infiltration tests are presented in Table 9-6. It should be noted that field tests 3 and 5 were ceased before a constant infiltration rate was reached, so the infiltration rates presented are approximate.

Table 9-6: Measured and calculated soil infiltration rate test results

Field test	Measured value	Calculate value	
	Infiltration rate [cm/min]	Infiltration rate [cm/min]	Saturated vertical hydraulic conductivity [cm/min]
Field test 1	0.291	0.350	0.449 (8×10^{-5} m/s)
Field test 2	0.065	0.063	0.049 (8.3×10^{-6} m/s)
Field test 3	Approx. 0.7	0.663*	0.154* (2.6×10^{-5} m/s)
Field test 4	0.320	0.322	0.459* (7.7×10^{-5} m/s)
Field test 5	Approx. 0.33	0.377*	0.565* (9.4×10^{-5} m/s)

**the calculated value is indicative as the infiltration rate was not fully stabilised before the test was finished.*

9.1.2.2.2 Groundwater Level Monitoring

The depth to groundwater for the selected study area locations have been graphed and are presented in Appendix F. Using the reference elevations of these monitoring locations, the dip measurements have also been converted to elevations and are presented on a graph in Appendix F.

It should be noted that pumping has taken place from Ngamia East, Nakukulas 9, Nakukulas 10, Kengomo 1, and East Lokichar WBHC; therefore, the groundwater levels on some occasions will be affected by this. It should also be noted that the geology in the area comprises complex and varying layers, which the monitoring wells have commonly been screened; therefore, no attempts has been made to separate the water level monitoring data into groups specific to a single stratum.

The dip measurements (excluding those taken when pumping is known to have been taking place) indicate that groundwater is typically encountered within 5 m to 20 m bgl. The dip to groundwater at Kapese is around 30 m below ground level (bgl) (~698 m asl). The difference in depth to groundwater from other locations, is likely to be due to the monitoring location being positioned at a higher elevation in the east of the basin. The groundwater elevations are in the northwest at Ewoi, Ekunyuk and Nabolei (~590 to 600 m asl). This indicates groundwater flow is towards the northeast. The groundwater elevation does not vary notably over time.

A graph of the groundwater elevations determined from the level logger data are presented in Appendix F. These data are highly variable and clearly show a range of groundwater elevations at some of the locations that represent groundwater lows (typically during the day when pumping is taking place) and groundwater highs (typically during the night when pumps are switched off). These data suggest that the resting groundwater elevations at the pumped wells are around 660 m asl at Nakukulas 9, 615 m asl at Kengomo 1, and 620 m asl at East Lokichar WBHC. The highest and lowest groundwater elevations are the same as the manual dip measurements (indicating the general direction of groundwater flow is towards the northeast) and there are no clear seasonal variations in the dataset.

A contour plot for the period 15 to 17 June 2015 (the narrowest date period with the most groundwater elevation data) is presented in Drawing 9.1. Drawing 9.1 indicates an estimated regional gradient of 0.0053, which falls within the range of gradients estimated in Price, 2015 (0.0026 to 0.0076).

9.1.2.2.3 Flood Level Estimation

Flood debris can (in the absence of other information) be associated to the last highest flood flow at a river section. Using the ratings curve from the HECRAS model discussed in section 9.1.2.1.3 and field observations of the maximum elevation of flood debris, the flood flow velocity required to generate flow debris at a certain elevation can be estimated.

Using the observed flood debris elevation at SW1 of 634.2 m above sea level (m ASL) and the ratings curve developed for that monitoring location, the estimated flood flow along the Kalabata is approximately 150 m^3/s. The HECRAS modelling also indicates that the velocity would be 1.6 m/s during this size event, which is in agreement with the expected flood flow given the low gradient of the channel invert.

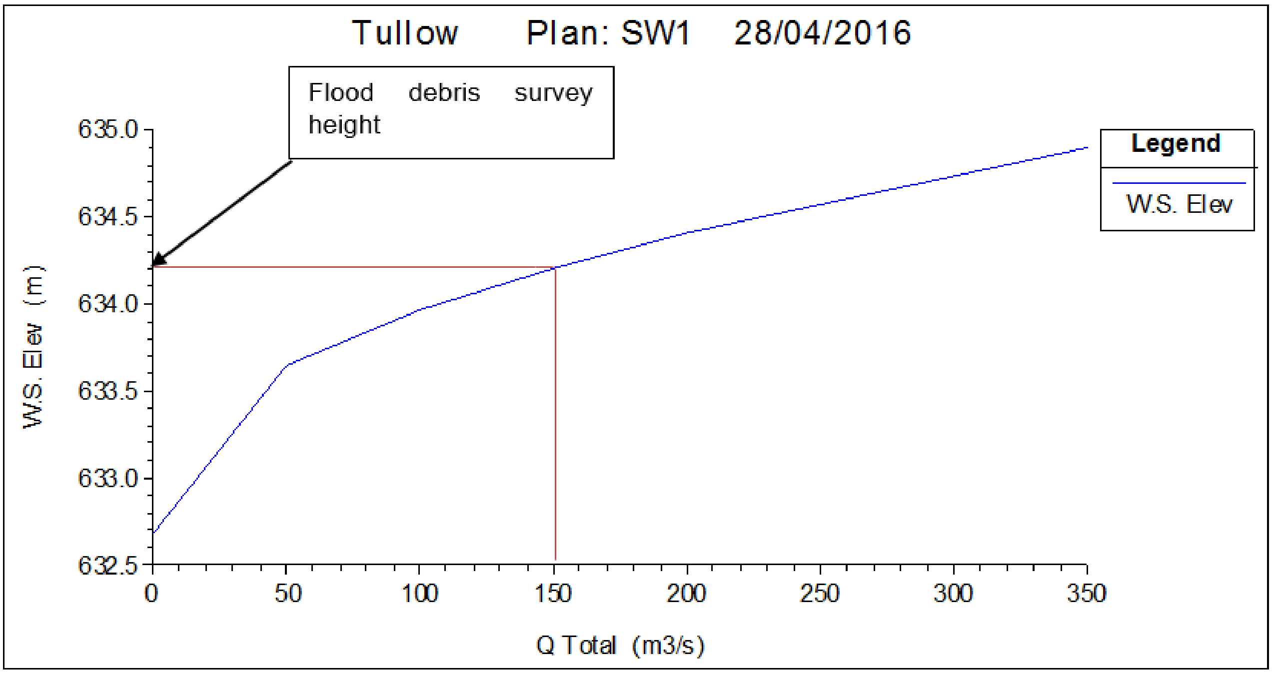

Figure 9-5: Predicted Flood Flow using SW1 Rating Curve

9.1.2.2.4 Surface Water Flow Monitoring

This section presents a summary of the key surface water flow monitoring results. The full field reports are included in Appendix F.

The field work undertaken between 25 May 2016 and 1 June 2016 found that that level loggers at the locations SW1 and SW2 could not be located and were likely washed away. The level logger at SW3 was located and data for the period 26 November 2015 to 28 May 2016 was downloaded. Monitoring location SW3 was revisited and data for the period 26 November 2015 to 29 August 2016 was also downloaded. This provided the only surface water data available for the baseline. Figure 9-5 presents the pressure data that was captured and highlights flow events associated with the wet season.

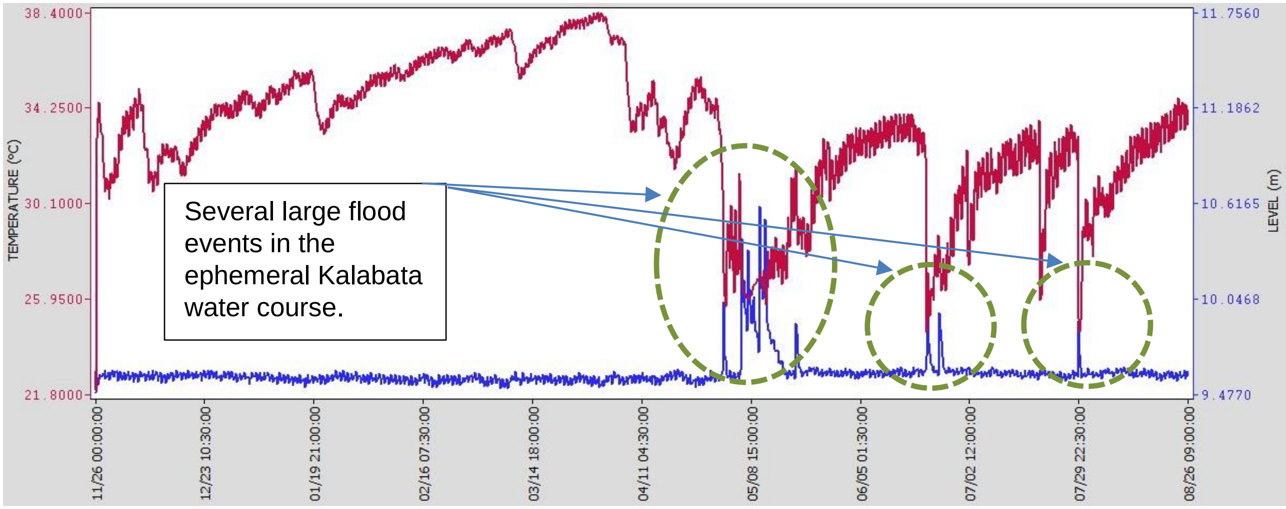

Figure 9-6: SW3 - Watercourse level data (26 November 2015 to 29 August 2016)

The pressure data downloaded from the level logger at location SW3 has been compensated for atmospheric pressure changes and converted to flow using the ratings curve (Figure 9-7). The flow data has then been compared to rainfall data from a monitoring station at Ngamia in Figure 9-7. The graph focusses on the data collected over the period when the majority of the rainfall occurred (i.e. April and May 2016). The graph shows that there is a fairly consistent response between rainfall and the data recorded at SW3.

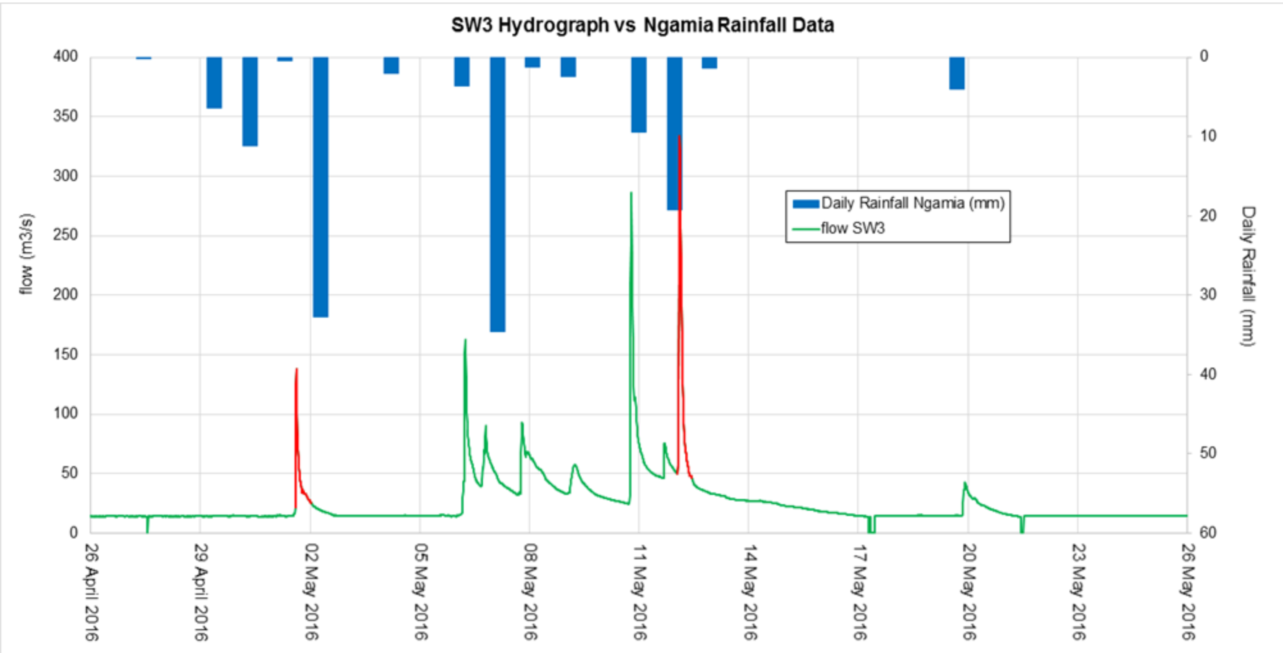

Figure 9-7: SW3 – Calculated Flow comparison to Rainfall Recorded at Ngamia

The hydrological response of the Kalabata catchment (area estimated as 468 km^2) has been characterised using the two most distinct events that were recorded at SW3 (1 May 2016 and 12 May 2016 shown in red on Figure 9-7) and have a clear association with large daily rainfall events recorded on the Ngamia rainfall gauge, which is located within the same catchment. Run-off coefficients for the catchment have been calculated using the hydrographs on 1 May 2016 and 12 May 2016. The coefficients for both events are a similar range between 22 % and 23 %.

9.2 Discussion

Based on the available secondary and primary data sources presented above, the following statements can be made about the surface water and groundwater system:

- The study area is located in an arid environment with drainage provided by an extensive dendritic network of wide shallow streams (luggas);
- Rain falls during the long wet season (March – June) and the short wet season (November – December);
- The main watercourse that flows through the study area is the Kalabata River, which is located in a valley to the east of the Ngamia and Amosing well fields. This is an ephemeral watercourse that is fed by direct precipitation, run-off and ephemeral flow from natural ditches (lugga) that provide a drainage network from the southwest;
- Flow in the luggas is ephemeral and driven by short duration, intense seasonal rainfall, as is shown by the data collected at SW3. Given the lack of vegetation, this likely leads to extensive erosion, high suspended solids content and rapid channel migration;
- Flood attenuation is provided by the shallow lugga channels, which are largely free of vegetation, and depressions in the surrounding wide, flat plains;
- Using the elevation of observed flood debris and HECRAS modelling, the flood flow on the Kalabata (at SW1 and SW3) is estimated to be between 150 m^3/s and 330m^3/s with velocities exceeding 1.5 m/s;
- Much of the rainfall will run-off the more compacted, less permeable, higher ground and provides the ephemeral flow in the luggas. The run-off coefficient for the Kalabata catchment, in which the study area is located, has been estimated as 22 % to 23 %;
- The luggas are shallow. The beds of the luggas are typically composed of unconsolidated sand and some fine gravels. Surface water infiltration and subsequent bed saturation, when evapotranspiration does not exceed rainfall, will occur quickly;
- Infiltration rates to the ground from tests have been calculated to be between 0.063 cm/min and 0.663 cm/min. The saturated vertical hydraulic conductivity is calculated to range from 8.3×10^{-6} m/s to 2.6×10^{-5} m/s;
- When rainfall exceeds evapotranspiration aquifer recharge will to occur and, during storms, surface water flow can occur. Given the high evapotranspiration rates, recharge to aquifers, or extensive surface run-off and drainage towards Lake Turkana, does not occur regularly and may only occur every few years or decades;
- Rainfall is reportedly spatially variable on a very small scale, so when surface flows do occur there is potential for a lugga to flow at one location and the same lugga to be completely dry elsewhere;
- Recharge is most likely to occur during the longer periods of rainfall or during heavy rain storms when large volumes of water fall onto the ground over short periods of time. Aquifer recharge in arid areas such as this is likely to be less than 10 % of long-term average rainfall. Estimates of local infiltration rates range between 1 mm/yr and <20 mm/yr;
- The primary data indicates that groundwater is typically encountered at depth of 5 m to 20 m bgl in the wells located in the east of the basin in which the study area is located;
- The depth to groundwater is greatest where the topographic elevation is highest (~ 30 m bgl at Kapese) and in the area just to the north of the study area (35-40 m bgl in Nabolei and Kengomo 1);
- The groundwater flow direction indicated by both secondary and primary data sources is towards the northeast, which corresponds with drainage towards the Kalabata River;

- Vertical hydraulic gradients in groundwater are reportedly downwards under non-pumping conditions. An estimate of the vertical downwards hydraulic gradient at East Lokichar WBHA is 0.035 and the vertical conductivity was estimated to be approximately 0.0001 m/d;
- Measurements made in wells in the Miocene volcanic sequence indicate the transmissivity is highly variable and test results have a range from <1 m/d to >750 m/d. Transmissivity values measured in wells in the alluvial deposits range from >600 m/d to >5,000 m/d;
- The estimated regional hydraulic gradient towards the northwest is 0.0053, which falls within the range of gradients estimated in Price, 2015 (0.0026 to 0.0076);
- Groundwater is abstracted from wells as a source of exploration water by Tullow. In November 2016 the main exploration local water supply abstraction was occurring from East Lokichar WBHC, Nakukulas 9, Nakukulas 10 and Kengomo 1;
- Tullow provides some of the abstracted groundwater to a series of tanks to augment the local people's supplies. Other sources of local water supplies include springs, oases, shallow wells and deep wells. Prior to Tullow's provision of water resources to local communities, community water supplies tended to come from hand dug wells in luggas and hand pumped wells installed by NGOs; and
- Recharge to aquifers from rainfall infiltration is limited and aquifer storage is limited, so unmanaged abstractions could exceed available water stored and recharged.

10.0 BIODIVERSITY

10.1 Study Area

For the biodiversity assessment two study areas, or project areas of influence on biodiversity values and receptors, were considered:

a) Biodiversity Regional Study Area (RSA), which includes an Upstream and a Midstream RSA (see Drawing 10-1).

b) Biodiversity Local Study Area (LSA), which includes Upstream and Midstream LSA (Drawing 10-2).

Local Study Area

The LSA was established as the area within which the ESIA will assess potential direct effects of the Project components (field development infrastructure and the proposed road route) on species and ecosystems, and biodiversity receptors. The LSA includes:

- Upstream LSA: Areas potentially directly affected by activities and infrastructure at Amosing and Ngamia wellpads and a buffer around the potentially affected areas (Drawing 10-2).
- Midstream LSA: Areas potentially directly affected by the proposed transport of oil from the Upstream Component throughout the Midstream Component to the port at Mombasa.

The local biophysical study area for baseline data collection for the upstream component of EOPS comprises the Ngamia and Amosing wellpads and a 500 m buffer around each of those.

The local and regional biophysical study area for the midstream component is a 200 m wide corridor, 100 m either side of the road network used to transport oil between the EPF at Amosing-1 and the gates of the Changamwe Refinery in Mombasa.

Regional Study Area

The RSA is broken into two parts:

- Upstream RSA: In the area of the Upstream Components, the RSA includes the LSA, and the areas within the catchment boundaries formed by the Turkwell, Kalabata and Kerio Rivers (Drawing 10-3). While the EOPS project is located within only the Kalabata catchment; a biodiversity database and mapping has already been developed for the wider RSA of all three catchments. Therefore, in order for the database can be referred to correctly, the wider RSA has been adopted for EOPS also.
- In the area of the Upstream Components, the RSA includes the LSA, and the areas within the catchment boundaries formed by the Turkwell, Kalabata and Kerio Rivers (Drawing 10-3).
- Midstream RSA: In the Midstream Component, the RSA includes the road transport route, and a 100 m buffer to either side of it, as for the LSA (Drawing 10-1). In areas where the transport route traverses through, or in close proximity to, areas of special biodiversity value (as defined under Kenyan legislation), for example, protected areas, then those areas were incorporated into the RSA boundaries. This was undertaken to capture all potential indirect, induced, and cumulative effects, including those from habitat loss, fragmentation, edge effects, barriers to movement, air emissions and dust, noise, sensory disturbance, traffic, changes to surface water quantity, quality and flow patterns, pollution from accidental spills, and introduction and spread of pest species.

10.2 Methods

10.2.1 Secondary Data – Literature Review and Consultation

A review of available literature, data and other information about the terrestrial and aquatic ecology of the Upstream and Midstream RSA was completed. Information gathered included that available for vegetation and habitats, flora and fauna. Data sources included, yet were not necessarily limited to the following:

- GBIF (2017);

- IBAT (2017);
- ILRI, 2011;
- Van Breugel et. al., (2015);
- NMK museum and herbarium records;
- White (1983);
- International Union for Conservation of Nature (IUCN) (2016); and
- Other published scientific studies, and historical and recent reports related to the project and wider area.

In addition to the collection of published and unpublished data, consultation was held with regional experts to gather their input and knowledge of the area, identify additional data sources, and to gain expert opinions and advice (Table 10-1).

Table 10-1: Stakeholder Consultation and Key Informant Interview Details

Date	Stakeholder/Key Informant	Organisation	Role
18 April 2016	Ademola Ajagbe	BirdLife International, Kenya	Team Leader, Conservation Action and Policy
18 April 2016	Per Karlsson	African Wildlife Foundation	Program Design Manager
23 June 2016	Josephine Nzilani	Flora and Fauna International	Programme Coordinator, East Africa
22 February 2017	Peter Njiri Mwangi	Kenya Wildlife Service	Senior Scientist
3 March 2017	Fredrick Aloo	State Department of Livestock Production. Ministry of Agriculture, Livestock, Fisheries and Blue Economy, Range Resource Development Division	Senior Scientist
8 March 2017	Gordon Ojwang	Directorate of Resource Survey and Remote Sensing	Senior Assistant Director, Natural Resources and Remote Sensing

The review of the available secondary data was used to assess the breadth and adequacy of the current body of ecological knowledge for the Upstream and Midstream RSA. The findings of the review were used to focus the primary baseline data collection on priority areas for field survey and analysis of biodiversity receptors for the impact assessment.

10.2.1.1 Species and Ecosystems of Conservation Concern

Using the desktop information, a screening of the Upstream and Midstream RSA was completed to identify biodiversity receptors (for example, species and habitats of conservation concern, protected areas), which could occur in the project's area of influence, and that could interact with project components.

The following attributes formed the basis of the screening:

Species of Conservation Concern[5]

- **Globally threatened species**: These include internationally recognised IUCN Red-Listed Critically Endangered (CR), Endangered (EN) and Vulnerable (VU) species, as defined by the IUCN Red List guidelines.
- **Nationally threatened species**: These include species listed under the sixth schedule of the Kenyan *Wildlife Conservation and Management Act (2013)*; priority species listed in the Kenya National Biodiversity Strategy and Action Plan (NBSAP) (Ministry of Environment and Natural Resources, 2000), species identified by Kenya Wildlife Service (KWS) as priorities for conservation action (KWS, 2017)
- **Migratory/Congregatory species**: Species listed on Appendix I and II of the Convention on Migratory Species (CMS), also known as the Bonn Convention. This convention, to which Kenya is a signatory, aims to conserve terrestrial, aquatic and avian migratory species throughout their range, and species whose individuals gather in large groups or colonies.
- **CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) species**: As a signatory to the CITES convention, Kenya has obligations to protect species listed on Appendices I, II and III, from over-exploitation.
- **Restricted-range or endemic species**: Restricted-range species are defined as species with global ranges (extent of occurrence (EOO) of 50,000 km^2 or less (Eken et al. 2004; Holland et al. 2012). For most terrestrial vertebrates (e.g. mammals, birds, reptiles and amphibians), and invertebrates (e.g. insects and arachnids), global ranges of 50,000 km^2 or less, are considered appropriate in global conservation practice (Eken et al. 2004). Thresholds for other invertebrates (particularly, aquatic and terrestrial molluscs) and aquatic species (e.g. fish) are typically set at 20,000 km^2 (Holland et al. 2012).

It is recognised that some species of conservation concern identified in the screening list would not actually occur in the Upstream and Midstream RSA for various reasons, such as unsuitable habitat. Therefore, an assessment of the probability of the various receptors actually occurring in the RSA was determined based on:

- Findings of previous studies and published scientific literature;
- Species records from the NMK (2016), and those stored in the GBIF (2016);
- Knowledge of the life histories of the species, habitat preferences, and known ecological requirements, as determined through published information, and information presented in the species profiles on the IUCN's Red List (IUCN 2016), for example; and
- Consultation with regional experts, and professional judgement and experience of the assessors.

Three levels of probability were used to describe the likelihood of occurrence: possible, probable and unlikely. These were defined as:

a) **Probable**: the species or ecosystem is likely to occur in the Upstream or Midstream RSA due to suitable habitat and resources being present, and known records from the area. The Upstream and/or Midstream RSA is within the known EOO and/or area of occupancy (AOO) of the species;

b) **Possible**: the species or ecosystem may occur in the Upstream or Midstream RSA, or move through the area (in the case of migratory and highly mobile species) due to presence of suitable habitat and/or resources. No records are known from the area, and/or it is a rare, erratic or a poorly known species or ecosystem. Nevertheless, the Upstream and/or Midstream RSA is within the known EOO and/or AOO; and

[5] The same criteria were applied to species recorded within the Upstream RSA and LSA during the baseline field studies in order to short-list species of conservation concern for impact assessment

c) **Unlikely**: the species will not likely occur in the area due to lack of suitable habitat and resources, and/or the Upstream and/or Midstream RSA is outside of the EOO and/or AOO.

The probability assessment was used as the starting point for the identification of sensitive biodiversity receptors that may occur in the RSA. Only those species and habitats with a possible and probable likelihood of occurrence within the Upstream and/or Midstream RSA were carried through and considered for the baseline survey and, subsequently, impact assessment[6].

Ecosystems of Concern

Ecosystems of importance to the public, government agencies, scientific community, NGOs and/or TKBV occurring within the Upstream and Midstream RSA were identified. Ecosystems of conservation concern included those which are:

- **Internationally recognised sites** of biodiversity importance, such as Important Bird Areas (IBA), Endemic Bird Areas (EBA), Key Biodiversity Areas (KBA), Ramsar sites, WWF Ecoregions;
- **Nationally designated and protected areas**, and other areas that may have specific conservation and management requirements, as set out in national Kenyan wildlife legislation and policy; and
- **Important habitat types outside of protected areas**, such as wetlands being crossed by the proposed transport route, or landscape features with importance in maintaining key ecological processes and functions needed to support and maintain important biodiversity attributes, such as forests forming ecological corridors between protected areas.

10.2.2 Primary Data

10.2.2.1 Land Cover Classification

An unsupervised (i.e. not ground-truthed), eighteen-class land cover mapping and classification exercise was completed for the Upstream LSA and most of the Upstream RSA[7] using ten-meter resolution Sentinel 2 satellite imagery, acquired on 28 March 2016. The following Sentinel 2 images were used to compile the land-cover datasets:

- Sentinel 2, acquired 28 March 2016, granule reference 36NYH;
- Sentinel 2, acquired 28 March 2016, granule reference 36NYJ;
- Sentinel 2, acquired 28 March 2016, granule reference 36NZH; and
- Sentinel 2, acquired 28 March 2016, granule reference 36NZJ.

The eighteen-class land-cover dataset is based on 10 m raster cells (equivalent to the original Sentinel 2 image data), and is in UTM 36 north (WGS84) map projection.

An additional, more detailed twenty-seven-class vegetation/land-cover dataset was generated from the same source imagery for the upstream Study Area, which included the LSA. This dataset provides more spatial and thematic detail on the vegetation communities on the plains, and along the riparian zones. The Modified Soil Adjusted Vegetation Index (MSAVI) was used to extract this finer community detail. Sub-division and re-coding of riparian vegetation and plains vegetation types was done using geographical and vegetation field data gathered during the vegetation survey done in June 2016. Land-cover details from the original 18 x class landcover classification were used to describe mountainous and settlement areas.

[6] It was assumed that the species or ecosystems chosen could act as proxies for many of the other species, should they occur, however remote the possibility. This is in line with global conservation priority setting, where certain species (typically vertebrates and selected invertebrates) are used as a surrogate for all animal species, and vascular plants as a surrogate for all plants (Secretariat of the CBD, 2006). As such, a precautionary approach was adopted where there was an uncertainty that a species could potentially occur in the RSA.

[7] The RSA for land cover assessment was completed primarily for the Full Field Development ESIA and as such has been defined as the watersheds of tributaries to Lake Turkana, that cross the Full Field Development area

The ten-meter resolution Sentinel 2 satellite imagery land cover classification was used for the assessment as it contains a much greater level of detail (10m resolution) than the LandSAT8 imagery (30 m resolution) used initially.

The mapping was initially completed as a desktop interpretation and classification process. It was then ground-truthed during the vegetation and flora field survey conducted in June 2016 (Section 10.2.3.2).

10.2.2.2 Field Studies: Vegetation and Flora

Two rapid field survey programmes (after Sayre *et al*., 1999) were conducted: one six-day survey took place during the shorter rainy season (10 to 16 November 2015), and another six-day survey at the end of the long wet season (23 to 29 June 2016). The survey campaigns were completed in the Upstream LSA and RSA for the Full Field Development (FFD) ESIA; however the EOPS study areas form a subset of the FFD study areas, so the data gathered is entirely relevant. These periods were particularly suited for maximising the detection of plants in fruit and in flower, which, in many cases, facilitate more accurate and verifiable identifications. The data collected were also used to verify the ecosystems and habitats identified in the area during the review of secondary data.

The flora and vegetation community baseline survey methods included the following (after Larsen, 2016):

- The November 2015 survey was completed according to map units preliminarily identified using an unsupervised high-level classification of LandSAT8 imagery (ERA, 2015);
- For the June 2016 survey, a more refined unsupervised land cover classification of high-resolution Sentinel2 imagery (GTI, 2016 – ref. Section 10.2.3.2) was used. The map units were defined on the basis of available information on vegetation pattern, structure and ecological variation (e.g., soil and moisture conditions, landscape position, level of disturbance);
- Description of plant communities, which followed Beentje (1994) and Herlocker (1979). Plotless landscape sampling frames were used to compile an inventory of plant species (i.e., trees, shrubs, forbs, and grasses), and to characterise the vegetation communities;
- Searches for the presence of Kenyan-listed and IUCN Red-listed plant species, in particular: CR, EN, and VU species; CITES-listed species; other priority plant species listed by the KWS; regionally/locally endemic species, range-restricted species and species of local importance (including ethnobotanical importance); and any threatened vegetation communities;
- Identification of populations and distribution of invasive and pest plants; and
- The ecological integrity and extent of existing vegetation communities.

Vegetation Community Condition Assessment

As per the Natural and Modified Habitats Framework, the condition of the vegetation communities was rated and assigned a subjective class after Herlocker's (1989) Kenya rangeland condition assessment criteria (Table 10-2). These criteria focus on soil erosion and vegetation structure indicators, with added criteria relating to livestock grazing and timber harvest land-uses. These latter criteria were identified as the primary drivers of change in the vegetation communities in the wider RSA (refer to Section 10.3.3). Further details on the condition assessment approach are provided in Appendix G.

Table 10-2: Condition classes (after Herlocker, 1989; IFC 2012b)

Condition Class	Condition Description
Good	Largely natural with few modifications.
Fair	Slightly modified; evidence of change in ecosystem processes is discernible; a small loss of natural habitats and biota may have taken place
Fair – Poor	Moderately modified;
Poor	Largely modified; a large change in ecosystem processes and loss of natural habitat and biota has occurred
Very poor	Seriously modified; ecosystem processes have been completely modified with an almost complete loss of natural habitat and biota

Vegetation Community Mapping

A detailed vegetation community map was derived for the Upstream RSA, based on the land cover assessment (refer to Section 10.2.2.1), as verified by the data gathered during the vegetation and flora field surveys. Details on the vegetation community mapping procedure are provided in Appendix G-1.

10.2.2.3 Field Studies: Invertebrates

A preliminary scoping survey for the FFD ESIA baseline, consisting of passive, observation-based surveys of transects (and no trapping), was conducted between 29 October and 04 November 2015, in lieu of the intended aquatic invertebrate survey. A dedicated invertebrate sampling survey was conducted (also for FFD) between 15 and 22 June 2016, during the long wet season. This season was deemed to be the most appropriate to survey invertebrates in the semi-arid environment of the RSA. Expert advice identified that most species would be actively breeding and foraging during this time, thereby allowing for increased survey effectiveness. Surveys during the dry season and short wet season were not considered viable given the potential for the targeted invertebrate groups not to be active and breeding during those times. Despite being conducted in the long wet season, the weather for the majority of the survey was very dry, with isolated showers towards the end of the survey. Those dry conditions would have influenced the diversity and richness of the taxa recorded.

Sampling methods included (after Hill *et al.,* 2005; Samways *et al.*, 2010; Gonçalves and Oliveira, 2013):

- Passive pitfall trap lines set in place for four-trap nights at each survey site (Drawing 5) (which were at the same locations as the reptile and amphibian surveys – see Section 10.2.3.4);
- Two passive light-traps established at each survey location and left open for one to two hours during the night at each site;
- Active, timed habitat searches and sweep net surveys conducted during the day and night at each site, plus additional non-trapped sites; and
- Voucher specimens were retained for taxonomic purposes, and deposited in the collection of the NMK.

Survey data was used to identify species in the Upstream LSA, with additional information, such as distribution, relative abundance, communities and habitat associations, used to inform the baseline of selected invertebrates[8] of conservation concern.

10.2.2.4 Field Studies: Herpetofauna (Reptiles and Amphibians)

A single survey was conducted during the long wet season, between 15 and 22 June 2016. The survey was conducted in tandem with the invertebrate survey since both surveys made use of passive pitfall trap lines. Like the invertebrate surveys, expert advice identified that a dry season survey would not be effective. Like many other tropical desert areas, the reptile and amphibian species of the semi-arid Turkana region are cryptic during this time to avoid extremes of heat and dryness (see, Heyer *et al.,* 1994; Spawls *et al.,* 2004; Channing and Howell 2006; McDiarmid *et al.*, 2012). However, the weather for the majority of the survey period was very dry, with isolated showers towards the end of the survey. Such dry conditions would have influenced the diversity and richness of the taxa recorded, particularly the amphibians.

The survey was focussed within the Upstream LSA, and adjacent areas identified as being of high potential to support species of conservation concern. Sampling methods included (after Heyer *et al.,* 1994; McDiarmid *et al.*, 2012; Larsen, 2016):

- Passive trapping for ground-dwelling reptiles and amphibians using pitfall trap/funnel trap and drift fence arrays (in place for four-trap nights at each site) (Drawing 5);
- Active, timed habitat searches during the day and night at each site, plus additional non-trapped sites;
- Voucher specimens were retained for taxonomic purposes, and deposited in the NMK collection; and

[8] The taxonomy of many groups is not well known; therefore, after discussion and consultation with NMK, the following groups formed the basis and focus for this baseline: beetles (Coleoptera); flies (Diptera); ants, bees and wasps (Hymenoptera); butterflies and moths (Lepidoptera); and grasshoppers and crickets (Orthoptera).

- Species were also recorded opportunistically.

Due to the dry weather during the majority of the survey, the diversity of reptiles and amphibians recorded was not as high as expected; for example, only one species of amphibian, the Turkana toad (*Amietophrynus turkanae*), was recorded. Some rain fell towards the end of the survey, mostly as isolated showers. Active searches were conducted in those areas where rain fall occurred.

Figure 10-1: An example of a light trap

Figure 10-2: Pitfall and funnel trap drift fence array for sampling reptiles and amphibians

10.2.2.5 Field Studies: Birds

Three seasonally representative field surveys were completed primarily for the FFD ESIA (although the later survey did focus on the EOPS LSA): 11 to 18 November 2015 (covering the short wet season, and corresponding to the winter migration period); 11 to 18 May 2016 (covering the end of dry season/beginning of wet season, and corresponding to the summer migration period); and 3 to 10 August 2016 (covering the end of the long wet season).

Sampling focussed on each of the identified vegetation communities and habitats to identify bird communities and populations within the Upstream LSASutherland *et al.*, 2004; Hill *et al.*, 2005; Larsen, 2016):

- Timed species counts across fixed transect routes within each of the oil field areas and each broad habitat type/vegetation community;
- Vantage point surveys conducted at proposed EOPS wells, and other FFD proposed infrastructure, with particular reference to threatened vulture and raptor species, and large flocks of birds;
- Point counts were done in areas of rugged terrain, densely vegetated habitats, and habitats that were heterogeneous or highly fragmented, such as hillier areas to the east of the upstream study area. Point counts were also undertaken in Lokichar town to determine whether resources in this location, such as refuse, could be drawing in species, in particular vultures; and
- Data from targeted bird surveys was supplemented with incidental observations recorded by the ornithologist and from surveys targeting other taxonomic groups.

Bird species of conservation concern, and their respective habitat associations, were identified, to inform the biodiversity receptors to be used in the impact assessment phase.

10.2.2.6 Field Studies: Mammals

Surveys for mammals covered medium-large and small mammals (volant[9] and non-volant), with different sampling techniques employed to cover the three different groups.

Three seasonally representative field surveys were completed primarily for the FFD ESIA (although the later survey did focus on the EOPS LSA): 03 to 18 November 2015 (start of the short wet season), 20 to 27 April 2016 (end of dry season) and 03 to 10 August 2016 (end of the long wet season). The methods employed for each group are outlined below. Survey methods largely followed those presented in Wilson *et al.* (1996) and Larsen (2016).

Medium and Large Mammals

- A remote camera trapping scheme was initially deployed during November 2015. Ten remote cameras (Reconyx PC900, www.reconyx.com) were installed at locations throughout the Upstream RSA, with a view for bi-monthly rotation and data download (after O'Connell *et al.,* 2011). Significant loss of remote cameras was experienced during that time, and the remaining cameras were withdrawn from the field after the first camera trap inspection in January 2016.
- Driven transect surveys (after Hill *et al.*, 2005) were completed between 20 and 27 April 2016, and 3 and 10 August 2016 to gain evidence of large and medium-sized mammal presence (for example, Striped Hyena (*Hyaena hyena*), Leopard (*Panthera pardus*)) throughout the Upstream RSA. Transects were driven during dusk (commencing approximately 30 minutes before sunset at a point furthest from Kapese Camp, and concluding upon arrival back at Kapese camp), and dawn (commencing approximately two hours before sunrise and concluding upon sun-up). The vehicle was driven at a maximum speed of 20 kph, and spotlight counts conducted - the location and species of any mammals observed were recorded.
- Interviews with local people were conducted throughout the Upstream RSA. Whenever the field team encountered local people during surveys, they were quizzed on their knowledge of mammals observed in the area. This included gathering information on how often they had seen these animals, the most recent sighting of the animals, and any interesting observations. A pictorial field guide (Kingdon, 1997) was used to assist conversations.
- Track pads (after Mateus *et al.*, 2011) were placed in areas identified as potential large mammal movement corridors and/or areas of attraction, such as water points and obvious trails.
- Camera traps were installed in suitable locations only for the duration of the active field surveys; they were removed at the end of the survey. These were baited with carnivore scent lures to attract any carnivorous mammals present in the area to the cameras.

Small Mammals

Three trapping surveys for small mammals (rodents) were completed primarily for the FFD ESIA (although the later survey did focus on the EOPS LSA): between 2 and 18 November 2015 (covering the start of the short wet season), 20 and 27 April 2016 (covering the end of the dry season), and 3 to 10 August 2016 (covering the end of the long wet season).

Small mammal survey methods were focussed on the deployment of Sherman trap lines across the different vegetation communities and habitat types within each proposed development area, and the CPF, to record the presence of (trappable) small mammals (after Wilson *et al.*, 1996). The traps were set in lines of eight to ten, and baited with a mixture of rolled oats, seeds, peanut butter, cheese and meat (after Patric 1970). Traps were checked every morning between 06h00 and 08h00 to reduce mortality of trapped animals due to heat stress. Traps were left in situ for a minimum of three consecutive nights before being moved to the next trapping location.

Trapped mammals were photographed, identified to species level, tagged and released. A non-lethal tissue sample (ear punch) was retained from some trapped rodents for DNA analysis; these individuals were also

[9] Animals capable of flight i.e. bats

tagged to identify them in the case of recapture. Tissue sampling and tagging was conducted in accordance with standard guidelines for the use of wild mammals in research (Sikes *et al.,* 2011).

Bats

Bat surveys were conducted between 2 and 18 November 2015 (covering the start of the short wet season), 20 and 27 April 2016 (covering the end of the dry season), and 3 to 10 August 2016 (covering the end of the long wet season). Methods included daytime searches for roosting bats within suitable habitat, trapping of flying bats at dusk using harp traps and/or mist-nets, passive, acoustic monitoring of bat echolocation calls at fixed points, and active acoustic monitoring during driven transects, with survey effort stratified by habitat type where possible (after Wilson *et al.*, 1996; Collins, 2016; Larsen 2016).

Static monitoring at several locations was conducted during the November 2015 survey, to scope the extent of bat activity and extent of species presence within the study area. Active monitoring was carried out during the April 2016 survey only, using a SM2BAT+ bat detector (Wildlife Acoustics Inc., www.wildlifeacoustics.com). The bat detector was mounted on a vehicle, and transects were driven within the Upstream RSA, concurrent with the large mammal driven transects. Transect routes were selected based on availability and accessibility of roads and tracks, with the aim of covering the different habitats within the area.

10.3 Results – Upstream Study Area

Section 1.3.1 describes the international and national context for biodiversity within the Upstream RSA and LSA, as determined through review of existing literature and data, that is, secondary data (ref. Section 10.3.1).

The remaining sub-sections in Section 10.3 describe the baseline situation for vegetation and flora, and each taxonomic group of animals, as determined from the active surveys within the Upstream RSA and LSA, that is, primary data.

10.3.1 Biodiversity Context

The Upstream RSA (FFD RSA has been adopted for the EOPS RSA - see Section 10.1) is bounded by the Kerio river to the east, which flows north into Lake Turkana, the Turkwell River to the west and north, and the hills in the south-west that form the boundary of the northern extent of the South Turkana National Reserve (Drawing 1). The area consists of an undulating plain, interspersed by low, steep-sided hills of volcanic origin (Amuynzu, 1991). It straddles two of the eco-climatic zones defined for East Africa (Pratt and Gwynne, 1977): the Arid Zone (Zone V), consisting of rangeland dominated by *Commiphora* and *Acacia* shrubland; and the Very Arid Zone (Zone VI), dominated by dwarf shrub grassland with *Acacia reficiens* occurring throughout.

The vegetation is characterised by Somalia-Masai *Acacia-Commiphora* deciduous bushland and thicket (Drawing 7a and 7b), much of which is sub-classified as stunted (White, 1983; Van Breugel *et al.,* 2015). The stunted bushland sub-class is defined by two to three-metre-high bushes and stunted trees (mostly *A. reficiens*) and occurs in areas where rainfall is less than 250 mm annually (Van Breugel *et al.,* 2015). This results in natural vegetation distributions restricted to drainage lines and natural depressions where soils are heavier and more water-retentive (Pratt and Gwynne, 1972). During the 1970s, it was recognised that overgrazing in the Arid Zones (Zone V and VI) was an important driver in this ecosystem. The lack of land titles in communal grazing areas, and the prevailing arid conditions, are cited as facilitating excessive grazing/browsing pressure and the associated degradation of the vegetation communities in the region (Pratt and Gwynne, 1977). Human settlements and livestock populations have continued to expand since then until the present day, adding further pressure.

Historically, the main species of indigenous grazing herbivore, which would have occurred in the RSA, included Grant's Gazelle (*Nanger granti*), Gemsbok (*Oryx gazella*), Grevy's Zebra (*Equus grevyi*), Guenther's dik-dik (*Madoqua guentheri*), Gerenuk (*Litocranius walleri*), Reticulated Giraffe (*Giraffa camelopardalis reticulata*), Black Rhinoceros (*Diceros bicornis*) and African Elephant (*Loxodonta africana*) (Coe, 1972; White, 1983). However, these occurred in low densities (Coe, 1972; Watson, 1969) and at low frequencies, due to ephemeral nature of annual grass growth in the immediate aftermath of rains (Pratt and Gwynne, 1977), and the exploitation of all grazing resources by Turkana pastoralists through maintenance of mixed livestock herds (Watson, 1969). Predatory species, including Wild dog (*Lyacon pictus*), Lion (*Panthera leo*), Leopard

(*Panthera pardus*) and Cheetah (*Acinonyx jubatus*), would also have been present (Coe, 1972; White, 1983). More recent studies suggest that the presence of excessive numbers of livestock throughout the Turkana region have resulted in the suppression of a broad range of wild herbivore species (Riginos *et al.,* 2012), presumably with concomitant effects on the assemblage of predatory carnivore species, to such an extent that wildlife are now virtually absent (de Leeuw *et al.,* 2001).

The region has a rich avian fauna; however, endemism is low; the majority of species are found elsewhere in East Africa or are European and Asian migrants (WWF, 2017b). Lake Turkana is an internationally-recognised IBA, with 84 waterbird species, including 34 Palaearctic migrants, for which it serves as an important flyway and winter stop-over site for birds on passage (Evans and Fishpool, 2001). The RSA is located within the East Asia/East Africa Flyway, as identified by BirdLife International.

10.3.1.1 Species of Concern Potentially Present in Upstream RSA and LSA

Based on available information, 50 species of conservation concern could occur within the Upstream RSA (Appendix G-2). These include:

- Six plant species;
- Three invertebrate species;
- One amphibian species;
- Four reptile species;
- 23 bird species; and
- 13 mammal species.

Of these, 43 have the potential to occur (that is, a possible or probable likelihood) within the EOPS Upstream LSA; these are summarised on (Table 10-3).

Table 10-3: Species of concern likely to occur in EOPS Upstream LSA

Scientific Name	**Common name**	**Kenya WCMA**	**KWS priority species**	**IUCN Red List**	**CMS**	**CITES**	**Other**	**Potential to occur in Upstream LSA**
Aloe turkanensis	-	-	-	-	-	-	Restricted range	Possible
Blepharis turkanae	-	-	-	VU	-	-	Restricted range	Possible
Euphorbia turkanensis	-	-	-	-		II	Restricted range	Possible
Neuracanthus kenyensis	-	-	-	-	-	-	Restricted range	Possible
Ocotea kenyensis	Camphor	Vulnerable	Y	VU	-	-	Restricted range	Possible
Xerophyta schnizleinia	-	-	-	VU				Possible
Belenois aurota	Brown-veined white butterfly	-	-	-	-	-	Migratory	Probable
Samba turkana	New bee species	-	-	-	-	-	New to science	Possible
Eryx colubrinus	Kenya Sand Boa	Protected	Y	-	-	II		Probable
Sclerophrys turkanae	Lake Turkana Toad	-	Y	DD	-	-	-	Probable

Scientific Name	Common name	Kenya WCMA	KWS priority species	IUCN Red List	CMS	CITES	Other	Potential to occur in Upstream LSA
Philochortus rudolfensis	Southern Shield-backed Lizard	-	-	DD	-	-	Restricted range	Possible
Python sebae	Rock Python	Endangered	Y	-	-	II	-	Probable
Ardeotis kori	Kori Bustard	-	-	NT	-	II	-	Probable
Aquila heliaca	Eastern Imperial Eagle	Vulnerable	Y	VU	I/II	I	-	Possible
Aquila nipalensis	Steppe Eagle	-	-	EN	II	II	-	Possible
Circus macrourus	Pallid Harrier	Near Threatened	-	NT	II	II	-	Possible
Clanga clanga	Greater Spotted Eagle	Vulnerable	Y	VU			-	Possible
Coracias garrulus	European Roller	Near Threatened	-	NT	I		-	Possible
Falco cherrug	Saker Falcon	Endangered	Y	EN	I/II	II	-	Possible
Falco concolor	Sooty Falcon	Near Threatened	-	NT	II	II	-	Possible
Falco naumanni	Lesser Kestrel	Vulnerable	Y	LC	I/II	II	-	Possible
Falco vespertinus	Red-footed Falcon	Near Threatened	-	NT	I/II	II	-	Possible
Gyps africanus	White-backed Vulture	Near Threatened	-	CR	II	II	-	Possible
Gyps rueppelli	Ruepell's Vulture	Near Threatened	-	CR	II	II	-	Possible
Melierax poliopterus	Eastern Chanting-Goshawk	-	-	LC	II	II	-	Possible
Necrosyrtes monachus	Hooded Vulture	-	-	EN	II	II	-	Possible
Neophron percnopterus	Egyptian Vulture	Endangered	Y	EN	I/II	II	-	Possible
Neotis denhami	Denham's Bustard	Near Threatened	-	NT		II	-	Possible
Polemaetus bellicosus	Martial Eagle	Protected	-	VU	II		-	Possible
Sagittarius serpentarius	Secretarybird	-	-	VU	-	II	-	Possible
Stephanoaetus coronatus	Crowned Eagle	Protected	-	NT	II	II	-	Possible
Terathopius ecaudatus	Bateleur	-	-	NT	II	II	-	Possible
Torgos tracheliotos	Lappet-faced Vulture	Vulnerable	Y	EN	II	II	-	Possible
Trigonoceps occipitalis	White-headed Vulture	Vulnerable	Y	VU	II	II	-	Possible
Canis aureus	Golden Jackal	-	-	LC	-	II	-	Possible
Hyaena hyaena	Striped Hyaena	Endangered	Y	NT		III	-	Possible

Scientific Name	Common name	Kenya WCMA	KWS priority species	IUCN Red List	CMS	CITES	Other	Potential to occur in Upstream LSA
Neoromicia helios	Samburu Pipistrelle bat	-	-	DD	-	-	Congregatory	Possible
Otomops martiensseni	Large-eared Free-tailed Bat	Vulnerable		NT			Congregatory	Possible
Panthera pardus	Leopard	Endangered	Y	NT	-	II	-	Possible
Papio anubis	Olive baboon	-	-	LC	-	II	-	Possible
Scotoecus albofuscus	Light-winged Lesser House Bat	-	-	DD	-	-	Congregatory	Possible
Tadarida ventralis	African Giant Free-tailed Bat	-	-	DD	-	-	Congregatory	Possible
Taphozous hamiltoni	Hamilton's Tomb Bat	Protected	-	DD	-	-	Congregatory	Possible
Taphozous hildegardeae	Hildegarde's Tomb Bat	Protected	-	VU	-	-	Congregatory	Possible
Tragelaphus imberbis	Lesser Kudu	Protected	-	NT	-	-	-	Possible

Abbreviations used: CR – Critically Endangered; DD – Data Deficient; EN – Endangered; LC – Least Concern; NT – Near Threatened; VU – Vulnerable; Y – Yes; I/II – Appendix G or Appendix GI.

10.3.1.2 Ecosystems of Conservation Concern

Internationally-recognised sites of biodiversity importance

WWF Ecoregions

The Upstream RSA largely lies within the Masai xeric grasslands and shrublands ecoregion, grading into the Northern Acacia-Commiphora bushlands and thickets ecoregion (Drawing 10-8).

- Masai xeric grasslands and shrublands: most habitats of this ecoregion have been considerably degraded by heavy grazing by excessive numbers of domesticated livestock (WWF, 2017a). Exceptions include protected areas such as Sibiloi National Park on the north-eastern edge of Lake Turkana, where good-quality habitat remains (WWF, 2017a).
- Northern *Acacia-Commiphora* bushlands and thickets: a transition zone between the drier Masai xeric grasslands and shrublands and Somali Acacia-Commiphora Bushland and Thicket ecoregions to the north, and the wetter Southern *Acacia-Commiphora* Bushland and Thicket ecoregion to the south (WWF, 2017b). Mammalian species diversity in the ecoregion is high, and reasonably well-protected across protected areas including South Turkana National Reserve, which is adjacent to the Upstream RSA, and a number of National Parks: Longonot, Nairobi, Chyulu, Tsavo East and West; all of which occur within the Midstream RSA (Section 10.4).

Lake Turkana Important Bird Area

The Upstream RSA is located adjacent to Lake Turkana Important Bird Area (IBA). The IBA is designated on the basis of its support of approximately 84 waterbird species, including 34 Palearctic migrants, some of which overwinter at the lake in very large numbers; for example, Little Stint (*Calidris minuta*), which typically number in excess of 100,000 indiduals. The lake is also a key stop-over site for birds on passage (BirdLife International, 2017).

Nationally Designated and Protected Areas

The Upstream RSA is located adjacent to South Turkana National Reserve, and Lake Turkana National Park and Important Bird Area (IBA) (Drawing 10-9).

South Turkana National Reserve

South Turkana National Reserve is approx. 20 km southwest of the Upstream LSA. It is characterised by a savanna rangeland ecosystem, and supports wildlife including Elephant (*Loxodonta africana*), Buffalo (*Syncerus caffer*), Beisa Oryx (*Oryx beisa beisa*) Olive Baboon (*Papio anubis*), Lesser Kudu (*Tragelaphus imberbis*), Thompson's Gazelle (*Gazella thomsonii*) Grant's Gazelle (*Nanger grantii*), Warthog (*Phacochoerus africanus*), and Dik-dik (Madoqua sp.) (Edebe *et al.,* 2010).

Lake Turkana National Park

Lake Turkana National Park is approx. 90 km northeast of the Upstream LSA. It is a large alkaline lake, predominantly fed by the Omo River to the north; the seasonal rivers, Kerio and Turkwell together contribute a lesser extent. Compared to other large African lakes, Turkana has relatively low fish species richness, providing habitat for about 50 species, 11 of which are endemic (Hughes and Hughes, 1992). UNESCO has designated Lake Turkana National Parks (consisting of Sibiloi, South Island and Central Island National Parks) a World Heritage Site (WHS). Existing pressures on the lake are a result of hydropower and irrigation development, which are changing the hydrological regime and affecting the level of the lake. These pressures are expected to affect the lake's floodplain fisheries, wetlands, agro-pastoral systems and associated human beneficiaries (Avery, 2013).

Important Habitats outside of Protected Areas

The following three potentially threatened (as per Rodriguez *et al.,* 2011) vegetation communities (van Breugel et al., 2015) were identified within the Upstream RSA (Drawing 10-10a):

- *Acacia tortilis* wooded grassland and woodland (aligns with White's (1983) Deciduous wooded annual grassland);
- Riverine wooded vegetation (aligns with White's (1983) Evergreen and semi-deciduous woodland); and
- Afromontane undifferentiated forest (aligns with White's (1983) Undifferentiated evergreen forest).

Several other habitats, including wetlands, forests and forest ranges were identified as important habitat within the Midstream RSA (Drawing 10-10b).

10.3.2 Land Cover Classification

The land cover assessment focused on the Upstream RSA and LSA, because this area will be directly affected by project activities and infrastructure. The assessment was not extended to the Midstream RSA because the proposed transport route is along existing and established national roads.

Upstream RSA

The 18-class land cover classification of the Upstream RSA is illustrated on Drawing 10-11, and the area covered by the various categories summarised in Table 10-4.

Table 10-4: Raw 18-class land cover classification of the Upstream RSA

Class Name	Description	Area in RSA (ha)	% of total RSA Cover
Bare sand #1	Bare sand dominated areas, with sparse to open grass cover, and a few scattered bushes and shrubs	411,978.13	23.34%
Dense low shrub	Dense low shrub and/or grass cover, with only a few bushes, often on rocky hills	187,486.73	10.62%
Bare sand #2	Bare sand dominated areas, with very sparse to open grass cover, and a very few scattered bushes and shrubs	187,480.04	10.62%
Dense bush #2	Dense bush and/or taller shrubs (but less dense than dense bush class #1	178,553.66	10.12%
Sparse low shrub	Sparse low shrub and/or grass cover, with only a few bushes, often on rocky hills	166,150.34	9.41%
Dense bush #1	Dense bush and/or taller shrubs (most dense bush dominated class)	126,222.86	7.15%
Open bush #2	Open and/or scattered bushes and/or shrubs, occurring across all landscape components	114,208.94	6.47%
Dense bush #3	Dense bush and/or taller shrubs (but less dense than dense bush class #2	85,071.64	4.82%
Sparse Grassland	Sparse to open grass cover areas, typically containing scattered bushes and shrubs, mainly on flatter plains	81,553.55	4.62%
Water (lake and river)	Water in lake and major river systems	75,541.15	4.28%
Dense bush #4	Dense bush and/or taller shrubs (but less dense than dense bush class #3: least dense, but more dense than open bush classes)	75,460.68	4.27%
Dense trees/bush	Dense tree and tall bush combination class	38,096.67	2.16%
Open bush #1	Open and/or scattered bush and shrub cover, often on rocky hills.	28,789.1	1.63%
Cultivated lands	All cultivated lands, including both currently active and old, long term fallow/abandoned fields	3325.62	0.19%
Cloud	Cloud obscured areas which could not be classified in terms of land-cover information.	2268.51	0.13%
Grassland	Grass dominated areas, with only a few trees, bushes or shrubs.	1562.15	0.09%
Water (shallow pan)	Shallow water in pan systems	857.39	0.05%
Settlements	All settlements and built-up areas	597.66	0.03%

The majority of the Upstream RSA (33.96%) consists of arid plains characterised by bare sand, with sparse grass cover and scattered stunted bushes and shrubs (Bare sand #1 and #2). The next most prominent land cover features (Sparse low shrub, Dense low shrub) occur on rocky, laval hillsides, consisting of low shrub/grass cover with a few emergent bushes, and accounting for approx. 20% of the Upstream RSA.

Only 39% of the RSA supports dense vegetation cover (Dense bush #1 #2 #3 #4, Dense trees/bush) – largely consisting of riparian woodland associated with ephemeral streams and drainage lines, and riparian woodland along large luggas. These landcover classes form a branched woodland network throughout the open plains, which are characterised by sparsely vegetated, stunted shrubland.

Upstream LSA

An additional, more detailed 27-class vegetation/land-cover dataset was generated from the same source imagery for an Upstream Land Cover study area which included the LSA. This dataset provides more spatial and thematic detail on the vegetation communities on the plains and along the riparian zones, and was used as the basis for vegetation mapping within the Upstream Land Cover study area and LSA. These more detailed categories are described in Table 10-5 and illustrated on Drawing 10-12.

Table 10-5: 27-class land cover classification of Upstream LSA

Class	Class Name	Description	Area in LSA (Ha)	% total LSA cover
1	Acacia riparian forest	Acacia dominated forest (tall trees) along major riparian zones	56.60	0.93%
2	Mixed Acacia riparian forest	Acacia and other spp. dominated forest (tall trees) along major riparian zones	22.46	0.37%
3	Riparian woodland	Riparian woodland (not closed canopy, taller forest) along major riparian zones.	1747.85	28.65%
4	Plain desert shrubland, tall, dense	tall shrubland on plains, dense cover	46.01	0.75%
5	Plain desert shrubland, medium, dense	Medium height shrubland on plains, dense cover	87.42	1.43%
6	Plain desert shrubland, low, dense	Low shrubland on plains, dense cover	65.28	1.07%
7	Plain desert shrubland, sparse	Low or tall shrubland on plains, sparse cover	20.52	0.34%
8	Sand, non-vegetated	Non-vegetated bare sand areas	53.85	0.88%
9	Plain arid woodland/grassland, dense	Dense non-riparian woodland cover on plains	1600.12	26.23%
10	Plain arid woodland/grassland, medium	Open/semi-dense non-riparian woodland cover on plains	1254.97	20.57%
11	Plain arid woodland/grassland, low	Open non-riparian woodland cover on plains	750.45	12.30%
12	Plain arid woodland/grassland, sparse	Sparse non-riparian woodland cover on plains	260.65	4.27%
13	Water (lake and river)	Water in lake and major river systems	-	-
14	Water (shallow pan)	Shallow water in pan systems	-	-
15	Mountain sparse low shrub	Sparse low shrub and/or grass cover, with only a few bushes on mountains or rocky hills	4.86	0.08%
16	Mountain dense low shrub	Dense low shrub and/or grass cover, with only a few bushes, on mountains or rocky hills	114.95	1.88%
17	Mountain open bush #1	Open and/or scattered bush and shrub cover, on mountains or rocky hills.	-	-
18	Mountain open bush #2	Open and/or scattered bushes and/or shrubs, on mountains or rocky hills	1.74	0.03%
19	Mountain dense bush #1	Dense bush and/or taller shrubs (most dense bush dominated class), on mountains or rocky hills	0.69	0.01%
20	Mountain dense bush #2	Dense bush and/or taller shrubs (but less dense than dense bush class #1, on mountains or rocky hills	3.01	0.05%
21	Mountain dense bush #3	Dense bush and/or taller shrubs (but less dense than dense bush class #2, on mountains or rocky hills	7.63	0.13%
22	Mountain dense bush #4	Dense bush and/or taller shrubs (but less dense than dense bush class #3: least dense, but more dense than open bush classes), on mountains or rocky hills	0.48	0.01%
23	Mountain dense trees/bush	Dense tree and tall bush combination class, on mountains or rocky hills	-	-

Class	Class Name	Description	Area in LSA (Ha)	% total LSA cover
24	Mountain grassland	Grass dominated areas, with only a few trees, bushes or shrubs, on mountains or rocky hills	-	-
25	Mountain sparse grassland	Sparse to open grass cover areas, typically containing scattered bushes and shrubs, on mountains or rocky hills	0.99	0.02%
26	Cultivated lands	All cultivated lands, including both currently active and old, long term fallow/abandoned fields	-	-
27	Settlements	All settlements and built-up areas	-	-
		Total Extent of Upstream LSA (Ha)	**6,100.52**	**100%**

Of the 27 detailed land cover categories, 20 occur within the Upstream LSA, which is approx. 6,100.00 Ha in extent. Plain arid woodland/grassland (including classes 9, 10, 11 and 12), consisting of non-riparian woodland on plains, is dominant, covering the majority (approx. 63%) of the lands within the Upstream LSA. Riparian woodland associated with lugga systems is the other major land cover category within the Upstream LSA, covering approximately 27% of the area. A relatively small amount (79 Ha, 1.3%) of riparian forest (classes 1 and 2), consisting of closed-canopy tall tree forest, is intermingled with the riparian woodland along major lugga systems. The remainder of the LSA land cover consists of plain desert shrubland (~ 4%) and bare sand (~1%), with mountain bush (134 Ha, ~2% of cover) occurring beyond the footprint of direct activities but within the the eastern extent of the Upstream LSA.

10.3.3 Field Studies - Vegetation and Flora

The field surveys confirmed three broad vegetation communities within the Upstream RSA (Drawing 10-13). The alignment of the vegetation communities with the detailed vegetation/land cover dataset are outlined in Appendix G.

- *Acacia/Commiphora* bushland/thicket:
  - *Acacia/Commiphora/Indigofera* stunted bushland;
  - *Acacia/Commiphora/Euphorbia* thicket;
  - *Acacia/Commiphora* deciduous bushland and thicket; and
  - Semi-desert shrubland.
- Riparian Forest.
- Ephemeral Stream Woodland.

These three main vegetation communities broadly align with those described by White (1983), ILRI (2007), KREMU (1980) and van Breugel *et al.* (2015). The characteristics of these communities, and their condition and integrity, are summarised below. Full species lists for each community are provided in Appendix G-3

10.3.3.1 Acacia/Commiphora bushland and thicket

This vegetation community aligns with the *Acacia-Commiphora* stunted bushland described by van Breugel *et al.* (2015). Four sub-types of the community were identified, according to variations in coverage and structure due to location (on plains or on laval hills) and degrees of aridity; however, the species composition of the sub-communities was similar. A full species list for this community is provided in Appendix G-3. The four sub-types are described in the following sections.

Acacia/Commiphora/Indigofera stunted bushland

This sub-type is associated with the plain desert shrubland land cover classes, and aligns with the dwarf shrubland described by the KREMU (Olang, 1982). It occurs on plains within the Upstream LSA and RSA.

This community occurs in drier areas of the Upstream RSA, and is more prevalent in the northern regions. It is dominated by a flat-topped form of the deciduous *Acacia reficiens*. Associated species include *Maerua crassifolia*, and occasional patches of dwarf *A. tortilis* and *Balanites rotundifolia* (Figure 10-3). Undergrowth is dominated by the dwarf shrub *Indigofera spinosa,* to approximately 20 to 30 cm height, with grasses and forbs occurring infrequently.

Figure 10-3: Acacia/Commiphora/Indigofera stunted bushland

Figure 10-4: Acacia-Commiphora-Euphorbia stunted bushland/thicket

Acacia/Commiphora/Euphorbia stunted bushland/thicket

This sub-type occurs throughout in the southern region of the Upstream RSA and is the dominant vegetation community in the Upstream LSA, accounting for approx. 65% of cover. It aligns with the *Acacia-Commiphora* stunted bushland described by van Breugel *et al.* (2015), and the shrub-grassland described by KREMU (Olang, 1982). It is associated with the plain arid woodland land cover classes.

This community and shows greater species diversity than the *Acacia*/*Commiphora*/*Indigofera* stunted bushland occurring in the northern, more arid region. Typical vegetation composition consists of: patches of pure *Acacia reficiens; A. reficiens* mixing with dwarf *A. tortilis*; occasional individuals of *A. paolii* and *Euphorbia cuneata*, *A. reficiens* and *Balanites rotundifolia*; and dwarf *A. tortilis*, *E. cuneata* and *Jatropha dichtar* (Figure 10-4). The understorey is dominated by *Indigofera spinosa* and *Sericocomopsis hildebrandtii.* The difference between thicket and more open bushland is a factor of density of plant growth, as opposed to any real difference in flora species composition, and may be attributed to differences in soil characteristics (particularly soil moisture) and rainfall levels (e.g., the density and tree height of *A. reficiens* increases with increasing rainfall (Olang, 1987)) rather than the vegetation itself.

Acacia/Commiphora deciduous bushland and thicket

This sub-type aligns with the Somalia-Masai *Acacia-Commiphora* deciduous bushland and thicket community described by van Breugel *et al.* (2015), and the ‘Bushland’ described by the KREMU (ref. Section 10.2.1.2.2). This community occurs in elevated, hill regions in the east of the Upstream RSA, and does not occur within the Upstream LSA. It is associated with the mountain dense shrub/bush land cover classes. It is characterised by a few emergent species, dominated by *Acacia tortilis, A. reficiens, A. mellifera*, and *Salvadora persica*, with an understorey of *Indigofera spinosa*, with *Barleria acanthoides* and *Euphorbia turkanensis* also occurring. Most species have a growth habit of small bushy trees, branched near the base (Figure 10-5). The species composition is very similar to that described for semi-desert shrubland (see below). The main differentiating factor is the association of this bushland and thicket with preferential flow paths or drainage lines, and places where rainwater temporarily pools, as opposed to the rocky substrate where semi-desert shrubland occurs.

Semi-desert shrubland

This sub-type of *Acacia*/*Commiphora* bushland and thicket also aligns with the Somalia-Masai *Acacia-Commiphora* deciduous bushland and thicket community described by van Breugel *et al.* (2015), and the Bushland described by the KREMU (Olang, 1982). This community occurs in rocky habitat in the eastern hills region of the Upstream RSA, and does not occur within the Upstream LSA. It is associated with the mountain sparse/open shrub/bush/grassland land cover categories. It is characterised by a sparse cover of shrub species (Figure 10-6), dominated by *Acacia tortilis, A. reficiens,* and *A. mellifera*, with an understorey of *Indigofera spinosa. Barleria acanthoides* and *Euphorbia turkanensis* also occur.

Figure 10-5: Acacia/Commiphora deciduous bushland

Figure 10-6: Semi-desert shrubland

10.3.3.2 Riparian Forest

This vegetation community aligns with the riverine wooded vegetation category described by van Breugel *et al.* (2015), and woodland described by White (1983). This community correlates with the riparian forest landcover category.

Acacia tortillis-dominated riparian forest is most commonly found associated with the large luggas in all regions of the Upstream RSA, and consists largely of mature *A. tortilis*, typically between eight to 12 m in height, with dwarf shrubs of the same species typically forming the understorey. During field surveys, this vegetation community was recorded on sandy, alluvial soils primarily along the banks of large, seasonal luggas within the Upstream LSA (Figure 10-7). These luggas typically have periodic flows following significant rainfall, and, increased moisture storage-capacity in their sandy soils. This increased water storage capacity compensates for the low rainfall and high potential evaporation experienced in the region, thus supporting large individual trees in these areas (van Breugel *et al.*, 2015).

Figure 10-7: Acacia tortillis-dominated riparian forest

Figure 10-8: Hyphaene stands in Kalabata lagga

Some stands of *Hyphaene* riparian forest occur in the large Kalabata lugga in the east of the Upstream RSA; none of these stands are present within the Upstream LSA. These palm stands are often associated with a more diverse riparian forest flora, including *Hyphaene coriacea, A. elatior, A. tortilis* and *Zizyphus mauritiana* existing as narrow forest strips along channel margins and on stable alluvial “islands” (Figure 10-8). The understorey of these palm stands typically includes *Salvadora persica*, *Calotropis procera, Z. mauritiana*, and young specimens of *A. tortilis,* and *H. compressa.* Some of the Kalabata River’s larger tributaries also support very large specimens (in excess of 15 m) of *A. tortillis* and *A. elatior*.

10.3.3.3 Ephemeral Stream Woodland

This vegetation community aligns with the riverine woodland and riverine thicket edaphic vegetation types described by van Breugel *et al.* (2015), which is a subset of the mapped riverine wooded vegetation community (see Drawing 10-13); and aligns with the riparian woodland landcover category (Section 10.3.2). It occurs on the banks of smaller luggas, and across the braided channels of the wider ephemeral streams (Figure 10-9) throughout the Upstream RSA, and is the second most prevalent vegetation community in the Upstream LSA, accounting for approx 28% of vegetation cover.

Species diversity is relatively high compared to the riparian forests, due to the presence of a greater diversity of small shrubs, grasses and forbs in the understorey, and the presence of some of the species more typical of terrestrial vegetation communities. The full species list is provided in Appendix G-3.

Figure 10-9: Ephemeral stream woodland

10.3.3.4 *Flora Species of Concern*

In total, 155 plant species were recorded in the Upstream RSA during field surveys (Appendix G). Of these, four flora species of concern were identified; these are summarised in Table 10-6.

Table 10-6: Flora Species of Concern identified during baseline surveys

Scientific Name	**Occurrence**	**Conservation Status**				**Other**
		Kenya WCMA	**KWS priority species**	**IUCN Red List**	**CITES**	
Blepharis turkanae	Only known from Turkana county (Vollesen 2008)	-	-	VU	-	Restricted range
Euphorbia turkanensis	Type locality is 1.5 km south-west of Lokichar and the species is known from a limited distribution at a small area of north-west Kenya (Carter and Smith 1988)	-	-	-	II	Restricted range
Neuracanthus kenyensis	Only known from northern Kenya (Marsabit, Isiolo and Turkana), at Kora National Reserve and in the Gemu Gofa region of Ethiopia-Kenya border (Darbyshire *et al.* 2010)	-	-	-	-	Restricted range
Xerophyta schnizleinia	Known from Northern Frontier in Kenya, Karamoja in Uganda, Ethiopia, Somali republic and Nigeria (Smith and Ayensu 1975).	-	-	-	-	Restricted range

All of these species were located in the 'Katamanak' hill region, approx. 5 km southeast (and outside) of the Upstream LSA. None were recorded within the Upstream LSA.

10.3.4 Field Studies - Invertebrates

A summary of the baseline invertebrate species data collected in the Upstream RSA and LSA is presented below. Detailed baseline results are provided in Appendix G-4.

A total of 6513 invertebrate specimens were collected in the RSA. Of these, 277 specimens were collected in the Upstream LSA. These included spiders (Class: Arachnida, Order: Aranae), centipedes (Class: Chilopoda), millipedes (Class: Diplopoda), woodlice (Class: Isopoda), camel spiders (Class: Arachnida, Order: Solifugae), scorpions (Class: Arachnida, Order: Scorpionae), and insects (Class: Insecta).

By far the most abundant and diverse invertebrates in the Upstream RSA were the insects, with 12 orders represented in the Upstream RSA, comprised of 61 families and 466 genera; of these, 10 orders, and 225 genera were confirmed within Amosing and Ngamia in the Upstream LSA.

The survey results for the insect groups, which were the focus for this baseline (ref. Section 10.3.3.3), are summarised in the following sections.

Coleoptera (Beetles)

Two-hundred-fifty-four species of beetle were recorded in the Upstream RSA and LSA, representing 20 families and 66 genera. Darkling beetles (Tenebrionidae) were the most species rich and abundant, with 14 genera, 19 species and 1928 individuals recorded. This represents 29 percent of all invertebrate specimens collected. Scarab beetles (Scarabeidae) were the next most abundant, with ten genera, 12 species and 1502 individuals recorded. This represents 23 percent of all invertebrate specimens collected. Ground beetles (Carabidae) were the third most diverse group, with nine genera and ten species recorded.

Habitats

Coleoptera were distributed throughout all vegetation communities in the Upstream RSA and LSA. Wooded ephemeral streams supported the highest richness, diversity and abundance, with 15 families and 49 species recorded. This was followed closely by riparian forest, where eight to 13 families and 23 to 39 species were recorded.

Non-riverine habitats, including the sub-communities of *Acacia*/*Commiphora*/*Euphorbia* thicket, *Acacia*/*Commiphora*/ *Indigofera* stunted bushland, and semi-desert shrubland, supported a much lower diversity of beetle fauna (three to four families in each). Those families and species recorded in these habitats overlapped with those recorded in the riparian habitats.

These observations suggest that the riparian forest and woodland habitats are important for the beetle biodiversity of the Upstream RSA and LSA, with higher richness and abundance recorded in these habitats. This is most likely explained by the more structurally-diverse habitat offered in these vegetation communities, and the higher moisture levels.

Diptera (Flies)

Twenty-three species were recorded in the Upstream RSA and LSA, representing seven families and six genera. House Flies (Muscidae) were the most species rich, and abundant, with three genera, and 115 individuals. Although this only represents three percent of all invertebrate specimens collected, the specimens from this family represent nearly 70 percent of all flies collected (115 individuals of 166). All the other flies recorded were not species rich or very diverse, with families typically being represented by one or two genera and/or species. Fruit flies (Drosophilidae), although not species rich or diverse, were abundant, with 30 specimens collected representing 18 percent of all flies collected.

Habitats

Greater species diversity was observed in the riparian forest and wooded ephemeral streams communities. As discussed above, this was similarly observed for the beetles (Coleoptera). Wooded ephemeral streams supported the greatest diversity, with six families recorded. The Muscidae family was common to all vegetation communities, and was the only Dipteran family recorded in *Acacia*/*Commiphora*/*Euphorbia* thicket sub-community, that is, away from the riparian habitats

Hymenoptera (Sawflies, Wasps, Bees, Ants)

Thirty species of Hymenopteran were recorded in the Upstream RSA and LSA, representing 12 families and 15 genera. Ants (Formicidae) were the most species rich and abundant Hymenopteran group, with six genera and 866 individuals recorded. This represents 13 percent of all invertebrate specimens recorded, and 78 percent of all Hymenopteran individuals recorded. Chalcid wasps (Chalcidae) were the second-most abundant group, with 205 specimens collected, representing almost 19 percent of all Hymenopterans sampled, followed by bees (Apidae), with 127 specimens sampled (11 percent). Other families showed lower levels of richness, diversity and abundance (with one to three genera represented).

Habitats

Wooded ephemeral streams supported the greatest diversity, with seven families recorded, followed by riparian forest, with five family groups recorded in each.

The *Acacia*/*Commiphora* thicket supported a higher diversity of Hymenoptera compared to other insect orders, with four families recorded, and also supported the third greatest abundance of Hymenoptera, with 406 individuals recorded.

Lepidoptera (Butterflies)

Twenty-four butterfly species were identified within the Upstream RSA and LSA, representing four families and 13 genera. The whites (Pieridae) was the most species-rich and abundant family, with 15 species positively identified. This family accounted for 62 of 80 sampled butterfly specimens. All other species were sampled in low numbers (one to five individuals) during the baseline survey.

The migratory species Brown-veined White Butterfly (*Belenois aurota*) was frequently encountered (24 occasions) during the November 2015 preliminary survey, with just three observations during the June 2016 survey. Given that it breeds throughout Sub-Saharan Africa, the potential breeding habitat within the Upstream RSA is considered to be of relatively low importance in the context of the vast area throughout which this species breeds and migrates, and it is not included as a species of concern for this assessment.

Habitats

Butterflies were recorded across all vegetation communities, with greatest abundance recorded in wooded ephemeral streams, riparian forest, and the sub-community of semi-desert shrubland, respectively. Species richness and diversity was relatively uniform across all habitat types, with the stream/lugga-associated communities (that is, riparian forest and wooded ephemeral streams) supporting higher numbers of families compared to other habitats.

Orthoptera (Grasshoppers, Crickets, Katydids, Locusts)

Twelve species of cricket and grasshopper were recorded within the Upstream RSA and LSA, from four families and eight genera. Species abundance was split almost evenly between crickets (Gryllidae) and grasshoppers (Acrididae). The grasshoppers showed greater species richness, with seven species recorded, followed by Gryllidae with three species recorded.

Habitats

Riparian forest and wooded ephemeral streams supported greatest species diversity and abundance, with all four families recorded in these communities. Only one species from one family (Acrididae) was recorded in other habitats, this was the grasshopper, *Sphingonotus savigni*.

10.3.4.1 Invertebrate Species of Concern

A single invertebrate species of concern was recorded during the baseline surveys; a single specimen of an unnamed ground beetle in the genus *Omophron* (Family: Carabidae, Sub-family: Omophrininae) (Figure 10-10) which was collected near Loperot, approx. 10 km northeast of the LSA (Drawing 4), and is likely to occur more widely (i.e. within the LSA). *Omophron* (Latreille 1802) is a genus of ground beetle, and the only extant genus in the subfamily Omophrininae. It is mostly distributed in the northern hemisphere, with the southern border of its African distribution running through South Africa and Madagascar (Valainis 2010). This individual is a new record for this species from Kenya, and may be a species new to science.

Figure 10-10: Omophron sp. collected at TKLA-1 in the Upstream RSA in June 2016

10.3.5 Field Studies – Herpetofauna

A summary of the primary baseline data of the reptile and amphibian species of the Upstream RSA and LSA is presented based on the findings of the field investigations. The detailed baseline survey results are presented in Appendix G-5.

Thirteen reptile species, and one amphibian species, were recorded. Eight of these were recorded specifically within the Upstream LSA (in Ngamia and Amosing). In addition, the Tullow Snake Catching Team have recorded seven snake species from Amosing and Ngamia, which were not recorded during the formal survey. With the addition of those records, the total count of reptile and amphibian species is 18, 15 of which were recorded in the Upstream LSA.

Habitats

Most species were trapped in riparian forest and wooded ephemeral streams, with just four species recorded from other, more open habitats such as *Acacia*/*Commiphora* bushland and thicket, and the sub-community of semi-desert shrubland. No habitat data was provided for reptile species caught in Ngamia and Amosing by the Tullow Snake Catchers, because call-outs are typically for snakes that entered work areas, that is, modified habitats; however, the dominant vegetation communities surrounding the fields in these areas are wooded ephemeral streams and *Acacia*/*Commiphora*/*Euphorbia* bushland/thicket.

10.3.5.1 Herpetofauna Species of Concern

Two species of conservation concern were recorded in the Upstream LSA (Table 10-7). The IUCN-listed data deficient Turkana Toad (*Amietophrynus turkanae*) (Figure 10-11) was recorded in riparian forest at Amosing. Very little is known about this toad, having previously only been recorded from two other localities in north-central Kenya (Channing and Howell, 2006; IUCN SSC Amphibian Specialist Group, 2016). Based on those localities, the record from the Upstream RSA at Amosing is a range extension for this species. The WCMA-protected (Wildlife Conservation and Management Act) and CITES Appendix GI-listed Kenya Sand Boa (*Eryx colubrinus*) was also recorded at Amosing. This is a widely distributed species, preferring desert, semi-desert and dry savannah habitats (Spawls et al. 2004).

Table 10-7: Herpetofauna Species of Concern recorded in Upstream RSA and LSA

Common Name	Species Name	IUCN Red List	Kenya WCMA	CITES	Distribution
Kenya Sand Boa	*Eryx colubrinus*	Not evaluated	Protected	II	Egypt, Sudan, Ethiopia, Eritrea, Kenya, Tanzania, Somalia
Lake Turkana Toad	*Sclerophrys turkanae*	DD	-	-	North-central Kenya

Figure 10-11: Turkana Toad (Amietophrynus turkanae)

The majority of the other species recorded have not yet been assessed by the IUCN, or are listed as least concern. Several of the recorded species are regionally endemic (Appendix G-5); however, most are not range-restricted and as such are not considered as SoC.

10.3.6 Field Studies - Birds

One-hundred-and-forty-nine bird species were recorded, the majority of which (109 species) were recorded during surveys in Amosing and Ngamia. Most of the recorded species are relatively common and typical of the region. Species community composition generally comprised of resident woodland and grassland species. The full list of bird species recorded in the Upstream RSA and LSA is presented in Appendix G-6.

No major differences in community composition were observed between seasons; however, a number of Palearctic and Afro-tropical migrant species were observed during the May and August 2016 surveys, which coincided with the end of the dry season/start of long wet season, and the end of the long rainy season, respectively.

A relatively high diversity of raptor species (19 species) was recorded over the course of the three surveys. Several of the observed raptor species are Palearctic migrants, including Black Kite (*Milvus migrans*), Eurasian Hobby (*Falco subbuteo*), Lesser Kestrel (*F. naumanni*), Pallid Harrier (*Circus macrourus*), Steppe Buzzard (*Buteo rufofuscus*) and Steppe Eagle (*Aquila nipalensis*).

Most species were recorded in the *Acacia*/*Commiphora*/*Euphorbia* bushland/thicket vegetation sub-type (116 species). However, the majority of these (103 species) were also recorded in the ephemeral stream woodland community. The richness, diversity and abundance of birds recorded within the riparian forest community was much lower, with only 36 species recorded. That being said, in general, the birds recorded within specific vegetation types were subsets of the wider bird community recorded across the Upstream RSA, with no species being particular to a specific vegetation community.

10.3.6.1 Bird Species of Concern

Sixteen bird species of concern were identified in the Upstream RSA, all of which were recorded in the LSA during surveys in Ngamia and Amosing (Table 10-8). These included six globally-threatened species, four nationally protected species, and thirteen migratory species. Some species, particularly those that were listed as Least Concern by IUCN and not protected by the Kenya WCMA, were additional to those predicted for the RSA in Table 10-3.

Table 10-8: Bird Species of Concern confirmed in Upstream RSA

Common name	Scientific Name	IUCN Red List	Kenya WCMA	CMS	CITES	Present in LSA
African White-backed Vulture	*Gyps africanus*	CR	Near-threatened	II	II	✓
Lappet-faced Vulture	*Torgos tracheliotos*	EN	Vulnerable		II	✓
Steppe Eagle	*Aquila nipalensis*	EN	-	II	II	✓
Bateleur	*Terathopius ecaudatus*	NT	-	III	II	✓
Kori Bustard	*Ardeotis kori*	NT	-	-	II	✓
Pallid Harrier	*Circus macrourus*	NT	Near-threatened	II	II	✓
Lesser Kestrel	*Falco naumanni*	LC	Vulnerable	I, II	II	✓
Eurasian Hobby	*Falco subbuteo*	LC	-	II	II	✓
African Pygmy Falcon	*Polihierax semitorquatus*	LC	-	II	II	✓
African Harrier Hawk	*Polyboroides typus*	LC	-	-	II	✓
Spur-winged Plover	*Vanellus spinosus*	LC	-	II	-	✓
Abdim's Stork	*Ciconia abdimii*	LC	-	II	-	✓
Cattle Egret	*Bubulcus ibis*	LC	-	II	III	✓
Common Quail	*Coturnix coturnix*	LC	-	II	-	✓
Black Kite	*Milvus migrans*	LC	-	II	II	✓
Steppe Buzzard	*Buteo buteo*	LC	-	II	II	✓

10.3.7 Field Studies - Mammals

Twenty-nine species were confirmed within the Upstream RSA, of which thirteen were recorded within the Upstream LSA (Table 10-9). Track-pad records indicate that an additional three species may be present; a porcupine species (either Cape Porcupine *Hystrix africaeaustralis* or Crested Porcupine *Hystrix cristata,* both least concern), a mongoose species (one of eleven species known from Kenya), and Side-striped Jackal (*Canis adustus* – least concern). In addition, anecdotal records, gathered from local people, indicated the presence of other species, such as Caracal (*Caracal caracal*) (least concern), porcupine and Leopard (*Panthera pardus*) (vulnerable).

Table 10-9: Mammal species recorded in Upstream RSA, 2015-2016

Common Name	*Scientific Name*	No. of Observations	IUCN RedList	Kenya WCMA	CITES	Recorded in LSA
Percival's Spiny Mouse	*Acomys percivali*	2	LC	-	-	✓
Wilson's Spiny mouse	*Acomys wilsoni*	1	LC	-	-	-
African Grass Rat	*Arvicanthis niloticus*	2	LC	-	-	-
Four-toed Hedgehog	*Atelerix albiventris*	5	LC	-	-	-
Somali Hedgehog	*Atelerix sclateri*	4	LC	-	-	-
Golden Jackal	*Canis aureus*	1	LC	-	III	-
Black-backed Jackal	*Canis mesomelas*	1	LC	-	-	✓
African Civet	*Civettictis civetta*	1	LC	-	III	✓

Common Name	*Scientific Name*	No. of Observations	IUCN RedList	Kenya WCMA	CITES	Recorded in LSA
Spotted Hyena	*Crocuta crocuta*	3	LC	-	-	✓
Rufous Sengi	*Elephantalus rufescens*	1	LC	-	-	-
Senegal Galago	*Galago senegalensis*	10	LC	-	-	✓
Small-spotted Genet	*Genetta genetta*	1	LC	-	-	-
Large-spotted Genet	*Genetta maculata*	2	LC	-	-	✓
Genet	*Genetta sp.*	1	LC	-	-	-
Black-tailed Gerbil	*Gerbilliscus nigricaudus*	1	LC	-	-	-
Gerbillus sp.	*Gerbillus sp.*	4		-	-	-
Striped Hyena	*Hyaena hyaena*	4	NT	Endangered	III	✓
Porcupine	*Hystrix sp.*	tracks	LC	-	-	-
Striped Polecat	*Ictonyx striatus*	5	LC	-	-	-
Yellow-winged Bat	*Lavia frons*	8	LC	-	-	-
Serval	*Leptailurus servalis*	2	LC	-	II	✓
Cape Hare	*Lepus capensis*	29	LC	-	-	✓
Guenther's Dik-dik	*Madoqua guentheri*	5	LC	-	-	-
Honey badger	*Mellivora capensis*	1	LC	-	III	-
Schlieffen's Twilight Bat	*Nycticeinops schlieffeni*	1	LC	-	-	-
Aardvark	*Orycteropus afer*	tracks, foraging	LC	-	-	✓
Bat-eared fox	*Otocyon megalotis*	2	LC	-	-	✓
Olive Baboon	*Papio anubis*	droppings	LC	-	-	-
Emin's Tateril	*Taterillus emeni*	3	LC	-	-	-
Unstriped Ground Squirrel	*Xerus rutilans*	39	LC	-	-	✓
Civet/Mongoose	-	tracks	-	-	-	✓

Medium and Large Mammals

Twenty medium and large mammal species[10] were recorded over the course of the three mammal survey visits within the Upstream RSA (Table 10-9, Drawing 10-15). Twelve of these were recorded inside the Upstream LSA; however given the distribution, habits and mobility of the mammal species, it is likely that all of the twenty recorded species will occur within the Upstream LSA at various points in time. In general, the recorded medium and large mammal fauna assemblage consists of medium-sized carnivorous/omnivorous mammals, such as African Civet, Large-spotted Genet, Serval, Jackals, Bat-eared Fox, Spotted and Striped Hyena, with the remainder made up of smaller-sized species such as hedgehogs, hares and ground squirrels.

The most frequently recorded species were Unstriped Ground Squirrel (*Xerus rutilans*) and Cape Hare (*Lepus capensis*), which were present throughout the Upstream RSA.

[10] Medium and large mammals includes all species except rodents and bats.

Small Mammals (rodents)

Seven small mammal species were captured in Sherman traps in the Upstream RSA across the three survey periods (Table 10-9). One species, Percival's Spiny Mouse (*Acomys percivali*) was captured within the Upstream LSA; however it is considered likely that any of the recorded species also occur within the Upstream LSA. The abundance and species richness of captured species was low compared to a potential 22 small mammal species that have been recorded in Turkana region to date (Coe, 1972; Webala *et al.,* 2010; Appendix G-7). The overall trap success rate for the survey was also relatively low, varying between three and eight percent across the three survey events (Appendix G-7). Similar results were achieved in a relatively recent small mammal study conducted on the eastern side of Lake Turkana (Webala *et al.,* 2010) in which low species diversity (eleven species in total, and six in similar habitat) and low capture success (5.46% average success rate) was also noted; the baseline survey results may thus reflect generally low levels of species richness associated with arid plain habitats.

Small Mammals (bats)

Two bat species were confirmed via trapping in the Upstream RSA during baseline surveys; Yellow-winged Bat (*Lavia frons*) and Schlieffen's Twilight Bat (*Nycticeinops schlieffeni*), both of which are least concern (IUCN, 2016).

Active transect surveys were conducted during 12 dusk and dawn periods in April 2016 (as part of the FFD ESIA baseline), and covered approximately 153 km. Two-hundred-and-one bat echolocation call files were generated during the driven transect survey. Of these, 61 were indistinguishable. Most of the rest were identified as calls from the families Molossidae and Vespertilionidae, suggesting up to six additional species including *Myotis tricolor, Pipistrellus kuhli, Neoromicia nanus, Charaephon pumila, Mops condylurus* and *Mops cf demonstrator* (Webala *et al.,* 2009) may occur. The mean encounter rate per kilometer was 0.91 calls, indicating a low overall level of bat activity within the Upstream RSA during that survey period.

Suitable roosting habitat for tree/crevice-roosting species is present within the Upstream RSA and LSA; Schlieffen's Twilight Bat was recorded from a tree roost. No cave-roosting species or fruit bat species are expected to occur within the Upstream LSA, due to absence of suitable habitat.

10.3.7.1 Mammal Species of Concern

Six mammal species of concern were recorded within the Upstream RSA, three of which were confirmed within the Upstream LSA during baseline surveys (Table 10-10).

Table 10-10: Mammal Species of Concern recorded during baseline surveys

Common Name	*Scientific Name*	IUCN RedList	Kenya WCMA	CITES	Recorded in LSA
Golden Jackal	*Canis aureus*	LC	-	III	-
African Civet	*Civettictis civetta*	LC	-	III	✓
Striped Hyena	*Hyaena hyaena*	NT	Endangered	III	✓
Serval	*Leptailurus servalis*	LC	-	II	✓
Honey badger	*Mellivora capensis*	LC	-	III	-
Leopard	*Panthera pardus*	NT	Endangered	II	-

10.4 Results – Midstream Study Area

The following sections describe the international and national context for biodiversity within the Midstream RSA and LSA, as determined through review of existing literature and data (ref. Section 10.3.1).

10.4.1 Species of Concern with Potential to Occur in Midstream RSA

Based on available information, 152 species of conservation concern could occur within the Midstream RSA (Appendix G-2 presents data from NMK along the Midstream route, GBIF data is also available but too voluminous to include in this appendix). These include:

- 28 plant species;
- Five invertebrate species;
- Four amphibian species;
- 11 reptile species;
- 77 bird species; and
- 27 mammal species.

Most of these species are particular to protected areas and, as such, are not expected to be relevant to the Midstream LSA, with the exception of those that occur within Tsavo West National Park which is being traversed by the road route.

10.4.2 Ecosystems of Concern

10.4.2.1 Internationally-recognised sites of biodiversity importance

Drawing 10-8 presents all the international areas of recognised biodiversity value occurring within the Midstream RSA. Each of these areas, and their significance, is summarised below.

WWF Ecoregions

The Midstream RSA coincides with four ecoregions recognised as part of WWF's Global 200 project (Olson and Dinerstein, 2002), which shortlists freshwater and terrestrial ecoregions that harbor exceptional biodiversity and are representative of its ecosystems. The four Global 200 ecoregions are:

- **East African Acacia Savannas:** The majority of the route lies within this Global Ecoregion, which includes the terrestrial ecoregions Southern *Acacia-Commiphora* bushlands and thickets, and Northern *Acacia-Commiphora* bushlands and thickets.
- **Rift Valley Lakes**: Approximately 370 km of the transport route passes through the Rift Valley Lakes ecoregion, a huge area which encompasses the nearby Lake Nakuru and Lake Naivasha, and extending to Lakes Victoria, Tanganika and Malawi.
- **East African Coastal Forests:** Approximately 50 km of the route passes through this ecoregion, which extends along the east African coast from southern Somalia through to southern Mozambique. Although characterized by tropical dry forest within a mosaic of savanna, grasslands and wetlands areas, much of the Kenyan part of this ecoregion is now mainly farmland (Olson and Dinerstein, 2002)
- **East African Mangroves:** Approximately 18 km of the route lies within this ecoregion, which encompasses mangrove areas extending from the coasts of Somalia to Mozambique.

Endemic Bird Areas

The Midstream RSA passes through three EBAs: the Kenya Mountains, Serengeti Plains and East African Coastal Forests:

- **Kenya Mountains:** the proposed route passes through this expansive EBA in several locations (Drawing 10-8); between KM 178-195, KM298-420, 451-458, and 523-593. The EBA includes mountainous areas above 2,500 m asl around the Rift Valley, including those in the interior of Kenya and northern Tanzania, and on the eastern border of Uganda. The EBA overlaps with IBAs, including Kinangop Grasslands, Chyulul Hills Forests, Lake Elmenteita, and Nairobi National Park, which are described in the next section. The EBA supports several range-restricted species of conservation concern, such as the endangered Sharpe's Longclaw (*Macronyx sharpei*) and Aberdare Cisticola (*Cisticola aberdare*), and the vulnerable Hinde's Babbler (*Turdoides hindei*) and South Pare White-eye (*Zosterops winifredae*) (BirdLife International, 2017a).
- **Serengeti Plains:** The proposed route intercepts this EBA between KM442-451, and KM458-523. The EBA includes the semi-arid plains to the south and east of Lake Victoria in north-central Tanzania and

south-west Kenya. Only two of the range-restricted species for which this EBA is designated occur in Kenya: the Usambiro Barbet (*Trachyphonus usambiro)* and near threatened Grey-crested Helmet-shrike (*Prionops poliolophus)* (BirdLife International, 2017b). The EBA includes three Kenyan IBAs: Lake Elmenteita, Lake Naivasha and Lake Nakruru National Park (see Section 10.4.2.2).

- **East African Coastal Forests:** this EBA generally overlaps with the East African Coastal Forests WWF Ecoregion described above. The proposed route crosses the EBA as it approaches the facility at the coast between KM1061-1092. The EBA supports a number of species of conservation concern, including the endangered species Skokoke Scops Owl (*Otus ireneae*), Amani Sunbird (*Hedydipna pallidigaster*) and Clarke's Weaver (*Ploceus golandi*); however, their distributions are uncertain due to difficulties of access, and lack of focused ornithological surveys in the region (BirdLife International, 2017c)

Ramsar Sites and Important Bird Areas

The Midstream RSA includes three Ramsar sites; Lake Elmenteita, Lake Nakuru, and Lake Naivasha; the latter two of which are also designated as National Parks. The Midstream RSA also includes 11 IBAs (BirdLife International, 2017d), three of which overlap the Ramsar sites above. The Ramsar sites and IBAs are illustrated on Drawing 10-8.

10.4.2.2 Nationally Designated and Protected Areas

Nationally Protected Areas

The Midstream RSA coincides with seventeen nationally protected areas, which are shown on Drawing 10-9. The nationally protected areas within the Midstream RSA are summarised below.

- **Kapcherop National Forest:** an Afromontane Forest that supports populations of African Juniper (*Juniperus procera*) prized for use as timber, and, as such, is subject to localised declines of old-growth forest groves where it occurs. The Forest Reserve partially coincides with the Cherangani Hills IBA discussed above.

- **Mau Forest Complex – Forest Reserves:** four forest reserves forming part of the Mau Forest Complex will be traversed by the proposed route; Timbora Forest Reserve, Northern Tinderet Forest Reserve, Tinderet Forest Reserve and Londiani Forest Reserve. The Mau Forest Complex is described above in the context of Important Bird Areas.

- **Menengai Crater National Park:** primarily designated for the presence of a huge caldera with high ecotourism value, as well as the surrounding Menengai forest, which appears to be largely understudied. Several birds of conservation concern have been recorded, and mammal diversity is relatively low.

- **Mount Longonot National Park**: the potential of linking the Hell's Gate-Mt Longonot Ecosystem with Lake Nakuru and Lake Naivasha through land purchase or easement is being explored as a potential solution to conservation management issues in the management units (KWS, 2010a), therefore, it is included in the Midstream RSA.

- **Nairobi National Park**: the park is fenced along this boundary but open on its southern boundary, allowing the second-largest migration (after the Mara-Serengeti) of large herbivores including Wildebeest (*Connochaetes taurinus*) and near threatened Plains Zebra (*Equus quagga*) in Kenya to occur. The park is also designated as an IBA with 516 species recorded (see Section 10.4.2.1)

- **Chyulu Hills National Park:** officially an extension of Tsavo West National Park, forming part of the Tsavo Conservation Area, and was primarily designated to provide protection to the area's unique moist mountain forest habitats, and due to its vital role as a water catchment area for important national surface water features including the Mzima Springs and the Tsavo and Galana rivers (KWS, 2008)

- **Tsavo West National Park:** the park holds substantial populations of a diversity of large mammals, including African Elephant, Cheetah (*Acinonyx jubatus*), Leopard (*P. pardus*), Greater Kudu (*Tragelaphus strepsiceros*) Grevy's Zebra, and the critically endangered Hirola (*Beatragus hunteri*). Two amphibian taxa, *Afrixalus pygmaeus septentrionalis* and *Hyperolius sheldricki*, are endemic to the Tsavo area (KWS, 2010).

- **Tsavo East National Park:** the largest protected area in Kenya, covering an area of approximately 14,000 km^2. The park, in combination with Tsavo West, has the single biggest African Elephant population on the continent, with an estimated population of approximately 14,000 individuals (KWS, 2010). Tsavo East National Park's (administrative) boundary with Tsavo West National Park is located along the Athi River (KWS, 2010); there are no fences separating the parks and animals can move freely between them.
- **Ngai Ndethya National Reserve:** the reserve has been severely encroached by settlement and farming activities but remains formally gazetted and falls under the Tsavo Conservation Area Management Plan. Management objectives include the preservation of a two-kilometer buffer area that prohibits cultivation along the Mtito and Athi Rivers in an effort to ensure that this area remains available and accessible to dispersing wildlife (KWS, 2008).

National Priority Conservation Areas

KWS has published lists of priority ecosystems for which conservation measures are required/proposed. These include endangered ecosystems, areas of environmental significance, and water towers[11] of national importance. Although all of these areas are associated with protected areas (ref. Drawing 10-9), some parts, such as the catchments of the lake ecosystems, are outside of nationally protected areas.

10.4.2.3 Important Habitats outside of Protected Areas

A number of other important habitats outside of protected areas with potential to support important biodiversity values were identified along the proposed route. They include forests, forest ranges and wetlands, and are illustrated on Drawing 10-10a.

10.5 Discussion

10.5.1 Upstream Study Area

Species of conservation concern confirmed within the Upstream RSA and LSA during baseline studies are summarised on Table 10-11. In addition, the 44 species of conservation concern considered likely to occur within the Upstream LSA (ref. Section 10.3.1.1, Table 10-3) will also be considered for impact assessment. Any potential project effects resulting from the Upstream Component of EOPS will be considered for these species.

Table 10-11: Species of Conservation Concern confirmed within Upstream RSA and LSA

Scientific Name	**Common name**	**Kenya WCMA**	**KWS priority species**	**IUCN Red List**	**CMS**	**CITES**	**Other**
Plants							
Aloe turkanensis	-	-	-	-	-	-	Restricted range
Blepharis turkanae	-	-	-	VU	-	-	Restricted range
Euphorbia turkanensis	-	-	-	-		II	Restricted range
Neuracanthus kenyensis	-	-	-	-	-	-	Restricted range
Invertebrates							
Omophron sp.	-	-	-	-	-	-	New record for Kenya
Herpetofauna							
Sclerophrys turkanae	Lake Turkana Toad	-	Y	DD	-	-	-

[11] Water towers: Nationally-designated mountainous areas forming the upper catchment of the main rivers in Kenya that play a crucial role in the delivery of ecosystem services including climate regulation, water storage, groundwater recharge, river flow regulation, flood mitigation, water purification, biodiversity conservation etc.

Scientific Name	Common name	Kenya WCMA	KWS priority species	IUCN Red List	CMS	CITES	Other
Eryx colubrinus	Kenya Sand Boa	Protected	-	-	-	II	
Birds							
Ardeotis kori	Kori Bustard	-	-	NT	-	II	-
Aquila nipalensis	Steppe Eagle	-	-	EN	II	II	-
Bubulcus ibis	Cattle Egret			LC	II	III	
Buteo buteo	Steppe Buzzard	-	-	LC	II	II	
Ciconia abdimii	Abdim's Stork	-	-	LC	II	-	-
Circus macrourus	Pallid Harrier	Near Threatened	-	NT	II	II	-
Coturnix coturnix	Common Quail	-	-	LC	II	-	-
Falco naumanni	Lesser Kestrel	Vulnerable	Y	LC	I/II	II	-
Falco subbuteo	Eurasian Hobby	-	-	LC	II	II	-
Gyps africanus	White-backed Vulture	Near Threatened	-	CR	II	II	-
Gyps rueppelli	Ruepell's Vulture	Near Threatened	-	CR	II	II	-
Melierax poliopterus	Eastern Chanting-Goshawk	-	-	LC	II	II	-
Milvus migrans	Black Kite	-	-	LC	II	II	-
Polihierax semitorquatus	African Pygmy Falcon	-	-	LC	II	II	-
Polyboroides typus	African Harrier Hawk	-	-	LC		II	-
Terathopius ecaudatus	Bateleur	-	-	NT	II	II	-
Torgos tracheliotos	Lappet-faced Vulture	Vulnerable	Y	EN	II	II	-
Vanellus spinosus	Spur-winged Plover	-	-	LC	II	-	-
Mammals							
Canis aureus	Golden Jackal	-	-	LC	-	II	-
Civettictis civetta	African Civet	-	-	LC	-	III	-
Hyaena hyaena	Striped Hyaena	Endangered	Y	NT	-	III	-
Leptailurus servalis	Serval	Endangered	-	NT	-	III	-
Mellivora capensis	Honey badger	-	-	LC	-	III	-
Panthera pardus	Leopard	Endangered	Y	NT	-	II	-
Papio anubis	Olive baboon	-	-	LC	-	II	-

Two protected areas (Lake Turkana National Park, Ramsar site and IBA; South Turkana National Reserve) lie adjacent to the Upstream RSA; however due to the distance from the LSA and the nature of proposed activities, these protected areas will be scoped out of the effects and impact analysis and will not be considered a potential receptor.

Three vegetation communities of conservation concern are mapped within the Upstream RSA. One of these - riverine wooded vegetation - aligns with the riparian forest mapped within the Upstream LSA during baseline field studies. Potential project effects resulting from the Upstream Component of EOPS will therefore be considered for this vegetation community within the Upstream LSA.

The following observations were made during the biodiversity surveys:

- The Upstream LSA is characterised by Acacia-Commiphora-Euphorbia stunted bushland/thicket, interspersed by a few large luggas supporting Riparian Forest, and numerous wooded ephemeral streams.
- Invertebrate and herpetofauna abundance and species richness was higher in riparian forest and wooded ephemeral streams throughout the Upstream RSA and Upstream LSA, with much fewer records from other, more open habitats such as *Acacia*/*Commiphora* bushland and thicket.
- Bird abundance and species richness was significantly higher in Acacia-Commiphora-Euphorbia stunted bushland/thicket than in riparian forest or woodland throughout the Upstream RSA and Upstream LSA; all bird species of conservation concern that were recorded during baseline surveys occurred in this habitat in the Upstream LSA.
- Low small mammal abundance and diversity may be indicative of generally low abundance and diversity of small mammal species within the Upstream RSA and surrounding area.
- Twenty species of medium-large mammal species were recorded, with thirteen of these consisting of opportunistic/omnivorous species (e.g. Large-spotted genet (*Genetta maculata*, Black-backed Jackal (*Canis mesomelas)*, Bat-eared Fox (*Otocyon megalotis)*, Spotted Hyena *Crocuta crocuta*, and the endangered species, Striped Hyena *H. hyena*). No vegetation community affiliations were noted, although the hills to the east and west of the RSA may be important corridors for mammal dispersal in the region.

10.5.2 Midstream Study Area

Internationally recognised Ramsar sites, IBAs, and Nationally-protected sites that lie adjacent to, or will be traversed by, the Midstream LSA (Table 10-12) will be the focus for assessment of potential impacts resulting from the midstream component of EOPS.

Table 10-12: Ecosystems of concern for Impact Assessment

Site	Proximity to Midstream LSA
Lake Elmenteita Ramsar Site and IBA	0.8 - 1.0 km west of LSA
Kinangop Grasslands IBA	LSA intercepts the IBA
Kikuyu Escarpment Forest IBA	LSA intercepts the IBA
Nairobi National Park IBA	LSA is adjacent to northern boundary
Chyulu Hills Forests IBA	LSA is adjacent to western boundary
Tsavo West National Park IBA	LSA intercepts the IBA
Tsavo East National Park IBA	LSA is adjacent to approx. 47 km of southwestern boundary
South Turkana National Reserve	Adjacent
Mau Forest Complex Forest reserves	LSA intercepts the forest reserves
Lake Nakuru National Park	0.5 km south of LSA
Kigio Wildlife Conservancy	Adjacent
Nairobi National Park	Adjacent
Chyulu Hills National Park	Adjacent
Tsavo West National Park	LSA intercepts the National Park
Tsavo East National Park	Adjacent

11.0 ECOSYSTEM SERVICES

11.1 The Concept of Ecosystem Services

Ecosystem services consist of all the natural products and processes that contribute to human well-being, and the personal and social enjoyment derived from nature (Landsberg, et al., 2013). They are the benefits that people and/or a project (the beneficiaries) obtain from ecosystems (IFC, 2012). The benefits gained can be either physical or psychological, and can be obtained actively or passively, directly or indirectly. The local scale ecosystem services may be the basis for rural livelihoods and subsistence; for example, grasses and shrubland in an otherwise arid landscape are an important grazing resource for livestock, which provides both cash income and food for low-income families. Ecosystem services whose beneficiaries are at the global or regional scale are not covered by this assessment.

Ideally, the Project should maintain the value and functionality of priority ecosystem services[12] to those beneficiaries directly dependent upon them, through direct management control.

11.2 Method

Kenyan legislation and policies pertaining to biodiversity conservation and wildlife management do not specifically define what constitutes an ecosystem service; however, ecosystem services are mentioned in the national *Wildlife Policy* in the context of sustainable economic development of the country (Ministry of Forestry and Wildlife, 2012). Ecosystem services are also recognised as features of protected areas that should be conserved (Wildlife Conservation and Management Act, 2013). The *National Biodiversity Strategy and Action Plan* (NBSAP) (Ministry of Environment and Natural Resources, 2000) provides for the conservation and sustainable use of natural resources that provide the basic sources of livelihoods for an estimated 80% of the country's population. These include food, firewood, construction materials, medicines and aesthetics; all of which are ecosystem services.

For the purposes of this assessment, the definitions of ecosystem services are based on those developed by the *Millennium Ecosystem Assessment* (MA, 2005) (Table 11-1).

Table 11-1: Ecosystem services categories (MA, 2005)

Broad categories	Definition
Provisioning services	Supporting human needs e.g., traditional hunting grounds, medicinal plants and minerals, water sources, wild foods, fire wood, construction materials. These are detailed in Tables 1 to 8 in Appendix H.
Cultural services	Aesthetic, spiritual, recreational and other cultural values e.g., sacred sites, traditional meeting areas, traditional knowledge, sense of place. These are detailed in Table 9 in Appendix H.
Regulating services	Control of the natural environment e.g., maintenance of key ecological processes, groundwater recharge, erosion control, water quality. These are detailed in Tables 10 and 11 in Appendix H.
Supporting services	Natural processes essential to resilience, and functioning of ecosystems. e.g., primary production, soil formation and conservation, nutrient cycling.

The baseline aims to describe the ecosystem services supplied in the Upstream Study Area, and the benefits that people get from those services (that is, a qualitative appraisal of demand for the services). It also identifies the services on which the Project will depend for its operational performance.

Primary data was obtained from a variety of biophysical and social surveys and assessments, including Key Informant Interviews (KIIs), completed in the Upstream Study Area. In addition to data gathered as part of the social, biodiversity and cultural heritage baselines, one KII held with Elders on 18 May 2017 was specifically

[12] Type I priority ecosystem services are those services upon which the local beneficiaries (including the Project) depend for their livelihoods, health, safety, and/or culture, and which project effects are most likely to impact; Type II priority ecosystem services are those services upon which the Project is directly dependent or that could prevent the Project from achieving planned operational performance.

focused on identifying ecosystem services in the Upstream Study Area. During this KII, the attendees were asked to help populate a detailed inventory of key ecosystem services. Secondary data was gathered from relevant available literature. All data captured during baseline data gathering is presented in Tables 1 to 11 in Appendix H.

11.3 Study Area

The ecosystem services study area includes the Upstream Study Areas used for the surface water the biodiversity and cultural heritage and the social baseline.

No review of ecosystem services was conducted for the Midstream Study Area, because no direct loss in extent, or anticipated loss in condition of ecosystems or change in demand for services, is predicted for the oil transport activities that will take place in the Midstream Study Area. These activities will use existing road routes.

11.4 Results

In Appendix G, Table 12 presents a summary of Supply of Ecosystem Services within the Upstream Study Area. and Table 13 summarises the current demand for Type I priority services in the Upstream Study Area by settlement.

The local population of the Upstream Study Area are traditionally nomadic pastoralists, most of whom are reliant on the local ecosystems for the provision of much of their basic needs, including cultural identity. Consequently, the demand for Type I priority services (after IFC, 2012; Landsberg et al., 2013) is spatially and temporally high (Section 13.0 and Section 14.0).

11.4.1 Provisioning Ecosystem Services

The Upstream Study Area provides a number of priority provisioning ecosystem services for beneficiaries within the upstream local study area and beyond. In particular, grazing/browsing resources for livestock, wild foods, medicinal plants, firewood and charcoal, freshwater supply and construction materials for homes and livestock, are in high demand. All of the Provisioning services identified within the Upstream Study Area are recognised as Type I priority ecosystem services, due to the reliance of beneficiaries on their continued supply, and the general lack of, or difficulty in accessing, suitable alternatives to these resources (Appendix G, Tables 1 to 8).

Grazing/browsing resources for livestock

Grazing/browsing resources for livestock are provided by most ecosystems within the Upstream Study Area, including *Acacia-Commiphora* bushland/thicket, riparian forest, and ephemeral stream woodland – these ecosystems account for 91% (5,551 ha) of land in the Upstream Study Area (Section 10.0).

The keeping of large, mixed livestock herds, which may include camels, goats, sheep, donkeys and cattle, is characteristic of Turkana people. The reasons for maintaining large herds include: optimisation of the available grazing/browsing resource (Pratt and Gwynne, 1972); fear of decimation by disease or drought (Pratt and Gwynne, 1972); and cultural factors, such as the prestige of holding large herds, which are seen as a reflection of wealth and status, and the concept of livestock as moveable wealth (Pratt and Gwynne, 1972; Dempf, 2014).

Livestock are a staple food source of the Turkana people, providing meat and milk – mostly from goats (Section 13.0 and Section 14.0). Key Informant Interviewees confirmed that keeping of livestock (camels, goats, sheep, donkeys, cattle) is primarily a reflection of wealth and status, and secondarily a source of meat and milk.

Figure 11-1: Camel herds – an indication of status

Wild Foods

Wild foods have traditionally been an important supplement to the traditional Turkana diet of milk and blood, particularly during the dry season (FAO, 1964; Pratt and Gwynne, 1977). The use of wild foods remains important, with nineteen wild food-plant species identified during the cultural heritage baseline data gathering surveys (Section 14.0). Plant species supplying wild foods were present across all ecosystems mapped within the Upstream Study Area. Riparian forest, in particular, is important because of the high density of preferred species, such as *Acacia tortillis*. The harvest of wild honey was observed on several occasions, in all ecosystems, during baseline surveys conducted within the Upstream Study Area (figure 11-2).

The use of wild animals for food is seen to be less important within the Upstream Study Area. People interviewed in Nakukulas, for example, indicated that children may sometimes hunt and eat birds such as *ekolsalalat* and *ekuri*, rabbits (*sungura*) and squirrels; however, adults do not eat these foods and instead largely eat goat meat. Nevertheless, dik-dik (*ngisuroi)* are said to be taken opportunistically for food (Section 14.0).

Figure 11-2: Tree from which wild honey has been harvested

Medicinal Plants

Medicinal plants are vitally important to Turkana people and their livestock. Twenty-two species with medicinal uses were identified during the cultural heritage baseline data gathering study, and there are likely to be many more, which have not yet been documented. Important species include *emus*, *echuchulka*, *amuroekile*, *elim*, *locham* and *ekamongo*, which are variously utilised for treating stomach complaints, coughs and eye ailments, or as antiseptics and animal medicines. Other species, such as *esokon* (*Salvadora persica*) and *eipa* (*Maerua oblongifolia*) are used as toothbrushes, and are harvested and sold by women as a source of livelihood (Section 14).

Based on the medicinal plants for which botanical species names could be derived (some local names referenced in other reports/relevant literature could not be linked to a botanical name – see Appendix H), it appears that most of these plants occur across all the ecosystems in the Upstream Study Area (refer to Section 10). No areas of particular importance for supply, such as a concentration of individuals or species, were identified during focus group meetings conducted as part of the ecosystem service prioritisation process (Appendix H).

Freshwater

Figure 11-3: Hand-dug wells in luggas

Beneficiaries are traditionally reliant on hand-dug wells in luggas as sources of drinking water, with many fairly permanent hand-dug wells and installed wells still in use (Figure 11-3), and migrating pastoralists were observed digging shallow wells in lugga sands shortly after a passing rain storm during the biodiversity baseline surveys.

Supplementary water resources are provided by TKBV in the Upstream Study Area via tanked water supply points, which are replenished by trucks on a regular basis. This water is abstracted from a borehole near Nakukulas that forms part of the permitted abstraction for the Project.

Firewood and Charcoal

Household cooking is predominantly fuelled by firewood, usually collected by women, from already-dead trees. The cutting down of trees for firewood or charcoal manufacture is generally not permitted; nevertheless, the use of timber for charcoal manufacture is likely putting pressure on tree resources. Other research in Turkana County has shown that, typically, once all of the dead firewood within walking/carrying distance of permanent settlements has been collected, people tend to revert to harvesting live trees within walking/carrying distance of their homesteads. This results in a radius of deforestation extending around such permanent settlements (Amyunzu, 1991; Olang, 1982; Reid & Ellis, 1995).

Information gathered during the 2016 cultural heritage baseline programme (Section 14.0) suggested that, traditionally, no-one in the Upstream Study Area is allowed to cut down any tree. If someone does cut down a family tree without permission, they are severely caned, and if anyone cuts down a tree of another family he is fined ten goats or one camel, particularly if the tree is *ewoi*, *edung*, *esanyanait*, *ekalale* or *esokon*.

However, data gathered during the Social baseline (Section 13.0) found that the livelihoods of all the families within the Ngamia and Amosing field areas are based on livestock and charcoal production. Income from charcoal sales is used to restock livestock after raiding. Indeed, charcoal production and sale was observed throughout the Upstream Study Area during baseline data gathering surveys in 2015 and 2016 (Figure 11-4).


Figure 11-4: Charcoal sale in Upstream Study Area

Construction Materials

A number of plants are used for construction of houses and shelters (Section 14.0). The most important are *eregai*, *epetet* (*Acacia nubica*), *edung* (*Boscia coriacea*), and *ebucharatet*. Branches from *Salvadora persica* are used for construction of shelters and *Hyphaene* spp. trunks are used as poles for construction (Booth et al., 2015). Hyphaene leaves are also important in the construction of roofs, and sealing walls (Figure 11-5).

Wood from *Cordia sinensis* is used for making traditional carved sticks with curved heads, and Ie*kicholong* (Turkana seat/head rest). Wood from *Commiphora* spp. is used for making local cups and bowls for drinking, and *ekicholong* (Booth et al., 2015). *Hyphaene* spp. leaves are used for weaving baskets and mats, and making rope (Booth et al., 2015). *Ekalale* (*Zizyphus mauritiana*) branches used for making bows for arrows, and fencing, and making stools (Booth et al., 2015). All Turkana wooden utensils are constructed from the Ekurichanait tree (*Delonix elata*) including plates (Atuba), cups (Elepit) and jugs (Aguarum) (Booth et al., 2015).

Figure 11-5: Traditional home built using timber and leaves

11.4.2 Cultural Ecosystem Services

Cultural ecosystem services are often intangible, as described within the cultural heritage baseline (Section 14.0). Intangible value from ecosystem services within the Upstream Study Area is derived from the natural setting, and the trees, which support a traditional way of life. Each settlement has traditional elder trees that are important meeting points. The system of family *ere*, whereby grazing rights are assigned to a certain degree, also forms part of the intangible cultural heritage.

Trees, and especially wild food plants, form an important part of the Turkana people's culture (Section 14.0). Some trees are revered as elder trees that used as meeting places or as sites for specific rituals, while others are used for headrests, carved sticks and utensils (Section 14.0). These trees and sites reflect the Turkana people's spiritual and heritage values, traditional knowledge systems, and cultural identity and diversity, and due to their irreplaceability, are recognised as Type I priority ecosystem services (Appendix H, Table 12).

Some important plants being used include *elim* (*Diospyros scabra*), *ekalale* (*Ziziphus mauritiana*), *ewoi* (*Acacia tortilis*), *eipa (Maerua oblongifolia)*, and *eregai* (*Acacia reficiens*). *Eregai* is seen as particularly important; when this plant is plentiful, the livestock have enough to eat, and, therefore, the people also have enough food and living conditions improve (Section 14.0). In terms of priority, *ewoi* and *ekalale* are the most important trees for the Turkana, producing leaves and flowers for livestock, and fruits for people during the dry season. Although the various plants with specific uses are generally covered under Provisioning services, the traditional knowledge associated with their use forms part of the Turkana cultural heritage and is included as a Type I priority ecosystem service.

During initiation ceremonies, *Edung* seeds are boiled for several hours and used to seal the process through being eaten by the elders presiding over the initiation as a sign of final blessing to the initiates. The same is true for marriage ceremonies and when a mother has given birth. In both cases, *edung* is consumed as the final meal served to the elders and the mother when she is ready to come out of seclusion from the house (Section 14.0). The natural setting provided by the landscape and its influence on initiation ceremonies, there system of grazing/habitation rights, and people's sense of space is considered a Type I priority ecosystem service under the education and spiritual values heading (Appendix H, Table 12).

11.4.3 Regulating Ecosystem Services

Regulating ecosystem services are provided on a landscape scale, and unlike provisioning and cultural ecosystem services, are not specifically linked to a particular vegetation community or habitat type. Regulating ecosystem services provided in the Upstream Study Area include regulation of local climate via surface reflectance and evaporation; regulation of soil stability and erosion control; maintenance of the natural hydrological regime through regulation of water timing and flows, and groundwater recharge; and evaporation rates (Havstad *et al*., 2007; Safriel *et al.,* 2005).

Pollination is recognised as a Type I priority ecosystem service for local beneficiaries because of the Turkana people's reliance on wild fruits and seed pods as a source of food for themselves and livestock; whilst regulation of water flows and timing, and soil stability and erosion control are considered Type II priority ecosystem services for the Project, playing an important role in maintaining operational performance (e.g. prevention of floods and erosion reduces the amount of maintenance required for infrastructure like roads) (Appendix H, Table 12).

11.4.4 Supporting Ecosystem Services

Supporting services are the natural processes, such as nutrient cycling and primary production that maintain the other services. Some of the primary ecological functions of the Upstream Study Area include the provision of habitat for climax vegetation communities and maintenance of fauna species populations; nutrient cycling and support of primary production and plant growth, thereby forming the base of the food chain; and water cycling (Appendix H, Table 12). The support of primary production, such as fruits used as food by people, has been identified as a Type I priority ecosystem service within the Upstream Study Area. Furthermore, sustainable water cycling is considered to be a Type II priority ecosystem service upon which the Project is dependent (Appendix H, Table 12). These ecosystem services are not tied to specific habitat types or vegetation communities, but are supplied at an ecosystem/landscape – level scale.

As Supporting ecosystem services have no specific/direct beneficiaries, and impacts to these are captured within the Provisioning, Cultural and Regulating categories, they are not included as a separate category in the impact assessment.

12.0 LANDSCAPE AND VISUAL

The landscape and visual baseline desk study has been undertaken to:

- Establish the key characteristics of the landscape and their relative sensitivity within the study area; and
- Assess the visual baseline by identifying visual receptors within the study area.

The methodology employed for this assessment is primarily based on UK guidance (GLVIA, 2013) in the absence of Kenyan Legislation.

12.1 Secondary Data

The following resources were used for the assessment:

- The following aerial imagery used to analyse the terrain and landscape features:
  - Pleiades, 0.5 m resolution, date of capture: December 2016; and
  - Pleiades, 0.5 m resolution, date of capture: February 2015.
- A virtual landscape created using numerous topographic datasets supplied by the client and analysed to provide the most realistic representation of the landscape[13]:
  - 1 m DTM (Digital Terrain Model) – sourced from the Pleiades Satellite. Date of capture: 1 April 2015;
  - 10 m DTM – sourced from the Prism Satellite. Date of capture: 20 March 2014; and
  - 90 m SRTM (Shuttle Radar Topography Mission) Topography – sourced from NASA on 9 December 2002.
- Preliminary project design data relating to the height of proposed infrastructure, in order to present viewsheds under baseline conditions:
  - The flare stacks at Ngamia well pads (3, 6, 8) and Amosing well pad (1) at 9.1 m; and
  - Existing storage tanks on the well pads (Ngamia 8 and Amosing-1) at 9.1 m.
- Settlement locations supplied by TKBV;
- Land Baseline data (Golder 2017a);
- Baseline Vegetation/Land-cover of Turkana Project Area generated using Sentinal-2 satellite imagery at a 10 m resolution (Golder, 2017b); and
- Protected Area dataset supplied by TKBV;
- The following Points of interest (POI) sourced from VisitTurkanaland website on 26 January 2017 to determine potential receptor locations of visitors, tourists and travellers to the region:
  - Lake Turkana National Parks World Heritage Area, encompasses the Northern Island, Central Island of Lake Turkana and the adjacent Sibilioi National Park. Central supports varied wildlife including Egrets, Stocks and Cormorants;
  - Eliye Springs is a resort is located on the western shore of Lake Turkana;

[13] No Digital Surface Models (DSM's) were used in the GIS analysis. DSM's are topographic coverages containing all elements of the landscape, including vegetation and trees

- Ferguson Gulf located on the western shore of Lake Turkana, it commonly used as a place to arrange a boat to Central Island, it contains high populations of flamingos and pelicans;
- The Kapodo Waterfalls are located on the border of Baringo and Turkana counties;
- Namorutunga Standing Stones are located on the road between Lodwar and Kalokol, it is a sacred place, believed to be 2,000 years old;
- Lobolo Swamp is located on the banks of Lake Turkana south of Kalotol. It contains a spring which supports a palm groove at the coastline;
- Turkana Boy Monument is located in Nariokotome. The monument is dedicated to the archaeological find of Turkana boy, a 1.5 million year old *Homo erectus* skeleton;
- Lake Logipi is lies at the northern end of the Suguta Valley, in the northern Kenya Rift. Hot springs are located on its northern shoreline;
- The Omo Delta located on the Ethiopian side of Lake Turkana;
- The Turkana River follows through the Miangoni Gorge. The gorge contains overhanging rock faces and trees; and
- Lotikipi Plains lies south of Lotikipi, which contains pristine landscape and wildlife.

Protected areas and POIs are presented in Drawing 12-1.

12.2 Methods

The study area for the Visual Baseline Assessment comprises the area from which infrastructure associated to the proposed development may be visible. In this case, the study area is a 10 km radius around the physical footprint of a proposed development. The distance of 10 km is selected as the average distance beyond which the human eye ceases to distinguish significant detail.

12.2.1 Landscape Character

It is a distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another. The landscape assessment is a process of identifying and describing variation in the character of the landscape.

Areas displaying similar characteristics are referred to as ‘Landscape Character Areas’ (LCAs). LCAs are made up of recognisable patterns or elements (physical and perceptual) that occur consistently in a particular area and define its character, or ‘sense of place’.

The process of assessing the landscape character was based on review of available aerial photography and topographical maps as well as previous studies, in terms of:

- Natural elements;
- Human-made elements;
- The topographical character of the site and its surroundings and potential occurrence of landform;
- Features of interest;
- The presence of water bodies;
- The general nature and level of disturbance of existing vegetation cover; and
- The nature and level of human disturbance and transformation evident.

ArcGIS 10.4.1 was used to process the data to determine the landscape. The terrain datasets were used to create a realistic terrain within the study area. The DTMs were mosaicked to produce a 5m cell resolution coverage of the study area.

The landscape characterisation was digitised using the baseline vegetation and landcover dataset (Golder 2017b).

12.2.2 Visual

Table 12-1 displays the heights used to represent the infrastructure which may be visible under baseline conditions.

Table 12-1: Indicative heights and elevations of proposed project infrastructure

Location	Facility	Height (m)	Elevation of proposed facility (masl)
Ngamia-3	Flare	9.1	732
Ngamia-6	Flare	9.1	743
Ngamia-8	Flare	9.1	731
Ngamia-8	Tank	9.1	732
Amosing-1	Flare	9.1	729
Amosing-1	Tank	9.1	729

The aim of the initial visual analysis is to identify the zone of theoretic visibility (ZTV) for each element of proposed infrastructure.

A viewshed analysis tool used the data in Table 12-1 along with the DTM, to present the ZTV. The results of the ZTV coupled with locations of homesteads in the study area, gathered during the September 2016 Land survey, allowed an identification of potential points of observation. This process then informed a series of locations from which photographs could be taken during the field survey. All photographs were taken towards the direction of the proposed well pads to ensure there is a record of the existing view from these locations.

The field study was conducted in May 2017. The locations were identified using the September 2016 Land survey, so a number of the homesteads were found to be abandoned in May 2017. The status (abandoned or otherwise) of each potential receptor is recorded in Table 12-2; whether abandoned or not, this data still forms a point of reference for baseline views of proposed infrastructure locations from potential receptor locations within the study area.

12.3 Results

12.3.1 Landscape Character

The study area is located within the Kalamata catchment in a sedimentary alluvial plain, which supports a vast range of pristine range land consisting of unspoilt rugged landscape of plains, sand luggas with grasses, trees and shrubs. The elevation of the study area, ranges from 635 masl to 1,300 masl. The land is used for seasonal grazing by pastoralists.

Within the study area, there is a significant variation in the character and scenic quality of the landscape. The Turkana region is predominantly flat sandy desert intermingled with scattered scrub and thicket increasing to denser scrub and thicket on the alluvial rivers plains and hills. Within this context, there are more subtle variations in characteristics, determined primarily by land use, landform, and the type and density of vegetation cover.

Landscape Character Area (LCA) boundaries do not necessarily indicate an abrupt change in landscape characteristics; the transition between the different areas may be gradual, especially the boundaries between the undulating scrub bushland LCA and the dense bushland scrub LCA. These categorizations are not related to whether habitats are natural or modified.

The sensitivity of the landscape was assessed in relation to its capacity to accommodate change without unacceptable adverse effects on the existing landscape character. The extent to which a landscape can accept such change is dependent on the physical characteristics of the landscape and the scale and nature of the change.

Four LCAs were identified within or adjacent to the project area:

- **LCA 1 Semi-desert:** Defined by a sandy plain with scattered stunted bushland. With reference to the biodiversity baseline, vegetation heights ranging from 4 to 5 metres;
- **LCA 2 Dense bushland**: Defined by and increased density of plant growth in the southern and western hills. With reference to the biodiversity baseline, Acacia/Commiphora deciduous bushland and thicket contains average vegetation heights of 4 to 5 metres;
- **LCA 3 Rocky Habitat/Stunted Bushland:** Defined by semi-desert shrubland, sparse cover of shrub species found on the eastern hills. With reference to the biodiversity baseline, Acacia/Commiphora/Euphorbia stunted bushland/thicket contains average vegetation heights of 4 to 5 metres; and
- **LCA 4 Alluvial woodland:** Defined by Acacia trees, growing on sandy alluvial soils with larger seasonal streams and periodic stream flow occur. Defined the extent of the floodplain of the watercourses. With reference to the biodiversity baseline, riparian forest is dominated by Acacia tortilis with heights ranging from 4 to 5 metres. Wooded Ephemeral Streams contain a high diversity of trees and shrubs, obtaining heights of 8 to 12 metres.

The predicted sensitivity of all the LCAs (i.e. their ability to accommodate the proposed infrastructure development) is low.

Eight permanent settlements, identified by TKBV, are located within the study area. Two are permanent major settlements and six are permanent minor settlements. Table 12-2 presents a description of the predominant existing views from these settlements.

Table 12-2: Permanent settlements as receptors

Visual Receptor	Location	Receptor type	LCA which forms predominant existing view
Lokicheda	Kochodin	Permanent major rural settlement	Semi-desert
Nakukulas	Kochodin	Permanent major rural settlement	Alluvial woodland
Lokitewoliwo	Lokichar	Permanent minor rural settlement	Semi-desert
Kangilae	Lokichar	Permanent minor rural settlement	Semi-desert
Lopuroto	Kochodin	Permanent minor rural settlement	Semi-desert
Kodekode	Kochodin	Permanent minor rural settlement	Semi-desert
Lotimaan	Kochodin	Permanent minor rural settlement	Semi-desert
Kaloucholem	Kochodin	Permanent minor rural settlement	Semi-desert

12.3.2 Visual Baseline – Primary data

The results of the ZTV exercise informed the primary baseline data collection.

Table 12-3 presents results from field survey work in May 2017. Photographs and locations of photographs are presented in Drawings 12-2 and 12-3.

Table 12-3: Baseline photo locations

Photo Location	Reason for photograph (according to September 2016 Land survey)	Comment from May 2017 visual survey
Ngamia view shed		

Photo Location	Reason for photograph (according to September 2016 Land survey)	Comment from May 2017 visual survey
N-1	■ Location was visible in three of the viewshed analyses; Ngamia-8 Tank, Ngamia-1 Flare and Ngamia-3 Flare. ■ It is described as being long vacated.	Ngamia-3 is visible. Ngamia-8 is not visible.
N-2	■ Although this homestead is described as long vacated it does have an elevation perspective at 746 m ASL, compared to the lower elevation of the well pads (720-732).	Abandoned. Well pads not visible
N-3	■ The location has been recently vacated and occurs on an elevation of 752 m ASL. ■ It was analysed as being visible to the flare at Ngamia-3.	Abandoned. Well pads not visible
N-4	■ Homestead is described as occupied and occurs at an elevation of 681 masl from Ngamia-1. ■ It also occurs on a slightly higher elevation of 736 masl.	Abandoned. Well pads not visible
N-5	■ Homestead is described as occupied and occurs at a distance of 525 m from Ngamia-1. ■ It was visible in three of the viewshed analyses, Ngamia-1 Tank and Flare.	Abandoned. Well pads not visible
N-6	■ Homestead is described as occupied and occurs at a distance of 284 m from Ngamia-1. ■ It was visible in two of the viewshed analyses, Ngamia-8 Tank and Ngamia-8 Flare.	Abandoned but relocated further west by approx 200 metres. Ngamia-1 & 8 visible.
N-7	■ Kodekode was not visible in any of the viewsheds but confirmation of this is recommended, as it is a permanent settlement.	Abandoned. Ngamia-1 & 3 not visible
N-8	■ Location was visible in two of the viewshed analyses, Ngamia-1 and Flare. ■ It is described as being long vacated but is a can be a good indicator to increasing distance verses actual visibility in the landscape.	Abandoned. Not visible.
Amosing view shed		
A-1	■ Homestead is described as occupied and occurs at a distance of 2700 m from Amosing 1. ■ It was visible in the flare and tank viewshed analyses. The homestead occurs on an elevation of 705 masl.	Abandoned. Not visible.
A-2	■ Homestead is described as occupied and occurs at a distance of 854 m from Amosing 1. ■ It was visible in the flare and tank viewshed analyses. ■ The homestead occurs on an elevation of 726 masl.	Abandoned. Not visible. Relocated to Nakukulas on security concerns.
A-3	■ Homestead is described as occupied and occurs at a distance of 1100 m from Amosing. ■ It was visible in the flare and tank viewshed analyses. ■ The homestead occurs on an elevation of 730 masl.	Inhabitants moving shortly. Well pads not visible.

Photo Location	Reason for photograph (according to September 2016 Land survey)	Comment from May 2017 visual survey
A-4	■ Homestead is described as occupied and occurs at a distance of 357 m from Amosing. ■ It was visible in the flare and tank viewshed analyses. ■ The homestead occurs on an elevation of 723 masl.	Abandoned. Relocated to Nakukulas. Well pads not visible.
A-5	■ Homestead is described as being recently occupied and occurs at a distance of 1770 m from Amosing. ■ It was visible in the flare viewshed analyses. ■ The homestead occurs on an elevation of 700 masl.	Abandoned. Relocated to Nakukulas. Well pads not visible.
A-6	■ Lopuroto was not visible in any of the viewsheds but confirmation of this is recommended, as it is a permanent settlement.	Abandoned. Location is not close to Loperuto. Well pads not visible.

12.3.2.1 Ngamia-1 Well Pad

Neither the eight permanent settlements nor any known POIs fall within the ZTV for Ngamia-1, therefore it can be assumed that they do not afford views of Ngamia-1 well pad.

The ZTV identified that there are 11 potential receptors (identified during the September 2017 Land baseline) that are located within a theoretical visual distance of the proposed flare. Photographs were taken at 5 locations towards Ngamia-1, either due to the proximity to Ngamia-1 or that these locations were within the viewshed according to the ZTV. There are a minimum of 2 luggas potentially in the line of view between receptors and the proposed well pad.

The field survey revealed that Ngaimia-1 could be visible from only one receptor, at N-6, which was occupied in September 2016 and remained occupied, but was relocated to nearby in May 2017.

12.3.2.2 Ngamia-3 Well Pad

Neither the eight permanent settlements nor any known POIs fall within the ZTV for Ngamia-3, therefore it can be assumed that they do not afford views of Ngamia-3 well pad.

The ZTV identified that there is 1 potential receptor (identified during the September 2017 Land baseline) that are located within a theoretical visual distance of the proposed flare. Photographs were taken at 5 locations towards Ngamia-3, either due to the proximity to Ngamia-3 or that these locations were within the viewshed according to the ZTV. There are a minimum of 3 luggas potentially in the line of view between receptors and the proposed well pad.

The field survey revealed that Ngaimia-3 could be visible from only one receptor, at N-1, which was occupied in September 2016 and remained occupied, but has been long vacated.

12.3.3 Ngamia-8 Well Pad

Neither the eight permanent settlements nor any known POIs fall within the ZTV for Ngamia-8, therefore it can be assumed that they do not afford views of Ngamia-8 well pad.

The ZTV identified that there are 19 potential receptors (identified during the September 2017 Land baseline) that are located within a theoretical visual distance of the proposed flare and tanks. Photographs were taken at 5 locations towards Ngamia-8, either due to the proximity to Ngamia-8 or that these locations were within the viewshed according to the ZTV. There are a minimum of 2 luggas potentially in the line of view between receptors and the proposed well pad.

The field survey revealed that Ngaimia-8 could be visible from only one receptor, at N-6, which was occupied in September 2016 and remained occupied, but has been long vacated.

12.3.3.1 Amosing-1 Well Pad

Neither the eight permanent settlements nor any known POIs fall within the ZTV for Amosing-1, therefore it can be assumed that they do not afford views of Amosing-1 well pad.

The ZTV identified that there are 34 potential receptors (identified during the September 2017 Land baseline) that are located within a theoretical visual distance of the proposed flare and tanks. Photographs were taken at 6 locations towards Amosing-1, either due to the proximity to Amosing-1 or that these locations were within the viewshed according to the ZTV. There are a minimum of 3 luggas potentially in the line of view between receptors and the proposed well pad.

The field survey revealed that Amosing-1 could not be visible from the receptors visited.

12.4 Discussion

The landscape around the well pads varies from undulating to flat. The theoretical visibility of the ZTV analysis ascertained possible visible locations. A field visit to 14 of the locations were assessed to ascertain the level of visibility of the facilities. Ngamia-1 and Ngamia-8 were visible from Photo location N-6 and Ngamia-3 was visible from N-1. Natural barriers of existing dense vegetation and trees along the luggas ensure a natural ability of the landscape and visual environment to accommodate the type of development envisaged.

13.0 SOCIAL ECONOMICS

The social baseline comprises nine sub-categories. All studies have been conducted by Golder or through sub-consultants managed by Golder. Where relevant, differences in methodology followed by sub-consultants are presented below. The nine categories presented below include:

- Administrative divisions and governance structure;
- Demographics;
- Infrastructure and services;
- Economics and Livelihoods;
- Land use and ownership;
- Community health and safety;
- Education;
- Social maladies; and
- Social Capital, Security and Conflict.

13.1 Methods

13.1.1 Secondary Data - General Socio-economic Data

A wide range of secondary material has been reviewed prior to fieldwork. This includes a review of printed resources by the government, reports by NGOs and multi-lateral organisations such as the United Nations and other development organisations. Where possible, quantitative information has been collected from organisations such as the Kenyan National Drought Management Authority (NDMA). During fieldwork, researchers have also sought to collect printed data directly from key informants interviewed.

Golder has also reviewed and drawn on data and information collected by Tullow and other consultants as part of earlier exploration and appraisal work.

All secondary material for all social baseline topics is referenced throughout the baseline and a full list of references cited is included in Section 16.

13.1.2 Secondary Data – Community Health

The approach used in the health impact assessment was based on an approved methodology endorsed by the International Finance Corporation (IFC) that supports the IFC Performance Standards on environmental and social sustainability. This approach uses 12 Environmental Health Areas (EHAs) to support the systematic analysis of health as it provides a linkage between project-related activities and potential positive or negative community-level impacts and incorporate a variety of biomedical and key social determinants of health (IFC, 2009). In addition, the International Petroleum Industry Environmental Conservation Association updated guide on health impact assessment in the oil and gas industry was used as this supports specific guidance to the upstream industry.

The desktop review for community health focused on the national, county and (where available) local level secondary health literature in the public domain. The desktop work had the intent to describe the broad health status of the population in the Study Area, based on a systematic review of the twelve EHAs.

Only secondary data (no primary data) was gathered for the Midstream Component.

13.1.3 Primary Data - General Socio-economic Data

Secondary research has been complemented by site visits to Kenya and Turkana as part of the baseline data gathering for the Full Field Development (FFD) ESIA.

A preliminary Scoping visit took place in May 2015, which included brief travel to Turkana but was limited to Tullow supplied data.

In June 2016 a two-day workshop was completed by Golder, bringing together the Golder ESIA social data gathering teams for the general socio-economic research, community health and safety, and security and conflict. The objective of the workshop was to align research objectives and plan for key information interviews and focus group discussions. After the workshop, the socio-economic research team trialled semi-structured questionnaires during key information interviews and focus groups. 8 trial interviews were conducted, which allowed for adjustments in semi-structured questionnaires and research approaches.

Primary data and information collection took place during two major field trips. The first 15-day trip took place from 22 June to 05 July 2016. Two teams conducted at total of 54 meetings with government officials, NGOs, Civil Society Organisations and residents living near Tullow operations. The meetings sought to get information primarily from the administrative units that are most likely to be affected. However, comparative information was also collected from government officials from those administrative units farther away in Turkana County, who are unlikely to be directly affected, as well as with NGOs and representatives of development organisations with a broader understand of the entire county and neighbouring counties in Kenya. This comparative data and information is useful in understanding socio-economic trends in other parts of the County to compare with those areas closest to the upstream study area.

During the first week, both teams focused on key informant interviews and focus groups located in the County capital, Lodwar. Researchers sought a balance of national and county government officials and ministries. Lodwar is also the main office location for many of the international NGOs and regional CSOs with a regional mandate in Turkana. During the second week, the two teams split up travelled to the Sub-county centres of Lokichar in Turkana South Sub-county and Lokorii in Turkana East.

The second trip took place from 10 to 19 May 2017. This visit sought to fill critical gaps in baseline information from the initial fieldwork. One research team conducted 25 additional key informant interviews for a total of 79 primary research meetings.

The following limitations were encountered during primary data gathering:

- Collection of secondary data for Turkana County, especially data at a Sub-county level, is complicated. This is related to the relative remoteness of the County, historical marginalisation from other parts of the Country and overall nature of pastoralist livelihoods that makes the collection of demographic and other data difficult;
- Administrative units have changed as a result of the new Kenyan Constitution;
- Government administrative units and traditional governance units are often inconsistent, which can compromise collection of primary data; and
- Many administrative units have the same name (e.g., Lokichar *Division*, *Location*, *Sub-location*, *Settlement* and *Ward*), and data collected are not always explicit on what figures represent. This is a limitation in aggregating secondary information and in collecting information from key informants.

13.1.4 Primary Data - Land

13.1.4.1 Baseline Data Gathering on Homesteads

Golder completed primary Land baseline data gathering in the Upstream Study Area, with a focus of gathering data on homesteads within approximately 1,000 m of the Ngamia (3, 6 and 8) and Amosing 1 wellpads. The study area was defined by preliminary noise modelling completed in mid-2016, as early noise modelling was considered to be a reasonable indicator for potential effects. Primary data gathering surveys occurred in September 2016 and May 2017. This work built on Land survey work completed by the TKBV Lands Team around the Ngamia and Amosing wellpads in November 2015 and December 2015 respectively.

The fieldwork identified the number and nature of pastoralist homesteads present within the study areas, and whether, at the time of survey, these were:

- **Long-term homesteads** ('permanent') – either currently occupied or unoccupied. Long-term homesteads are occupied in an area over an extended period covering both wet and dry seasons and typically for a period of a year or more;
- **Short-term homesteads** (seasonal) - typically used for 2 to 3 months, e.g., during wet season grazing, either currently occupied or unoccupied; and
- **Very short-term homesteads** (migratory) - used for a few nights en-route to other areas, either currently occupied or unoccupied.

The baseline data gathering method is described in detail in the field reports in Appendix I. Broadly speaking it involved the following steps:

- Preparatory Desk Based Work to define a study area based on preliminary noise modelling and using satellite imagery, within which a grid of squares (Figure 13-1), which was laid over the wellpad and the surrounding area to provide a methodical way of surveying the entire area. A total of 40 x 500 m squares covered the Ngamia area, and 18 x 500 m covered the Amosing area;
- Field Survey Work where each grid square in the Ngamia and Amosing areas was systematically scouted, on foot and in vehicles depending on the nature of the area. Features such as homesteads, animal shelters and graves were recorded as GPS coordinates, photographed and entered onto data record sheet:
  - Pastoralist homesteads were categorised;
  - Where homesteads were occupied, discussions and records were taken; and
  - Where homesteads or animal shelters were vacated, the nature of the homestead was identified and estimates were recorded based on the expertise of the TKBV team member.
- Field Reporting, as presented in Appendix I, including identification and categorisation of homesteads, GPS locations, analysis of each homestead and photos of homesteads.

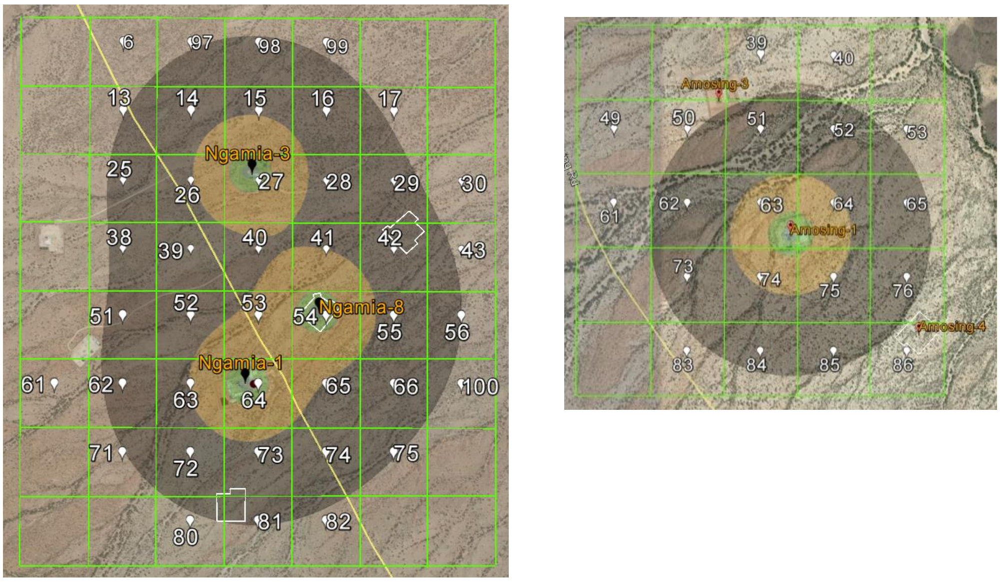

Figure 13-1: 500 m grid squares covering the Ngamia (or left) and Amosing 1 (on right)

13.1.4.2 Identifying Affected Persons and Basis for Eligibility

During the May 2017 field work, discussions were undertaken to feed into establishing the approach for identifying people and homesteads potentially affected by EOPS, including:

- Work to identify, with support from the TKBV Lands team, how effects on land and natural resource use would be defined and how project affected persons (PAP) will be identified;
- Discussions with homestead residents and other members of the local settlements to better understand *ere*[14] and the implications of ere affiliation for determining the scale of potential effects from EOPS and all potentially affected persons; and
- Work to identify, should impacts be concluded by the ESIA, who needs to be involved in community discussions, access agreements and discussions involving compensation or assistance.

13.1.5 Primary Data - Community Health

Primary data and information collection took place as part of data gathering for the FFD ESIA between 12 and 16 April 2016. The objectives of the field activity were to gain a high level impression of the health status in the study area and define what health services were available; understand the availability and quality of health data; identify key informants and obtain a broad understanding of the Project and the potential health impact areas of concern. The specific activities included the following:

- Meeting with the County Health Executive to introduce the health impact assessment process for the Project;
- Meeting with the Lodwar Hospital Health Team including the Chief Executive Officer of the Hospital, and tour of the facility;
- Visit to Lokichar Health Centre and Key Informant Interview with the Clinical Officer in Charge to gain an understanding of the health infrastructure and the health issues in the local study area; and
- A tour of key settlements in the study area to get an impression of the living conditions.

In total, seven key informant interviews were conducted during fieldwork.

The following limitations were encountered during primary data gathering:

- The EOPS health baseline was limited to high level health information obtained from secondary sources and few primary data obtained from an initial scoping field visit and social baseline. The information provides a high level impression of the potential health impact areas of concern. The data gathered should be adequate to develop mitigation measures related to potential health impacts at this stage of EOPS; and
- There were plans to conduct additional key informant interviews with key health personnel in the County and local Study area, but this was made impossible by a nationwide doctors strike during the planned study, rendering the officers unavailable.

13.1.6 Primary Data - Security

Fieldwork for a specialised team, focusing on security and conflict issues, was conducted parallel to the initial socio-economic research. The team travelled extensively in Turkana and West Pokot Counties, paying particular attention to border areas, migration corridors and areas of historical tension between the two ethnic groups. Between 27 July and 9 August 2016, 17 meetings were held and included key informant interviews with government officials responsible for security focus group discussions with traditional leadership and elders.

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[14] *Ere* are the ancestral domain of a family, describe in more detail in the Section 13.2.1.5 on Traditional Social Units.

13.2 Discussion of Baseline Data

13.2.1 Administrative Divisions and Governance Structure

13.2.1.1 National and Regional Administration

Turkana County is one of 47 county governments in Kenya and with a size of 77,000 km^2, it is the second largest county in the country covering 13% of the country. Counties are relatively new administrative units that were created by the County Government's Act in 2012 and were a result of the new Constitution of Kenya adopted in 2010 (Turkana County Government, 2017). Counties replaced the former Districts that were in use prior to the new Constitution. Turkana County shares international borders with Ethiopia to the north, South Sudan to the northwest and Uganda to the west. Within Kenya, the County borders West Pokot and Baringo Counties to the southwest, Samburu County to the southeast and Lake Turkana in the east all the way to the Ethiopia border. Marsabit County forms the entire opposite shore of Lake Turkana.

The national government began a devolution process in the wake of interethnic violence after the 2007 elections. The 2010 Constitution substantially remodelled the Kenyan state by creating two layers of government at the national and county level. Elected governors replaced provincial administration executives that had previously been appointed by the President (Crisis Group, 2017).

While most parts of Kenya view devolution as a positive step, with 77% of the population throughout the country supporting the new model, the context of the Northern Rift Counties is susceptible to past abuses along ethnic and sub-ethnic lines (Crisis Group, 2017). The process of devolution is still unfolding and is part of the unfolding baseline context of the Project. The dynamic is most relevant in the relationship between County and National Government, where roles and responsibilities are still being developed.

13.2.1.2 Local Administration

Turkana County is divided into seven Sub-counties. Each Sub-county is further divided into Divisions, Locations and Sub-locations. All administrative units are outlined in Table 13-1 to Table 13-3. Administrative Divisions are shown in Figure 13-2, and Sub-Locations are shown in Figure 13-3. Sub-counties or Constituencies are represented by one Member of Parliament (MP) per county, each sitting in the National Assembly. Within the County, each Constituency is divided into electoral Wards, each being represented by a Member of County Assembly (MCA) in the County Assembly. In addition to the 30 MCAs listed per Constituency, there are an additional ten MCAs nominated by political parties, making a total of 40 MCAs.

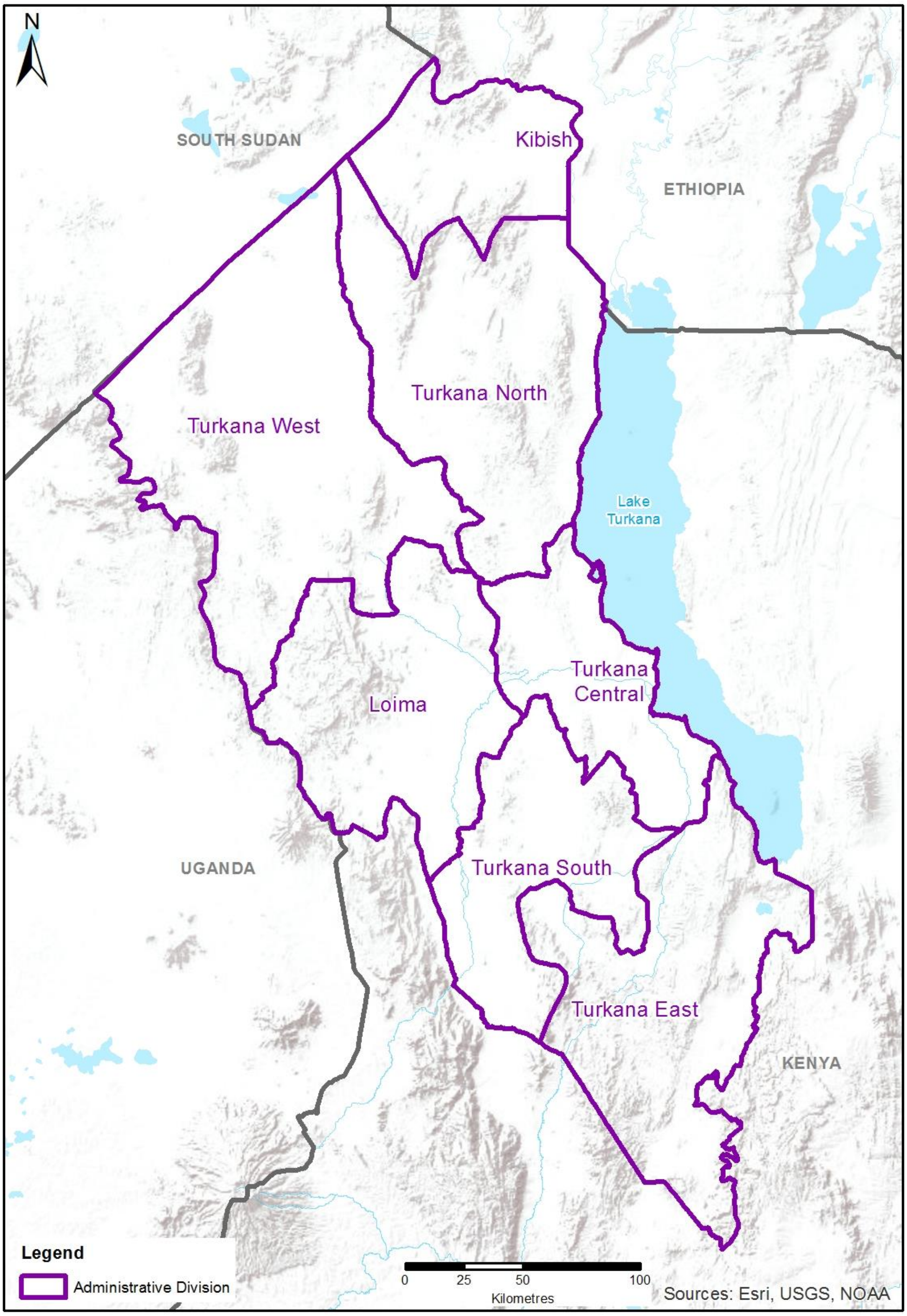

Figure 13-2: Administrative Sub-counties for Turkana County

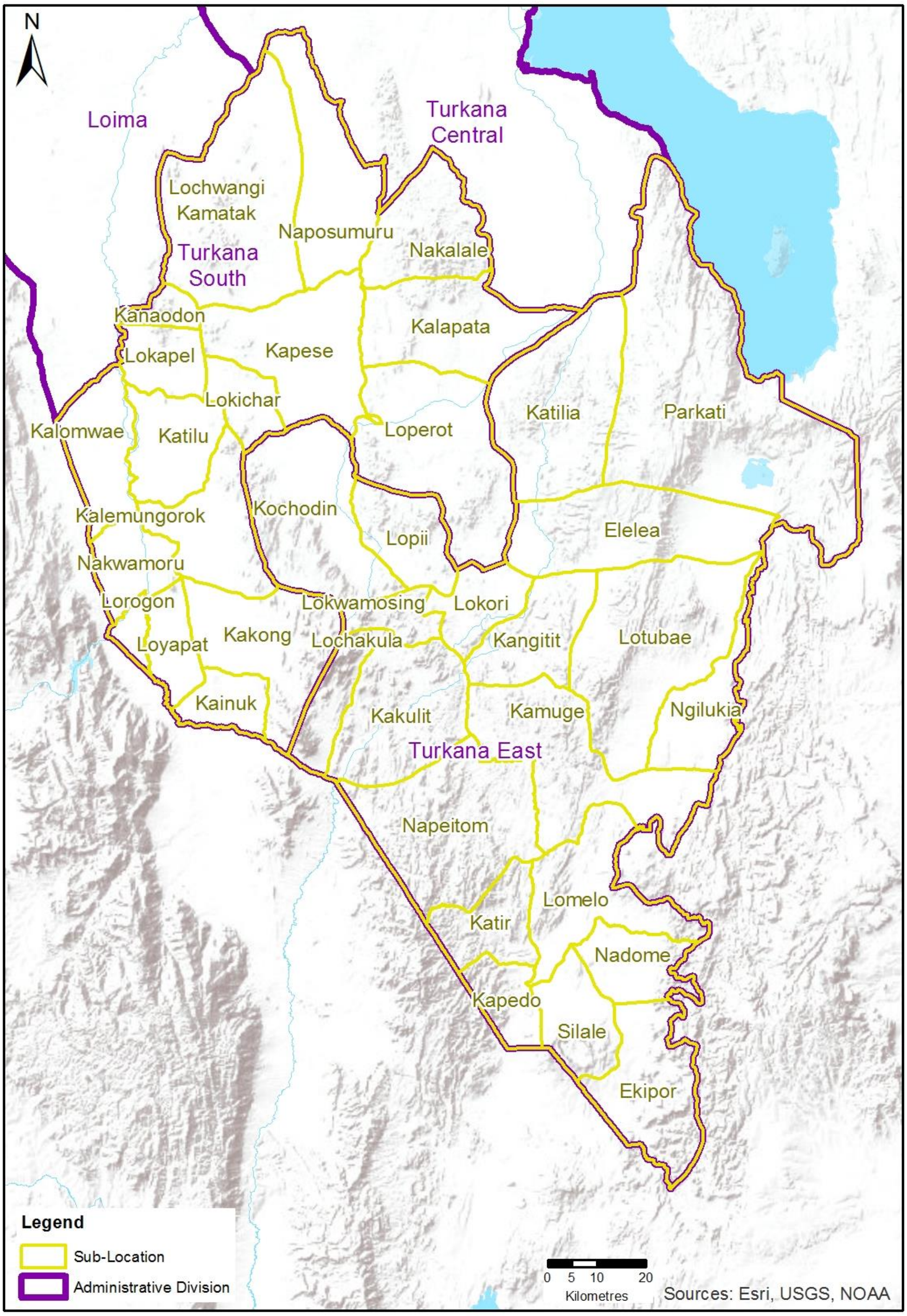

Figure 13-3: Sub-locations for Turkana East and Turkana South

Table 13-1: Wards per Constituency in Turkana County

Constituency	Number of Wards
Turkana South	5
Turkana East	3
Turkana Central	5
Loima	4
Turkana West	7
Turkana North	5
Kibish[15]	1
Total Number of Wards	30

The Kibish Sub-county, located in the northern part of the County on the border with Ethiopia was created in 2011 by the national government as a special Sub-county. Kibish consists of three Divisions, but two overlap into Turkana North Sub-county. The Independent Electoral and Boundaries Commission (IEBC) is expected to clarify this situation during its next consideration of the boundaries. This will clearly demarcate a border between Kibish and Turkana North Sub-county (Key Informant Interview, 25 June 2016).

The primary focus of socio-economic studies concentrate on the two Sub-counties that contain the footprint of the Project, Turkana South and Turkana East Sub-counties. A full list of the administrative units within these Sub-counties is listed in the table below.

Divisions, Locations and Sub-locations are part of a national government administrative structure. This overlaps with the Sub-county structure, however a Ward is part of the newly instituted devolution process. Sub-county Administrators and Ward Administrators are part of the county government administration structure. The Constitution of Kenya (2010) set up these two levels of government, making a shared mandate between the national government and counties (Turkana County Government, 2013).

Table 13-2: Sub-county Administrative Units: Turkana South

<table>
<tr><th colspan="4">Turkana South</th></tr>
<tr><th>Division</th><th>Location</th><th>Sub-location</th><th>Ward</th></tr>
<tr><td rowspan="7">Lokichar</td><td rowspan="2">Lokichar</td><td>Lokichar</td><td rowspan="4">Lokichar</td></tr>
<tr><td>Kapese</td></tr>
<tr><td rowspan="2">Lochwangi Kamatak</td><td>Lochwangi Kamatak</td></tr>
<tr><td>Naposumuru</td></tr>
<tr><td rowspan="3">Kalapata</td><td>Kalapata</td><td rowspan="3">Kalapata</td></tr>
<tr><td>Loperot</td></tr>
<tr><td>Nakalale</td></tr>
<tr><td rowspan="6">Kainuk</td><td rowspan="3">Kainuk</td><td>Kainuk</td><td rowspan="3">Lobokat</td></tr>
<tr><td>Kakongu</td></tr>
<tr><td>Loyapat</td></tr>
<tr><td rowspan="3">Kaputir</td><td>Kalomwae</td><td rowspan="3">Kaputir</td></tr>
<tr><td>Nakwamoru</td></tr>
<tr><td>Lorogon</td></tr>
<tr><td rowspan="2">Katilu</td><td rowspan="2">Katilu</td><td>Katilu</td><td rowspan="2">Katilu</td></tr>
<tr><td>Lokapel</td></tr>
</table>

[15] In this table, Kibish has a special status as the table shows the number of Wards per Sub-county. Kibish was given the status as a Sub-County in 2011 and is considered a special Sub-county. While having this status as a Sub-county, it administered by the same Deputy County Commissioner as Turkana North under the National Government. Under the County Government, Kibish is a single Ward, which has the same boundary as the Sub-county. Kibish has its own Sub-county Administrator. This is often confusing as Kibish has some administrative roles overseen by Turkana North. The Sub-county itself has 3 Locations and 7 Sub-locations with 8 Major Rural Settlements. A map showing Divisions would show Kibish as part of Turkana North.

Turkana South			
Division	*Location*	*Sub-location*	*Ward*
		Kalemngorok	
		Kanaodon	

Table 13-3: Sub-county Administrative Units: Turkana East

Turkana East			
Division	*Location*	*Sub-location*	*Ward*
Lomelo	Lomelo	Lomelo	Kapedo/Napeitom
		Katir	
	Napeitom	Napeitom	
	Nadome	Nadome	
		Ekipor	
	Kamuge	Kamuge	
		Ngilukia	
	Kapedo	Kapedo	
		Silale	
Lokori	Lokori	Lokori	Lokori/Kochodin
		Kangitit	
		Lotubae	
	Kochodin	Kochodin	
		Lopii	
	Lochwaakula	Lochwaakula	
		Kakulit	
		Lokwamosing	
	Katilia	Katilia	Katilia
		Elelea	
		Parkati (Paragati)	

Reorganisation associated with changes from the 2010 Constitution has caused some challenges in understanding role and responsibilities among various levels of government authorities, however, representatives of national and county government structures report that they cooperate successfully in this time of transition to a devolved government. Golder sought to speak to representatives of both structures, specifically national government officials, Assistant County Commissioners, who oversee Location Chiefs and their Assistant Sub-location Chiefs; and county officials such as Sub-county Administrators and Ward Administrators.

New legislation within the Decentralised Administration Bill is expected to further structure administrative units under the County Government into "villages". This is expected to be different than the structure described above. In the new system, each village will have a Land Administrator that will work with Ward Administrators to be the "person on the ground" with knowledge of land issues and potential disputes (Key Informant Interview, 09 May 2017). Below the Ward Administrators, new Village Administrators will be created and these people will work with a Village Council. Each Village Administrator is expected to oversee 3 to 5 of the current Major Rural Settlements and the approximately 3,000 to 6,000 people. On these estimates, there are expected to be around 150 in total in Turkana County. The current legislation is being held up as the authors discuss details around the appropriate population size to constitute a Village (Key Informant Interview, 10 May 2017).

The composition of the Village Council will be 5 to 7 elders from the population and the Chair of the Village Council being the Administrator (Key Informant Interview, 10 May 2017).

Adakar, traditional pastoralist social groups described in more detail below, will be treated as special units within new system. As *adakar* have their own leadership, a representative of an *adakar* will be included in the Village Council while the group is present in a given Village. When it moves, it will join the Village Council in the next area. Not all Villages are expected to have *adakar*, as some more urban settlements have relatively small pastoralist communities (Key Informant Interview, 10 May 2017).

Not all Counties will be described as part of the midstream baseline given that most will be affected only by the minimal increase in trucks that will be using an existing highway system. However a brief overview of West Pokot County is presented given the neighbouring County's role in past conflict and land use.

West Pokot County is divided into four Sub-counties. Sub-counties and their associated electoral Wards are presented in Table 13-4.

Table 13-4: Wards per Sub-County Constituency in West Pokot County

Sub-County Constituency	Number of Wards
Kapenguria	6
Kacheliba,	4
Sigor	6
Pokot South	4

13.2.1.3 Changes Driven by Devolution

Research highlights mixed views on the trends related to devolution, as the National Government transfers more responsibilities to the county governments.

Devolution is said to have brought services and decision-making closer to people, in contrast to the pre-devolution situation where much of the decision-making was done from Nairobi.

Some see an increase in the number of early childhood development (ECD) facilities and construction of health dispensaries and health centres. The devolution is also said to have an impact on infrastructure with more roads being paved and street lights being put in population centres. It is also said to improve security in the county through the inter-county peace initiatives (Key Informant Interview, 28 June 2016).

However, key informants in the NGO sector observe similar trends common prior to devolution in which diversity is concentrated in urban areas. While there is agreement that some services have improved, the disparity of services for those close to urban areas and those even 5 km urban settlements is still large. In some situations, poorer people are being pushed farther away from urban areas as land in and around towns such as Lodwar become used for non-communal purposes. (Key Informant Interview, 27 June 2016).

13.2.1.4 Settlement Categorisation

TKBV have developed a categorisation for settlements within the Study Area that will be used in the ESIA.

- **Urban Settlements:** main settlement in each Sub-county, permanent buildings, centre of business for region, location of political representatives and government offices.
- **Permanent Major Rural Settlements:** population over 2,000 people/400 households, likely to have been in current location for at least three years, structures less permanent (i.e., brick, mud walls, iron sheets or doum palm leaves) and Location or Sub-location Chief resident.
- **Permanent Minor Rural Settlements:** population less than 2,000/400 households, structures less permanent, no Location or Sub-location Chief resides in settlement and settlement linked to nearby Major Rural Settlement or Urban Settlement.

During TKBV stakeholder engagement outreach during the exploration and appraisal phase, Minor Rural Settlements typically have an association with a nearby Major Rural Settlements for access to services, government officials, trade, etc. Baseline research will primarily focus on Urban and Major Rural Settlements.

The total administrative units in the three Sub-counties of Turkana are summarised in Table 13-5. The Major Rural Settlements are not the total Major Rural Settlements in the area of influence, but rather those identified to date through the TKBV stakeholder engagement efforts. The actual number is assumed to be larger and will be revised in the future baseline data collection process related to Full Field Development.

Table 13-5: Total Administrative Units and Identified Major Rural Settlements

Sub-county	***Division***	***Location***	***Sub-location***	***Ward***	***Major Rural Settlement***
Turkana South	3	6	17	5	24
Turkana East	2	9	20	3	11
Turkana Central[16]	3	8	20	5	20
TOTAL	**8**	**23**	**57**	**13**	**55**

For the purpose of the EOPS Project, Table 13-6 lists the Urban and Major Rural Settlements most likely to experience environmental and social affect in the two Sub-counties of the Project footprint, including their relationship to other national and county government administrative units.

Table 13-6: Urban and Rural Settlements

Sub-county	**Location**	**Sub-location**	**Urban/Major Rural Settlement**	**Ward**
Turkana South	Lokichar	Lokichar	Lokichar (urban) Lokichar Moruongor IDP camp Nalemsekon Kamarese Kaakali	Lokichar
		Kapese	Kapese Lomokamar Kasuroi	
		Lochwaangikamatak	Lochwaangi Kamatak Kaaroge	
	Kainuk	Kainuk	Kainuk	Lobokat
	Kalapata	Loperot	Loperot Nalemkais	Kalapata
	Katilu	Kalemngorok	Kalemngorok	Katilu
Turkana East	Lokori	Lokori	Lokori (urban) IDP Lokori	Lokori/Kochodin
	Kochodin	Kochodin	Nakukulas Lokicheda	
		Lopii	Lopii	

[16] Turkana Central included for context, even though outside study area.

13.2.1.5 Traditional Social Units

Within the Upstream study area, the vast majority of land is unregistered community land. Generally it is recognised that unregistered community land is owned[17] by all people of Turkana, and is held in trust by Turkana County Government on behalf of the people who hold informal rights to the land. However our understanding is while unregistered community land is owned by all people of Turkana, the Turkana have specific geographical affiliation with land including *ere* and *ekitela* or territorial Sections.

Key terminology related to the traditional social units include:

- ***Awi (pl*: *ng'awi) or household:*** The most fundamental unit of social aggregation is the family unit which is headed by a male head of household one or multiple wives, children and often other dependent women. Household may cluster and travel with two to five other households to form a large *Awi* or *Awi Apolon* (McCabe, 2008);
- ***Ere (pl: ng'ereria):*** describes the ancestral domain of a family. An *ere* may be described by the current household (including grand-parents, siblings and children) as the location from where the family derives and to a variable extent may live (seasonally or more permanently for the old, women and children) and graze their livestock. The *ere* is not necessarily a place of perm anent abode or settlement in so far that seasonal migration may take the *ere* family away from their *ere*. The *ere* family may claim authority over, and preferential access to, natural resources (e.g. trees and seasonal grazing) located within the *ere*, but this claim does not convey (land) ownership rights and failure to exercise such rights may result in other parties using these resources. As such Turkana can access land within a family's *ere* for temporary grazing purposes but it is understood that permission must be sought. The person with the right to speak on behalf of people in the *ere* is the man who heads the *ere* family. Borders of the *ere* are usually delineated by features such as a *luggas,* ridgelines, livestock tracks (for moving stock long distances), roads and occasionally certain species of trees. These borders are generally known by everyone living in the vicinity;
- ***Ekitela (pl: ngitela)* or territorial Section:** All herd owners are members of a territorial Section, geographic areas, often with overlapping boundaries[18]. Sections differ in various ways, such as environmental conditions or characteristics. Though once a territorial unit in a socio-political system, their role is diminished by government administration (Muller-Demf, 1994);
- ***Emacar (pl ngimacarin)* or Clans*:*** Non-territorial social organisation related to kinship and stock associations. All Turkana are born into the clan of one's father and women join the clan of their husband upon marriage. Clans are exogamous (i.e., a man may not marry a woman from his clan) and membership is symbolised by brands that appear on animals in a herd (McCabe, 2008);
- ***Adakar (pl. ngadakarin):*** A clustering of *awi* or homesteads. Sometimes referred to as "cattle camps" even if the herd does not specifically contain cattle. Golder's research indicates that *adakar* is often used interchangeable with the term *kraal*, a term more commonly used in South Africa; and
- ***Arumrum: (pl. ng'arumrumio)***: New form of social organisation starting from the mid-1990s consisting of a large encampment of multiple heard owners under the leadership of a single man. Concentrically built thorn fences and heavy armament was designed to fend off attacks. (McCabe, 2008). This clustering could include up to 100 households (Eriksen, S, and J Lind. 2009).

The relationship between national, county and traditional leadership is complex and evolving as county governments implement changes toward more devolved government under the new Constitution establish in 2010. Location and Sub-location leadership, Chiefs and Assistant Chiefs, are aided by their Chief's Elders, individuals who live in settlements throughout a Location or Sub-location, and assistant the Chief in his or her duties. In the Kanamkemer Sub-location in Turkana Central, the Assistant Chief allocated two Chief's Elders for each settlement. These individuals may carry out her functions when she is absent (Key informant interview

[17] Within the South Lokichar area, the vast majority of land is unregistered community land. Generally it is recognised that unregistered community land is owned by all people of Turkana, and is held in trust by Turkana County Government on behalf of the people who hold informal rights to the land.

[18] Muller-Dempf 2014

24 June 2016). According to one Sub-county Administrator, such Chief's Elders are considered part of traditional governance structures and the traditional, county and national governance systems are interdependent. The Chief's Elders work with *adakar* or *kraal* elders and Seers, *Emerons* in Turkana language or diviners, are also part of a non-formal government system. While not legally recognised, the main functions of the traditional governance structures are pastoralist issues, management of security, disaster and pasture management and early warning (Key information interview, 24 June 2016). A Location Chief further explained that elders work with the Chiefs to understand who has migrated into and area and to support the Chief in solving petty domestic issues that can arise from the household to the wider *adakar* level. The Seers, in addition, also work with the Chiefs to foretell the future. (Key information interview, 28 June 2016).

In 2012, a group called the Council of Elders was formed as part of a county initiative to improve communication with rural pastoralists. This organisation has its own administrative structure outlined in a constitution approve in June 2012. According to representatives of the Ministry of Public Service, Decentralised Administration and Disaster Management, the Council of Elders serve as intermediaries between the county government system and traditional governance systems. Even though many members are said to live in more urban and populated settlements, they derive their strength from consulting elders base in *adakar* and who sit under the tree of men (Key informant interview, 28 June 2016). The tree of men of "*Ekitoe a Ngikileok*"[19] in the Turkana language, is explained as an "institution being of an ancient establishment linked to the history of organisation of Turkana People (Turkana Council of Elders, 2012). The tree of men is both an institution and place, in research being the location where elders from a given area meet and deliberate in the implementation of their work. Many research interviews were held "under the tree of men". This place is also used for ceremonial feasts, initiations and gatherings (Muller-Demf, 1994). Chief elders in Lakwamosing explained that they gather at the tree of men to solve disputes over stolen animals, adultery, negotiations over a dowry and other offences such as fighting (Focus Group Discussion, 02 July 2016).

The Council of Elders Constitution explains that they promote the principles of Turkana leadership from the basic social unit of family to communal leadership (Turkana Council of Elders, 2012). Unlike other tribes in East Africa that follow kinship organisation in the form of lineages, the Turkana can be described as a gerontocracy – governed by old people. In the family unit, this means the head of the household has the authority. In the community, it is the elders. These positions are not only old men, but rather individuals who also have wealth, display generosity and wisdom. This does not mean that the power of elders is unquestioned. Those who do not perform well can be ignored and replaced through public opinion (Muller-Demf, 1994).

Members of the Council of Elders are separate from the Chief's Elders, who primarily focus on the tasks related to the Location and Sub-location overseen by the national government. However, the Chairman of the Council of Elders explains that there are frequently topics that require coming and cooperation is common (Key information interview, 26 June 2016).

Chief's Elders in Lakwamosing Sub-location explained their different roles and responsibilities in the *adakar*. Specifically, they said that Chief's Elders do not deal with land and water management issues, which are managed by the adakar elders. They only get involved in difficult cases that require government intervention, particularly issues related to security and peace around the *adakars*. (Focus Group Discussion, 02 July 2016). A member of the Council of Elders in Turkana East Sub-county explained that members in his area know leaders from *adakar* in a given place. He identified at least five traditional leaders – *adakar* elders – who are linked to specific clans and sections. He said the inclusion of territorial section leaders is important for the discussion of issues around land a good understand of the importance of *ere* and how grazing patterns are manage in different and overlapping territorial sections (Key Informant Interview, 04 July 2016). Similarly, in another example of how government leaders work with traditional elders, the Katilla Ward Administrator in Turkana East described how they cooperate closely with kraals in the area by inviting the leadership and ex-warriors to participate in peace talks (Key Informant Interview, 03 July 2016).

[19] Sometimes referred to as *Ekitoe a Ngikasukou*, literally tree of old me or elders.

13.2.2 Demographics

The most recent census data from the Kenya Population and Housing Census (KPHC) in 2009 counted a total population of 855,399 in the Turkana District, which was 2.2% of the total population of just over 38.6 million people. The census counted a total of 988,592 ethnic Turkana in the whole country, indicating that 86% of the Turkana people reside in Turkana County.

The population of Turkana County was expected to be over 1 million in 2012, but precise official statistics are not available. Table 13-7 below provides the projections for population figures in Turkana County based on a predicted and steady population growth rate of 6.4% a year. (Turkana County Government, 2013).

Table 13-7: Total Population of Turkana County

	2009 (Census)	2012 Projection	2015 Projection	2017 Projection
Turkana County	855,399	1,036,586	1,256,152	1,427,797

Source: TGC

Population figures for Turkana County are frequently presented with a note of caution given that there is unreliable data due to the movement of pastoralist communities, making it making it difficult to count and track population figures.

By comparison, the population of ethnic Pokot in Kenya was 632,557 and population of West Pokot County was 512,690 in the 2009 census. No figure for the number of ethnic Pokot or other ethnic minorities living in Turkana County is available. The relationship between ethnic Pokot that do reside in Turkana County is described in more detail in Section 13.2.9 on Social Capital, Security and Conflict.

The two Constituencies in the EOPS Study Area made up approximately 225,000 people. Tables 13-8 and 13-9 show the results of 2009 census to the Sub-location level.

Table 13-8: Total Population of Turkana South Sub-county

Turkana South					
Division	**Population**	**Location**	**Population**	**Sub-location**	**Population**
Lokichar	67,742	Lokichar	23,452	Lokichar	10,820
				Kapese	12,632
		Lochwangi Kamatak	20,781	Lochwangi Kamatak	14,561
				Naposumuru	6,220
		Kalapata	23,509	Kalapata	8,941
				Loperot	7,384
				Nakalale	7,184
Kainuk	26,247	Kainuk	11,128	Kainuk	7,151
				Kakongu	1,883
				Loyapat	2,094
		Kaputir	15,119	Kalomwae	3,634
				Nakwamoru	9,080
				Lorogon	2,405
Katilu	41,924	Katilu	41,924	Katilu	17,686
				Lokapel	7,475
				Kalemngorok	8,531
				Kanaodon	8,232
Total Population Turkana South Sub-County					**135,913**

Source: 2009 census

Table 13-9: Total Population of Turkana East Sub-county

Turkana South					
Division	**Population**	**Location**	**Population**	**Sub-location**	**Population**
Lomelo	25,438	Lomelo	2,900	Lomelo	1,144
				Katir	1,756
		Napeitom	6,305	Napeitom	6,305
		Nadome	4,572	Nadome	2,975
				Ekipor	1,597
		Kamuge	8,651	Kamuge	5,104
				Ngilukia	3,547
		Kapedo	3,010	Kapedo	1,415
				Silale	1,595
Lokori	65,028	Lokori	32,682	Lokori	8,261
				Kangitit	6,400
				Lotubae	18,021
		Kochodin	4,849	Kochodin	2,039
				Lopii	2,810
		Lochwaakula	6,514	Lochwaakula	1,566
				Kakulit	2,029
				Lokwamosing	2,919
		Katilia	20,983	Katilia	7,747
				Elelea	3,907
				Parkati	9,329
Total Population Turkana East Sub-County					90,466

Source: 2009 census

The County is characterised by clustered settlements. Rural areas are settled with the nomadic pastoral communities on a temporary basis because of their movement in search of water and pasture for their livestock (Turkana County Government, 2013). Rural settlements are often dispersed along luggas with the community taking their name from the lugga closest to the location. This means that such settlements are linear as the grow alongside the luggas.

Lodwar town, Kakuma and Lokichggio are the three main urban centres in Turkana County. Lodwar town had the largest population of the urban centres with a total of 35,897 people according to the 2009 census. Kakuma is unique in that it hosts a refugee camp sheltering people fleeing from Sudan, Ethiopia, Uganda, Somalia and Burundi (Turkana County Government, 2013).

Multiple efforts have been made to obtain comparative data on demographics in Turkana East and South Sub-counties. While many Location Chiefs do have written documents or the ability to estimate their population, it is clear that hand-written data and statistics should be treated with caution. Some cite the same figures as the 2009 census and others have typed documents without any clear source or data. No data was obtained from Assistant County Commissioners, Sub-county Administrators or Ward Administrators.

During Key Informant Interviews in May 2017, Sub-location Chiefs provided population estimates for their jurisdictions. These figures were explained to be the data used in the distribution of food aid, provided throughout the area of influence and based on population size (Key Informant Interview, 17 May 2017). Table 13-10 provides a comparison of the data provided with the data from the 2009 census.

Table 13-10: Total Population of Locations Closest to EOPS Infrastructure

Location	Population (2009 census)	Estimated Population (KI May 2017)	Sub-location	Population (2009 census)	Estimated Population (KI May 2017)
Lokichar (TS)	23,452	36,275	Lokichar	10,820	17,068
			Kapese	12,632	19,207
Kochodin (TE)	4,849	6,410	Kochodin	2,039	3,972
			Lopii	2,810	2,438

Source: 2009 census, KI 17 May 2017

Assuming the Location Chief's estimates are accurate, comparisons can be made with the expected rate of growth from the County Integrated Development Plan, which suggested an approximate increase of 67% by 2017 (Turkana County Government, 2013). Kochodin is the only Sub-location estimated to exceed the expected increase, almost doubling its population size. The Sub-location of Lopii within the Kochodin Location is estimated to have reduced its population by 13%, the most likely reason being insecurity.

However, there are many reasons to question the figures in the table above. While the rate of growth is close to the projections after the 2009 census, unpublished reports have suggested that the figures are much higher, some suggesting that areas of Kochodin, including some of the closest villages to the oil pads to be used for the Project, may be over 15,000 people alone.

Anecdotal information suggests that population figures shift because of the availability of grazing land and water, as well as security concerns. The Sub-location Chief of Lochwangi Kamatak in Turkana South said this is the case with the oasis in his area where water was good for animals, but not fit for human consumption (Key Informant Interview, 29 June 2016). The Sub-location Chief of Kakongu, also in Turkana South, described a similar dynamic. In his Sub-location, he said influx of pastoralists can increase the population tenfold in a short span of time. This results in problems as groups fight for water, and in some cases, increases crime, theft of animals and even the rape and abduction of girls (Key Information Interview, 01 July 2016).

In Kamuge Location of Turkana East, the Chief confirmed that even though the population has increased since the 2009 census, much of the population has temporarily moved to more urban centres such as Lokori due to insecurity. This, he explained, creates a situation in which they set up new permanent areas of residence, but still desire the chance to go back to their traditional home or *ere*. In many situations, some members of a household will stay in the population centres, but families will still keep their animals within Kamuge in *arumrum*, the mobile pastoralists groups set up to improve security in rural areas (Key Informant Interview 01 July 2016).

13.2.2.1 Migration

Migration is at the heart of the way most residents of Turkana County live. Raising animals is the main part of social and economic life. Studies of Turkana life written in the 1950s are still relevant today, where a person is said to grow up and pass through the stages of life being accompanied at every stage by stock. As soon as one is able, boys begin to herd his father's stock. Girls learn to water, milk, skin and cut up carcasses and cook meat and work skins (Gulliver, 1951). The severe hazard of erratic rainfall is a critical influence on the main economy of the region, predominantly animal husbandry. Those living in Turkana have adopted strategies to exploit scattered resources that vary unpredictably, causing people to adopt flexible strategies of mobility. This mobility of people and their herds is a prerequisite for survival for a large majority of the Turkana people (Muller-Dempf, 1994). One anthropologist with extensive research experience in Turkana said a general rule of thumb is that most Turkana operate on the assumption that two of every five years is "far from being good", one year is a drought and every ten years there is a catastrophic drought when two or more drought years happen in a row. As a result, Turkana exploit the harsh environment with herd management and adaptability (Muller-Dempf, 1994).

The pastoralist communities of Northern Kenya migrate as part of their livelihood, moving their homes and animals to utilise natural resources in the difficult natural environment. This traditional migration is distinct from a second type of migration that is driven by external factors. In Turkana County, this includes conflict and a search for security, as well as migration for economic opportunities. The second type of migration – economic migration – may ultimately improve trade, employment, infrastructure and services, but it can also negatively affect the project area "host" communities in relation to environmental, social and health issues.

Primary research illustrated how many households move on a seasonal basis and how varied their routes can be. Pastoralist culture is nomadic and people migrate with their herds for better grazing lands and to water sources during the different seasons of the year.

As an example of the second type of migration, one Lodwar based NGO explained there is a trend in rural-to-urban migration, which they attribute to people dropping out of pastoralism because of conflict, prolonged droughts and loss of animals to disease. Such migration generates informal settlements in major towns like Lodwar. This trend was observed as early as the mid-1980s when the United Nations set up camps to support refugees in Lokichoggio Urban Settlement in Turkana West Sub-County. Refugees supported by these camps were from civil wars in neighbouring countries (Key Informant Interview, 22 June 2016). In Turkana Central, one Sub-location Assistant Chief attributes population increase to displacement of people from post-election violence in 2013 and other natural causes like flooding (Key Informant Interview, 24 June 2016).

Some migration patterns have reportedly been influenced by the presence of TKBV. The Lobokot Ward Administrator commented that for the last 12 months there was high growth of business opportunities in the Ward. Many people started small businesses because the area became a strategic place where Tullow truck drivers (and other truckers) could spend the night. There was influx of people in the area causing congestion in the Lobokat Settlement. This caused some people to move to other areas – sometimes less secure places – for the purpose of having enough land for their animals. (Key Informant Interview, 01 July 2016.)

13.2.2.2 Vulnerable Groups

Vulnerable groups, and how they are defined, in Turkana County should be considered in the context of the most recent drought that has put a large part of the County's residents at risk in 2017. The effects of the drought were apparent during field work conducted in May 2017. Drought monitoring is discussed in Section 13.2.4 on Economics and Livelihoods. Food distribution has served nearly 900,000 people during food distribution cycles that sought to alleviate the effects of the drought (Daily Nation, 2017).

The consideration of "vulnerable" groups in the context of Turkana County must also be considered in the context of the term throughout Kenya. The 2010 Constitution in Article 260, makes specific provisions for "marginalised groups", by which it defines marginalised as:

- A community that, because of its relatively small population or for any other reason, has been unable to fully participate in the integrated social and economic life of Kenya as a whole;
- A traditional community that, out of a need or desire to preserve its unique culture and identity from assimilation, has remained outside the integrated social and economic life of Kenya as a whole;
- An indigenous community that has retained and maintained a traditional lifestyle and livelihood based on a hunter or gatherer economy; or
- Pastoral persons and communities, whether they are (i) nomadic; or (ii) a settled community that, because of its relative geographic isolation, has experienced only marginal participation in the integrated social and economic life of Kenya as a whole.

The Constitution further states that "marginalised group" means a group of people who, because of laws or practices before, on, or after the effective date, were or are disadvantaged by discrimination…" By such Constitutional definitions, the Turkana people as a whole can be considered marginalised or vulnerable.

Other common criteria for assessing vulnerability are poverty rates. In 2013, the County Integrated Development Plan estimated that 90.8% of the population live below the poverty line (Turkana County

Government, 2013). Such rates are extremely high and further suggest that the entire County can be considered vulnerable.

However, in this context, there are also local distinctions between poor and the most vulnerable. Mueller-Dremf writes that standard definitions of poverty are not always appropriate for a place like Turkana. In field research, he found that Turkana rarely perceive themselves as poor even by most definitions they would quality by this label. He goes on to explain the Turkana language has no word for being poor (Mueller-Dremf, 2014).

Another factor in assessing poverty, sometimes left out of standard measurements of income, are whether households are non-pastoralist, as distinguished from those that still practice pastoralism. This distinction can influence the pattern of poverty with most poverty being found in settled or town-based ex-pastoralists, casual labourers and traders (Little, 2014).

While it is clear that by definition in the Constitution that the Turkana people are marginalised, traditional criteria for assessing poverty need to be considered in the pastoral context. When asked about vulnerability during field research, key informant frequently cited common factors that are used at targeting additional aid or humanitarian assistance to individuals within a Location or Sub-location. Commonly cited groups are:

- Orphans Vulnerable Children (OVCs);
- Elderly;
- Widows;
- People with disabilities; and
- People with HIV.

According to the Assistant Sub-location Chief of Lochwangi Kamatak, vulnerable groups are sometimes identified using criteria set by group intending to assist vulnerable groups (Key Informant Interview, 29 June 2016).

The National Drought Management Authority (NDMA) in Kenya is the governmental body, which exercises overall coordination over all matters relating to drought risk management and to establish mechanisms, either on its own or with stakeholders that will end drought emergencies in Kenya and promote sustainable livelihoods. The NDMA was established to develop project-based interventions at a time when drought periods were becoming increasingly frequent and intense, directly affecting the household food security and livelihoods of more than ten million people (NDMA, 2017).

The NDMA identified vulnerable households by registering poor households in 2012 on a database with World Vision and Oxfam. There was a system of wealth ranking which was used to generate a database of “poor” households. Through this database, they were able to assess eligibility of households to receive benefits from a cash transfer program as part of a hunger safety net sponsored by the government and UK DFID (Key Informant Interview, 27 June 2016).

The County Government notes that people with disabilities group have been marginalized in all sectors of development within the county. They explain that such people have been treated with disdain and seen as dependents who cannot add value to developmental processes. There has been a national campaign to recognize that people living with disabilities should not be treated with contempt but should be given equal opportunities similar to those given to other special interest groups such as women and the youth. A major challenge in the county is that there are only a few institutions that take care of the needs of persons with disabilities (Turkana County Government, 2013).

Vulnerable groups receive aid from a variety of sources depending on the groups in need. For youth and women, for example, the government has set aside 6.9 million KES (~$65,400 USD). This has assisted over 1,200 registered groups who are aided in the development of business ideas. Managed via the Ward Administrators, the programme awards from 70,000 KES up to 1.1 million (~$700 up to ~$10,400 USD) for projects related to shore management along Lake Turkana (Key Informant Interview, 29 June 2016). Vulnerable people are also assisted by NGOs and organisations such as the NDMA. The Sub-location

Assistant Chief of Kakongu listed the Red Cross and World Vision as known NGOs that have provided assistance (Key Informant Interview, 1 July 2016).

13.2.3 Infrastructure and Services

In general, by nature of its location, climate and relatively neglected history since independence, the infrastructure and services of Turkana County are poor. However, there are recent signs of improvement. A representative of the NGO GIZ stated that infrastructure and services are improving as a result of the devolved system of government. Health facilities are improving and the distance to health facilities has been reduced. There are more Early Childhood Development (ECD) facilities that has allowed more access to education for small children. Improvements have been generally better in Lodwar, both as a result of increased employment from devolution and the activities of key NGOs. However, some areas have not seen much improvement at all, especially in areas affected by a lack of security along the A1 highway (Key Informant Interview, 25 June 2016).

13.2.3.1 Waste

Waste disposal is a major contributor to environmental degradation in the county and it is a problem since the local authorities collects only 0.2% of the community waste. Only 20,000 households in the County are thought to use latrines. This situation contributes to water, soil and air pollution and poses a health threat to the communities (Turkana County Government, 2013).

One NGO in Lodwar that has monitored waste management notes an overall lack of facilities to manage waste and poor infrastructure especially in the informal settlements in the town of Lodwar, which is said to be the only settlement in Turkana with waste management services. The group reported that even in Lodwar there is no legal site to dump the waste generated. There are only two solid waste collection trucks that have selected a few pickups in Lodwar town. These trucks make one trip a day and this is the only waste management service in the entire town. The trucks still use the previous dump site for waste, but have recently received a permit by improving the location and fencing it. The overall lack of waste facilities causes people to dump illegally, including in the Turkwel River that runs through Lodwar (Key Informant Interview, 22 June 2016).

The Lodwar Water and Sewerage Company (LOWASCO) is the only service to collect the liquid waste, mainly sewage discharge from septic tanks across Lodwar, and dump it separately. Most of this sewage comes from hotels and septic tanks (Key Informant Interview, 22 June 2016).

13.2.3.2 Water

The Turkana County has inadequate water for domestic use, livestock and crop irrigation. The rainfall is inadequate and unreliable. About 88% of the county's residents depend on surface and sub-surface dams for water, which often do not hold sufficient water due to the high evaporation rate during the dry seasons. According to the County Government, the main water sources in the county are hand dug shallow wells, piped water and river water. Access to quality water is a critical problem for the County although a recent programme managed by the National Government and UNICEF has benefited some communities with new wells dug to improve assess in schools. Some of these wells generated high yields. There is only one water supply company, LOWASCO, which operates only in Lodwar. All other areas get their water the main sources noted above (Turkana County Government, 2013).

The distance to the closest water point varies throughout the County but averages between 5 and 10 km. In urban settlements and some market centres, Water User Associations have developed piping systems that move water closer to settlements. However, this is the exception. In remote areas of the County, people can travel 10 to 20 km to reach their closest water source (Turkana County Government, 2013).

Across Turkana East and Turkana South, TKBV have contracted a supplier to use water bowsers to fill the water storage tanks daily. The Location Chief of Kochodin indicated that there is a government plan to drill a borehole in Nalemsekon for purpose of irrigating 500 acres of land, which has already been fenced. It will benefit about 100 households. One borehole was drilled by TKBV in Nakukulas area and a hand pump in Karuko. The furthest distance people travel in Nakukulas settlement to get water is 500 m (Key Informant Interview, 04 July 2016).

13.2.3.3 Electricity

The challenges facing the power sector in Turkana include weak transmission and distribution infrastructure, high cost of power, low per capita power consumption and low Country-wide electricity access. Only 1% of households have access to electricity in the home, even with the close proximity of the Turkwel dam hydroelectric facility (Turkana County Government, 2016). Hydroelectric power only connects Kainuk Settlement, the only centre with electricity from the national grid. Lodwar settlement is powered by diesel generators and several other projects are underway to connect larger population centres. Within the household, 95% use kerosene and firewood for lighting. Similarly, cooking is done with wood, kerosene and charcoal. Some solar energy has been used for pumping of water and lighting, especially in schools (Turkana County Government, 2016). Kenya Power is also piloting the use of solar energy. It has installed panels at the Lodwar station to complement diesel production. In addition, the Ministry of Energy has installed 98 solar panels on schools and government buildings (Turkana County Government, 2013). Some households near Lodwar were observed to have solar panels and wired electricity, but supply was said to be intermittent and data on such infrastructure was not available.

The Location Chief in Kochodin confirms that there is no electricity supply in the area with most people using torches for lighting purposes (Key Informant Interview, 04 July 2016).

Wind is seen as a potential resource for the future. This potential has led to the development of the Lake Turkana Wind Power project in neighbouring Marsabit County. This project will comprise of 365 wind turbines and will connect to the national grid. Once operational, it is expected to generate 310 MW (approximately 15% of the countries installed capacity). As of October 2016, the project was expected to input its first 90 MW of wind power into the national grid by the second quarter of 2017 (Lake Turkana Wind Power, 2017).

13.2.3.4 Roads and Transport

The County road network is poorly developed. There are 5,496.2 km of existing roads, of which only 488.5 km are bitumen. Key challenges for road development as seasonal rivers that cut through roads, poor soils that increase the cost of construction and maintenance. Many roads are not passable during rainy seasons (Turkana County Government, 2013).

There are 22 air strips for air transport. Only the airport in Lodwar is a tarmacked facility (Turkana County Government, 2013).

The poor condition of roads was mentioned in numerous interviews. The roads are corrugated and badly weathered with potholes. Many sections are impassable in wet conditions and vehicles get stuck for days. Highway robbers also take advantage of laxity in security to rob road users. This also affects economic activities. In Kalmngorok, livestock traders blame the road conditions on their ability to meet supply orders (Focus Group Discussion, 05 July 2016). In Lokori Ward, the Ward Administrator explained that the dry season allows for greater access to surrounding areas, linking the area to other trading centres not available in the rainy season (Key Informant Interview, 01 July 2016).

13.2.3.5 Media

Radio is one of the few forms of media available in the County. Radio Turkana, one of the main stations, covers about 75% of the County and has broadcast information on oil and gas exploration. Coverage of the station is mostly in Turkana East, Turkana South, Turkana Central, and Loima. While this is a commercial entity, it works with charitable organisations to support development initiatives such as encouraging testing for HIV (Key Informant Interview, 25 June 2016).

There are no newspapers printed in Turkana County.

13.2.4 Economics and Livelihoods

The majority of Turkana County depends on nomadic pastoralism, crop farming as well as fishing and weaving which are also common sources of livelihood. Types of livestock bred in the county are cows, goats and sheep (shoats), camels, donkeys, poultry (mainly chicken). Most of these breeds are indigenous and the Kerio River and Turkwel River are key sources of water to support animal husbandry. Farming is mainly practiced at household level through irrigation along the Rivers Turkwel and Kerio. The main crops produced in the county are sorghum, millet, maize, and vegetables like kales. Fishing is also practiced in Lake Turkana. (Turkana County Government, 2013).

In response to a drought and increase in food prices that took place in 2010 to 2011, Oxfam led a group of development agencies in trying to improve early warning systems, differentiate between chronic and acute vulnerability and better understand livelihoods in order to better understand how to respond to emergencies. This generated a division of Turkana County into six zones in a livelihood framework. Each zone is defined as an area within which people generally share the same patterns of access to food such as they grow the same crops or keep the same types of livestock. They also share the same access to markets. Patterns of livelihood clearly vary from one area to another. Local factors such as climate, soil, access to markets all influence livelihood patterns (Oxfam Save the Children, 2012).

EOPS falls mainly in the central livelihood pastoral zone (TCP). Within this zone, 80% of the population rely on livestock to provide the main source of food and cash income. The remaining 20% depend on a combination of self-employment (e.g., charcoal, mat and basket making, brewing), wild food and relief. This zone has relatively less grassland than the border pastoral livelihood zone (TBP), but is more secure and has better access to key County markets, as well as to government services. There is no agriculture, nor any cash crops in the TCP (Oxfam Save the Children, 2012).

The NDMA, described previously, also divides the County into similar livelihood zones in its monthly analysis of for drought and early warning. Within the NDMA framework, the EOPS is located in the Pastoral-all species zone. (Key Informant Interview, County NDMA Coordinator, Lodwar, 27 June 2016).

13.2.4.1 Pastoralism and Agro-pastoralism

Turkana County has about 2.5 million hectares of arable land. Land has been under-exploited for agricultural production. Only 31% of land in the high and medium potential area is under production, which represents only 5% of the land in the country. Arid and semi-arid land (ASAL) represents 84% of the land also remains largely underutilized. The agricultural yield is limited by factors like water, soil nutrients and skilled labour, as well as pest, animal disease and post-harvest wastage. (Turkana County Government, 2016).

There is limited quantitative data that allows for trend socio-economic trend analysis. The NDMA monitors the spread of diseases amongst livestock and some biophysical and socio-economic indicators. NDMA has 21 monitors in each livelihood zone. Each month, each monitor conducts 30 individual surveys in order to get data for the whole County (Key Informant Interview, 27 June 2016).

Aggregated information used each month to determine an overall status in the early warning system. Based on the overall aggregate determination, NDMA raises a flag at various state institutions such as school in order to inform residents of the current status (Key Informant Interview, 27 June 2016). Recent months have shown an extended period of the “alarm” status.

Table 13-11: Livelihood Zone and County Status for Drought Early Warning July 2016 – June 2017

Zone	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
Pastoral-all species	Norm	Norm	Norm	Alert	Alert	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm
Agro-Pastoral	Norm	Norm	Norm	Alert	Alert	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm
Fisheries	Norm	Norm	Norm	Alert	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm
Formal Employment	Norm	Norm	Norm	Alert	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm
COUNTY	Norm	Norm	Norm	Alert	Alert	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm

Other indicators of stress on Turkana pastoralists are low levels of milk production and consumption. In April, the total for each was 1 litre, an indicator of stress on animals. Normal production levels are stated to be over 85 litres (NDMA, 2013 – 2017).

From qualitative research in June and 2016 and 2017, Golder sought to understand the dynamic and current trends in the main livelihoods in the Project area. Although pastoralism is still the main source of livelihood for people in the Project area, efforts are being made to encourage diversification, primarily through complementary livelihoods such as livestock trading, which requires the development of more financial skills (Key Informant Interview, UN Women, 23 June 2016). However, barter trade is still being practiced by many pastoralists where there is no money (Focus Group Discussion, 03 July 2016).

The Turkana County Government has been implementing programmes to support pastoralists in diversification of their livelihoods and creating more permanent settlements and market opportunities. These efforts include encouraging pastoralists to register in order to obtain data related to household size, gender and identification numbers. This register is used at Final Distribution Points (FDPs) for food in cases of emergency, but also helps to inform government programmes in providing essential services like health and education to enable people to have some sort of permanent settlements (Key Informant Interview, 25 June 2016). In the Kochodin Location, where the Project will be, livestock traders noted that one main challenge is the inadequate knowledge on how to conduct the livestock business (Focus Group Discussion, 04 July 2016).

In Lochwangi Kamatak, the Sub-location Assistant Chief estimates that roughly 60% of the youth in his area have left nomadic life and gone to towns and larger settlements in search of salaried employment, particularly with oil exploration. For those who did get hired for a brief period, they do not want to return to traditional pastoralist livelihoods. They prefer to find work as a livestock merchant or other small trade. The disruption to households is that they are less able to move with livestock since youth had previously been the family member who travelled long distances with livestock (Key Informant Interview, 29 June 2016).

Livestock traders in Nakukulas explained that the market fluctuates based on seasons and requirements of buyers. They usually buy animals at a cheaper price in the dry season, especially in January. This is because some pastoralists need food, but also because it is harder to find pasture, so more are willing to give up their livestock. The risk of buying in such times is that the animals themselves lose value, causing them to lose money if lost weight, the basis of price. They also consider distance to pasture when they buy. Having to travel 20 km or more can cause goats and sheep to miscarry. Another factor is whether they can graze animals close to established settlements as migrating longer distances increases the risk of theft and raiding (Focus Group Discussion, 04 July 2016).

13.2.4.2 Small Business and Trade

The Turkana County has three urban centres namely Lodwar, Kakuma and Lokichoggio. Lodwar is the most developed with more infrastructural and social amenities. There are nine market centres in the entire county (Turkana County Government, 2016). The closest market to the project area is the main market is in Lokichar town. In Kangakipur, for example, business traders explain that they must go approximately 60 km to Lokichar to buy and sell their items, they hire a vehicle to transport their food stuffs to the area. Each of contribute an agreed amount of money so that it can be given to the owner's vehicle. (Key Informant Interview, Pastoralist business lady, Kangakipur, 04 July 2016).

Principal markets are traders from Kitale, Nairobi and Webuye, an industrial town in Western Kenya South West of Kitale. Exhibitions and major county events also provide a platform for sales. Small businesses rely on these activities to increase their sales. Transport is a challenge as some markets are further without having access to vehicles (Key Informant Interview, 28 June 2016).

There are few lending institutions due to unfavourable business environment, which has limited access to financial services and lack of properly organized marketing. Where financial services are available, the cost of credit has been unfavourable resulting in the lack of capital to finance enterprise development. Limited access to financial services has greatly affected trade, livestock and agriculture sub-sectors (Turkana County Government, 2013). The county government supports their groups although it is reported by some stakeholders that the support is not enough. (Focus Group Discussion, 01 July 2016).

13.2.4.3 Wages and Salaries

Wage earners constitute only 6% of the population in Turkana County. Unemployment levels are estimated at 70% in contrast to national figures of 42% (Turkana County Government, 2013). The devolved government structure has produced more employment opportunities at county government level. (Key Informant Interview, 22 June 2016). The county department structure has created diverse job opportunities, which contributes to wages and salaries. However the unemployment rate remains much higher compared to national levels. A large proportion of this labour force remains untapped due to inadequate skills/training for the locals and also fewer employment opportunities (Turkana County Government, 2013).

There is very limited data on salaries and the contribution of cash salaries to household incomes.

13.2.4.4 Industrial Sectors

While the predominant economic activity is related to pastoralism, other contributions to the County economy are the use of natural resources from trees (agro-forestry), mining and tourism (Turkana County Government, 2013).

Agro-Forestry

The income generating activities derived from the local indigenous forests in the county include aloe vera processing for soaps and shampoo by two groups, one in Namoruputh in Loima Sub-county and Kalemngorok in Turkana South. This activity also includes also charcoal production, a practice that is done through the collection of fallen trees and regulated by a license program managed by the Forest Department in the County government (Turkana County Government, 2013).

Mining

There are many on-going activities on mining. These include mining of gold although on small scale but in various locations within the county (Turkana County Government, 2013).

Tourism

Tourism accounts for close to 10% of Kenya are GDP and the County government estimates that this has great potential to general employment in the future (Turkana County Government, 2016). The main tourism attractions in the county are Lake Turkana, which is protected by UNESCO as a World Heritage Site, Central Island Marine parks within the lake, and Turkana South Game Reserve. The government, as part of the Vision 2030 development plan, has earmarked the construction of a resort city at Eliye Springs, one of the landing beaches along Lake Turkana (Turkana County Government, 2013).

The main wildlife found in the county are in the game reserve in Turkana South District. There are also hippos and crocodiles in the lake in addition to the various fish species in the lake. There exists various bird species, key among them the flamingos in Lake Turkana (Turkana County Government, 2013).

Other Industries

Fieldwork highlighted other small trade and industry that are practiced in the County.

One of the main activities in Kamuge is salt harvesting, said to engage 3,000 people in harvesting, packaging and retailing of this salt. At the beginning, the salt was sold in Lokori. However the entrepreneurs have grown their market to cover Lokichar, Katilia, Lodwar, Katilu, Kalemngorok and Kainuk. The salt is mainly used for treating camels and for chewing with tobacco. One kg of salt sells at Ksh. 150. There are four types of salt harvested in Kamuge. Tobacco salt, Livestock salt (salt lick), Vegetable salt and “Prias” which is mostly preferred by camels (Key Informant Interview, 01 July 2016).

In Kangakipur Sub-location, mats are woven by women and girls and sold in local shops and in Lokichar. Woven mats are also used to settle bills in local shops. Shop keepers receive mats of equivalent value to food rations bought and later sell the mats in Lokichar. (Key Informant Interview, 04 July 2016).

13.2.4.5 Poverty

Turkana has some of the highest levels of poverty in the country. Kenya National Bureau of Statistics (KNBS) reports poverty at 94%. However, such figures need to be considered in context described in Section 13.2.2.2 on Vulnerable Groups. As discussed in that Section, many consider wealth through the context of herd size and a household ability to maintain their animals. Livestock traders in Nakukulas said they would characterise a wealthy person as someone who has 20 camels, 500 small stock, 30 heads of cattle and 50 donkeys. (Focus Group Discussion, 04 July 2016). By contrast, poverty is considered to be when someone has no animals. Such distinctions are relevant when understanding the relatively high poverty rates.

13.2.5 Land Use and Ownership

Baseline data has been collected in the upstream study area for the purpose of assessing areas around the well pads that may be indirectly affected by EOPS.

13.2.5.1 Summary of Baseline Data

The following information is a summary of the Land Baseline, the field reports from the September 2016 and May 2017 surveys present results and discussion of the fieldwork, and are included in Appendix I.

The following provides the conclusion of fieldwork in the area surround the Ngamia (3, 6 and 8) wellpads:

- In the Ngamia study area, there are two long term homesteads that were occupied in May 2017, which would be classified as potentially affected persons. This compares with six long term occupied homesteads in September 2016. Both of the two long term homesteads occupied in May 2017 were also occupied by the same families in September 2016. The two families have a total of 25 family members living at the homesteads. Some family members are away from the area grazing livestock in areas further west during dry season months and areas to the east during wet season months; and
- In May 2017 there were 11 other occupied homesteads – five of these are classified as short term/seasonal homesteads which are likely to be occupied for two to three months during the wet season grazing period (April to June). Six of the 11 homesteads were newly established (January/February 2017) and it remains to be seen if these will be occupied to just two or three months (i.e., short term homesteads) or will remain in the area as long term homesteads.

The following provides the conclusion of fieldwork in the area surround the Amosing 1 wellpad**:**

- In May 2017, there were no occupied long term homesteads. However, five long term homesteads had been recently vacated by families who had moved to Nakukulas in March/April 2017 due to security concerns and risks of livestock raiding. The families are expected to return to these long term homesteads when security concerns reduce and would be classified as potentially affected persons. Although all absent in May 2017, these five homesteads have an estimated total of 57 residents. These families generally graze livestock in areas further west during dry season months and areas to the east during wet season months; and
- Four of the above five long term homesteads were also occupied in September 2016.

The proposed definition persons potentially affected by EOPS are families living in long term homesteads. Other types of homesteads were counted during baseline collection as well, but are not considered to be affected given that the location of these homesteads can vary from year to year and over relatively large areas. During data collection, these seasonal homesteads did not indicate a pattern of repeat seasonal use for any specific area.

13.2.6 Community Health and Safety

13.2.6.1 National Health Overview

The distribution of disease burden in Kenya reflects a predominance of communicable diseases, as well as maternal, neonatal and nutritional conditions. According to the latest statistics (2013 data), the leading causes of disease burden are HIV/AIDS, lower respiratory infections, diarrhoeal diseases, tuberculosis and neonatal prematurity, as shown in Figure 5. The leading risk factors are child and maternal malnutrition, unsafe sex, and poor access to safe water and sanitation and poor hygiene [IHME 2015].

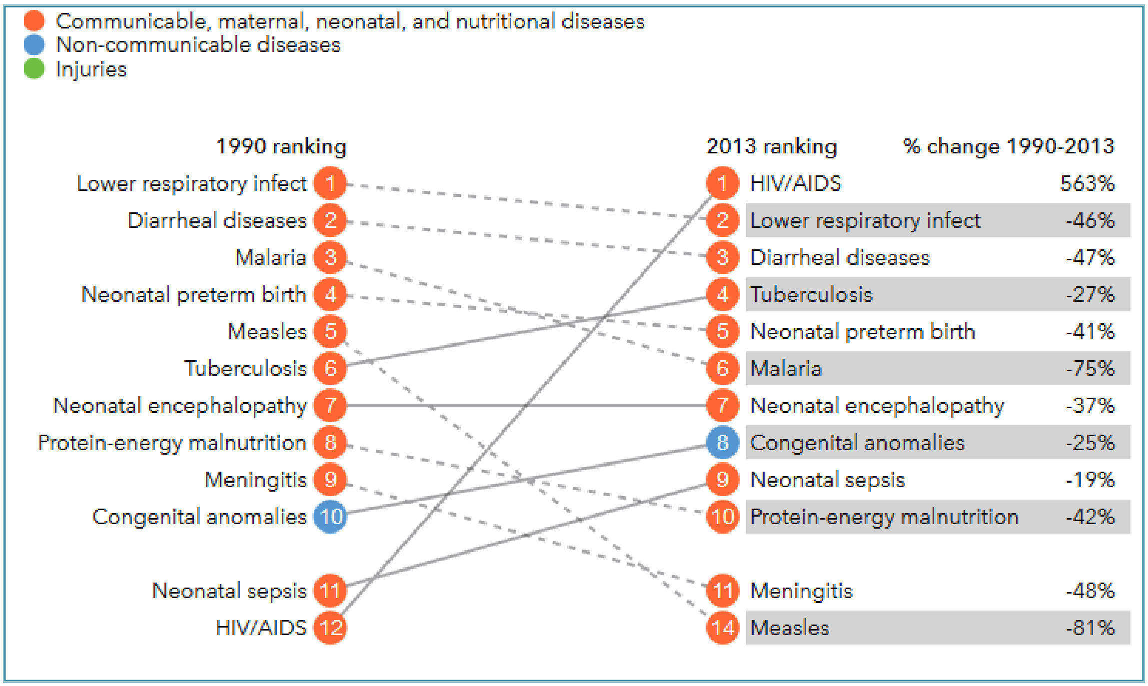

Figure 13-1: Ranking of leading causes of premature deaths in Kenya, a comparison between 1990 and 2013

Non-communicable diseases (NCDs) are perceived to be an emerging health concern in the country, and while firm evidence is limited, reports indicate that cardiovascular diseases and cancers are a leading cause of deaths among adults [WHO 2014]. Kenya also experiences outbreaks of new/re-emerging conditions such as polio, arboviral disease (such as dengue) as well as other health emergencies. Neglected tropical diseases such as lymphatic filariasis, leishmaniasis and intestinal worms also contribute to a significant disease burden in certain areas [WHO 2014].

13.2.6.2 General Health Profile of Turkana County

The 2014 Kenya Demographic and Health Survey (2014 KDHS) [a) NBSK 2015, b) NBSK 2015a] gives the most updated and comprehensive health statistics at a national and county level. Previous demographic and health surveys were reported at a provincial level, with the last survey completed in 2008/2009, prior to devolution to the County system. Importantly, the 2014KDHS does not describe all data sets for Turkana County as a unit, but generally within the Rift Valley region, and while a large section of this area falls out of the current Turkana County, this information does provide the most representative set of data available.

The data presented in Table 13-12 shows that demographic and health indicators for Turkana County are generally worse than the regional or national average. Many of the health indicators reflect the poor access to, or utilisation of public healthcare institutions at the County level, reflected by the example that only 23% of women respondents actually gave birth in a health facility, compared to 61% of respondents at a national level. Children were a particularly vulnerable group in the County, with up to 23% of children under 5 years of age short for their weight (or wasted), an indication of acute malnutrition and food insecurity. This compared to reported 5.7% of children in the Rift Valley region and 4% nationally, who were reported as wasted [NBSK 2015]. In addition, the current drought situation (2017) has led to reports of a food crisis and possible starvation in communities in the County [Reliefweb 2017]. Educational attainment of women are important demographic indicators that affect child health, with 64% of women in Turkana County having no education (33.8% in West Pokot), compared to 9.2% in the Rift Valley region and 7% nationally. 75% of women in Turkana County cannot read at all and 80% do not access any form of mass media, with this affecting health seeking behaviour and health promotion/prevention activities [NBSK 2015].

Table 13-12: Key health indicators at national and county level, 2013-2014

Indicator	Turkana County 2013/14	Rift Valley 2013/14	National Average 2013/14
Household size	6.9	n.a	3.6
Total fertility rate (per woman)	6.9	4.5	3.9
Infant mortality rate (per 1000 live births)	n.a	34	39
Under-5 mortality rate (per 1000 live births)	n.a	45	52
Maternal mortality ratio (per 100,000 live births)	n.a	n.a	362
Literacy rate among adults >=15 years (%), male: female	53:25	n.a	92:88
Contraceptive prevalence rate (% of currently married women 15-49 years)	10	35	58
Births assisted by a skilled assistance (%)	23	34	62
Births delivered at a health facility (%)	23	33	61
Measles vaccination coverage (% of children 12-23 months)	72	n.a	87
Stunting prevalence (% children with height for age <-2SD)	24	36	26
Underweight prevalence (% children with weight for age <-2SD)	34	19	11
Wasting prevalence (% children with weight for height <-2SD)	23	9	4
Proportion of households with at least one insecticide treated mosquito net (%)	46	41	59
Utilisation of insecticide treated bed nets (% children under-5 years)	21	30	54
Access to safe drinking water (% of households)	44	n.a	71
Access to improved sanitation (% of households)	18	n.a	53
Prevalence of HIV/AIDS (% adults 15-64 years)	7.6	4.7	5.6
Prevalence of TB (per 100,000 population)	183	n.a	266
Malaria test positivity rate (% of febrile children under-5 years)	50	n.a	41
Children (12-23 months) fully vaccinated (%)	57	85	68

Sources: include 2014 KDHS [NSBK 2015] and the Ministry of Health Fact Sheet for Turkana County (2014) [a)MoH 2015; b)KDHS 2008/2009].
Notes: n/a = not available.

Baseline data (presented in the subsequent health sections) show that the commonest diseases are malaria, respiratory infections, diarrhoeal diseases, malnutrition and HIV/AIDS. Predisposing factors to disease include favourable environments for mosquitoes, dust that contribute to respiratory ailments, poor access to safe drinking water and sanitation, high level of poverty and food insecurity, as well as cultural practices that affect health behaviour and practices as well as health seeking behaviours.

13.2.6.3 Health Infrastructure

In a key informant interview with the Turkana County Executive Officer (CEC) for health, April 2016 it was reported that the Counties health infrastructure consisted of three County referral hospitals (Lodwar in Turkana

Central, Lopiding in Turkana West, and Lokitaung in Turkana North), two Sub-county hospitals, 46 health centres and 131 dispensaries. In addition to these, there were two faith based or agency hospitals (in refugee camps) and an estimated 25 private clinics [KII 2016a].

County documents show that access to health is low compared to the size of the territory and population. Official information also indicated that health personnel are not sufficient with one doctor for every 70,000 people and one nurse for every 5,200 people [MoH 2015], which is significantly less than the WHO ideal target of 23 doctors for every 10,000 people. TKBV has mapped some health facilities in the EOPS study area, but little information or data on health trends has been collected.

It was reported that the devolution to County system has increased funding available to public health, with the second largest budget allocation (at 15%) of the total County budget. This provision has been made to correct past inequalities and address the poor County health indicators. However, it was mentioned that the full amount was not received (receiving about 8% of County budget), as funds were allocated to other areas. Evidence of upgrades was noted at Lodwar referral hospital, with further building and equipment upgrades planned [KII2016a].

13.2.6.4 Environmental Health Areas

The following describes the baseline health status in relation to the proposed Project with reference to the EHA framework. This is described in detail in Appendix I and is based on secondary data that was identified during desktop review and primary data that was gathered during the initial scoping trip in April 2016 as part of planning for the health baseline for the FFD ESIA.

EHA #1: Communicable Diseases linked to Housing Design

Communicable diseases linked to housing design, which have been identified in the Upstream Study area include:

- **Tuberculosis** (TB) – Estimates for Turkana County (2014) indicate a TB prevalence of 183 per 100,000 and an incidence rate of 60 per 100,000 [MoH 2015], both lower than the national average;
- **Acute respiratory infections** (ARIs) – These include pneumonia, upper and lower respiratory tract infections. These conditions are also a major contributor to the burden of disease in Turkana County;
- **Measles -** Turkana County is prone to measles outbreaks owing to the suboptimal coverage of measles vaccine (72% in 2014) [NBSK 2015]; and
- **Meningitis -** Turkana County is vulnerable to meningitis outbreaks owing to its border location and presence of refugee populations.

EHA #2: Vector-related Disease

The most important disease vectors in the upstream study area are mosquitoes that may transmit malaria and certain filarial disease, and flies - especially sandflies that transmit leishmaniasis.

- **Malaria -** Malaria is the leading health concern in Turkana County, with the burden of disease considered to be higher than is generally reported on malaria spatial distribution prevalence models [KII 2016b]. Malaria prevalence is estimated at 20 to 40% among children under-5 years in Turkana County [NBSK 2015]. Nearly half of febrile patients seen at the health facilities in the County test positive for malaria [MoH 2015]. Turkana County recorded a lower insecticide-treated nets coverage of 46% (2014 data) [NSBK 2015]. Malaria was also listed first among ailments affecting the local community in Lokichar, with a spike in cases during the rainy season [KII 2016c]. Coverage of insecticide-treated nets was reported to be inadequate in Lokichar with no mass distribution programmes performed by either the County or national government health authorities [KII 2016c].

EHA #3: Soil, Water and Waste-related Diseases

Data for 2013 shows that only 44% of households in Turkana County had access to safe drinking water and a dismal 18% had access to improved sanitation [KIRA 2014].

- **Diarrhoeal disease - cholera** and **typhoid fever** are some of the commonest diseases in this context. Turkana County is particularly prone to cholera outbreaks, especially in the rural area, or amongst nomadic pastoralists [Kiiru J. et al. 2013]. Outbreaks of cholera and dysentery (bloody diarrhoea) occur commonly in the County, with this attributed to the presence of refugee populations, nomadic lifestyle and unsafe drinking water and sanitation/hygiene practices.
- **Soil transmitted helminthiases** (STH) **-** STH infection is endemic in Turkana County with an estimated prevalence of 1% to 20%.
- **Schistosomiasis (**bilharzia) **-** Data shows a lower prevalence of (<1%) of the disease in Turkana County [Brooker S. et al., 2009].
- **Poliomyelitis** (polio) - Turkana, West Pokot and North Eastern parts of the country are considered hotspots for potential polio outbreaks [IRIN 2011].
- **Hepatitis A and Hepatitis E -** are endemic in Kenya.

EHA #4: Sexually-transmitted Infections, including HIV/AIDS

- **HIV/AIDS -** HIV/AIDS is among the top five health challenges in Turkana County. Statistics for Turkana County are generally higher than the national average. Data (2013) indicates a prevalence of 7.6%, ranking seventh highest nationally [NASCOP 2014]. The number of people living with HIV stood at 45,000 in 2013, including 5,736 cases among children, the tenth highest nationally. The County records nearly 3,000 new HIV infections annually [NASCOP 2014].
- **Sexually transmitted infections** (STIs) - such as gonorrhoea, syphilis and chlamydia are an important global health priority because of their devastating impact on women and infants. STIs are a health concern in the County, with cases occurring concomitantly with HIV [KII 2016b]. Lokichar HC records 2-3 cases of STIs every day, and while the case load has increasing in recent years, it was felt that many cases still go unreported. Research has indicated that northern Kenya including Turkana County has a high prevalence of Hepatitis B [Relief Web 2016a].

EHA #5: Food and Nutrition-related Issues

- **Food insecurity** in Turkana County has been a near permanent issue with nearly three-quarters (73%) classified as food insecure, and relying on food aid [TCG 2015].
- **Malnutrition** - Malnutrition was listed among the top five health challenges in Turkana County [KII 2016a] as well as around Lokichar [KII 2016a]. Findings from the 2014 KDHS show that 24% of children under-5 years in the County were stunted (short for age- indicating chronic malnutrition), 23% were wasted (thin for age, indicating hunger or acute food shortages) and about a third (34%) were underweight [NSBK 2015].

EHA #6: Non-communicable Diseases

- **Non-communicable diseases** (NCDs) - have emerged as the highest cause of disease burden globally. Estimates indicate that NCDs account for 27% of total deaths Kenya [WHO 2014a].
- **Hypertension** - the most frequent and important risk factor for cardio-vascular disease is a growing concern in Kenya with an estimated urban prevalence of 13% among women and 12% among men [van de Vijver S.J.M. et al. 2013]. NCDs particularly hypertension, diabetes and cancers are an emerging health issue in the County [KII 2016b].
- **Diabetes -**is an emerging health concern in Kenya. Estimates suggest that nearly 200,000 Kenyans are living with diabetes and the number is projected to increase to 0.5 million by 2030 [WHO 2011].

- **Cancer -** burden continues to increase largely because of the aging and growth of the global population alongside behaviours that increase cancer risk, particularly smoking.
- **Chronic respiratory diseases** - including chronic obstructive pulmonary disease (COPD) and asthma are an important consideration in this context.

EHA #7: Accidents and Injuries

Road traffic accidents (RTAs) and domestic or other forms of violence are of particular relevance in this setting.

- **RTAs** - An estimated 3,000 people die on Kenyan roads annually [Dossa A.2013]. Nearly 20 to 30% the road accidents are fatal.
- **Violence** - Gender-based violence is a common occurrence in Kenya. Victims of domestic violence are often abused inside what should be a secure environment - their own homes. Gender based violence and sexual violence was reported as an increasing concern in the County. Inter-ethnic conflict has been a concern in the semi-arid north, especially between the Turkana, Samburu and Pokot communities. The main sources of conflicts are land, grazing areas for livestock, boundary disputes, and cattle rustling. The situation is worsened by the illegal availability of firearms in the communities [OCHA 2014].
- **Trauma related incidences** - were listed among the health concerns in Turkana County. At Lokichar health centre, trauma was listed sixth among the commonest conditions seen Gunshot wounds were a major contributor to trauma cases, with Lodwar Hospital registering 40 to 50 cases in a month, with these often referred from outside areas as the hospital has a theatre and orthopaedic capability. There is a high ownership of guns (generally illegally) and incidents were often associated with tribal factionalism and cattle theft [KII 2016b].

EHA #8: Veterinary Medicine and Zoonotic Diseases

Zoonotic diseases are caused by infectious agents that can be transmitted between animals and humans.

- **Influenza** - virus infection is an important consideration in this context, including SARS, H5N1 and H1N1 viruses. Kenya recorded cases of avian pandemic influenza (H5N1) in 2006 and over 600 cases of pandemic influenza A (H1N1) in 2009 [Matheka D.M. J. Mokaya, and M. Maritim 2013].
- **Rabies -** a viral infection which infects domestic and wild animals is spread to humans through close contact with infected saliva via bites or scratches. The disease remains an important risk in the study area.
- **Viral haemorrhagic fever -** a general term for a severe illness, sometimes associated with bleeding and multi-organ failure, but with high mortality rates. According to the County epidemiologist, a suspected case of viral haemorrhagic fever was registered in the County in 2016 but this was not confirmed [KII 2016b].

EHA #9: Potentially Hazardous Materials, Noise and Malodours

These may also be listed as environmental health determinants and include items such as pollution of air, soil and water as well as possible exposure to organic or inorganic pollutants, noise and malodours. In a meeting with the Lodwar hospital health team participants voiced their concern on issues of environmental impacts that may be harmful to health of people and were particularly interested in how the Project will manage its waste, and minimise noise and air pollution [KIM 2016].

EHA #10: Social Determinants of Health

- **Mental and behavioural disorders** - These include conditions such major depressive disorder, anxiety disorders, drug use disorders, alcohol use disorders, and schizophrenia [Murray C.J.L. et al. 2012]. With only one specialized mental hospital and 0.19 psychiatrists per 100,000 population, mental healthcare in Kenya is generally inadequate [WHO 2011a]. No secondary data was found for mental health disorders in Turkana County.

- **Substance abuse** - Drug abuse including alcohol, commercial sex activity, and teenage pregnancy were mentioned among emerging social issues in the Upstream study area [a) KIMa) 2016, b) PDC 2016].
- **Education** is a key determinant to support and uplift the health status and wellbeing of an individual in a society and indeed communities. Data (2014 KDHS) shows that the literacy levels in Turkana County are amongst the lowest nationally. Only half (53%) of men and a quarter (25%) of women are literate [NSBK 2015]. Nearly two-thirds of women (64%) and over a third of men (35%) having no formal education [NSBK 2015]. According to the County epidemiologist pregnancy related issues, including illegal abortions were a leading health concern in the County [KII 2016b].
- **Polygamy** is an acceptable cultural way of life among the Turkana people and a man can marry as many wives as he can afford to pay the bride price for [KIG 2016]. Polygamy was mentioned among the predisposing factors to high rate of HIV/AIDS in Turkana County [KII 2016].
- **Violent behaviour** was reported as common in general society, with this reflected in the high rates of gender based and sexual violence. The criminal justice system was potentially weak, but criminality was not common (such as petty theft and housebreaking) as the common as the community justice system was swift and effective [KII 2016c].

Baseline conditions related to social maladies are considered in more detail in Section 13.2.8.

EHA #11: Health Seeking Behaviour and Cultural Health Practices

- **Health seeking behaviour** (HSB) - Findings from the 2014 KDHS show that care seeking from a formal health provider has increased nationally from 49% in 2008 to 63% in 2014 [NBSK 2015]. The same survey also found that 62% in Turkana County seek medical care from a health facility or formal provider. A tour of Lodwar Hospital and Lokichar health centre revealed that there was an overflow of patients beyond their bed capacity. This could suggest preference for formal healthcare and increasing pressure on available health services.
- **Traditional medicine** plays an important role in HSB. Cultural practices in both rural and urban Kenya support the use of herbal medicine for treatment of certain ailments, even when access to modern medicine is available, especially when affected with chronic ailments such as HIV/AIDS, hypertension, infertility, cancer and diabetes [Kigen G.K. et al. 2013]. Use of traditional medicine is a common practice among the Turkana people, and most adults, especially women, know a large number of herbal plants (*ekitoi/ngikito*) that they use as medication [Harragin S. 1994].

EHA #12: Health Systems Issues

A good health system delivers quality services to all people, when and where they need them. This requires a robust financing mechanism, a well-trained and adequate workforce, reliable information on which to base decisions and policies, well maintained facilities and logistics to deliver quality medicines and supplies. Reproductive health, maternal and child health are some of the key measures of a health system.

- **Reproductive health** - At 6.9 births per woman, the fertility rate in Turkana County is among the highest in the country [NSBK 2015]. Just half (53%) of married women nationally and a low 10% in Turkana County use any family planning method [NSBK 2015].
- **Maternal Health -**. Maternal health indicators for Turkana County are much worse than national average. While a majority (91%) of pregnant women receive skilled antenatal care, majority (77%) give birth at home under the care of unskilled traditional midwives [NSBK 2015. Pregnancy related issues were cited among the leading health concerns in the County with increasing cases of abortions as a result of teenage pregnancies and irresponsible sexual behaviours [KII 2016b].
- **Child health -** The health of child is a basic indicator of a country's socioeconomic situation and quality of life. No secondary data on child mortality rates is available for Turkana County.
- **Immunisation -** Statistics (2014) show that full immunisation coverage stood at 68% nationally and 57% in Turkana County. Except for measles vaccine (at coverage of 72%) all the other vaccines administered

to children in Turkana County reached the minimum recommended coverage of 80% required for herd immunity [NSBK 2015].

Health system issues emerged a key concern during the health impact assessment scoping study field visit to Lodwar and Lokichar in April 2016. In a meeting with Lodwar hospital health team, it was reported that demand for healthcare services had increased tremendously in recent years, with the facility operating above the available bed capacity (of 202) [KIM 2016]. It was common for patients to share beds, or to be placed on beds in the corridors outside the wards due to limited space. This creates patient care issues as well as infection control concerns due to overcrowding. The hospital health team express further concern that industrial development associated with the advancement of the oil fields in Turkana would attract more people to the County that would place added pressure on the ability to deliver effective services. They cited the lack of health prevention and promotion programmes that lead to increased uptake of secondary healthcare services [KIM 2016]. In addition, there was an expectation on Tullow to support the increased demand for healthcare services, with the acknowledgement that the company has developed three hospitals (at level 3 standard) in Lodwar, Lokichar and Lokori [KIM 2016].

On direct observation, the Lodwar referral hospital was generally clean with adequate hygiene, but the overcrowding did pose risks to nosocomial infections. There was evidence of construction, with the development of an ICU, additional operating theatre and other plans. The CEC for health the County epidemiologist reported that a significant build and development programme was underway in the County, with the focus on Lodwar referral hospital, but that it would include other facilities as well [a) KII 2016a, b) KII 2016b].

The poor road network limits access to the referral health facilities to and from Lodwar. Referral from Lodwar was generally to Kitale or Eldoret, but the distance and poor roads made this challenging [KII 2016b].

At Lokichar health centre, challenges were reported including inadequate staffing, referral difficulties, inadequate infrastructure (patient wards) with the facility operating above the current bed capacity, inadequate medical supplies and inadequate equipment especially for maternity services. There was only one ambulance in an operational condition, and due to lack of funds the family of the person requiring referral needs to provide money for fuel to facilitate the transport. Power in the facility was provided through solar panels, but challenges with batteries means the facility often does not have power at night. Water supply is also a challenge as the pump from the well depends on solar power that is often not operational [KII 2016c].

Outbreak and epidemic response was limited in the County, with the County epidemiologist also fulfilling the role of Lodwar hospital Chief Executive Officer [KII 2016b]. The County covers a vast area and the migrant population and movement of people across borders as well as the refugee camps play a major risk for the development of disease outbreaks. The County has limited capacity to predict and manage these outbreaks [KII 2016b].

13.2.7 Education

In total, there are only 315 primary schools and 32 secondary schools in all of Turkana County. There are polytechnic institutes in Kakuma and Lodwar; two colleges, one focus on health and the second on teacher training. The only campus university sites are in Lodwar and Lokichoggio and a Technical Training Institute is being built in Lodwar (Turkana County Government, 2013). Specific data on school infrastructure in the nearest Sub-locations was not available.

The low literacy levels of 22.2 percent in the county can be attributed to many causes which include extreme poverty, understaffing in schools and cultural practices such as early marriages. Other calamities such as drought and inter boundary conflicts also inhibit the provision of proper education resulting in low literacy and education standards (Turkana County Government, 2013).

The Ministry of Education, Culture and Sports says that the pastoralist lifestyle has contributed to past low enrolment, but that there is 200% increase generated by new education facilities, especially the Early Childhood Development (ECD) centres providing free primary education (Key Informant Interview, 29 June 2016). This new emphasis on ECD has also been attributed to increased awareness among parents to make sure they take their children to school. While this is a generally positive trend, it has created shortages of infrastructure. (Key Informant Interview, 22 June 2016).

Other challenges cited in improving education include long distances to schools and teacher shortage, particularly as many teachers leave education to seek better paying jobs in the newly developed County administration (Key Informant Interview, 29 June 2016). School fees were also noted as being prohibitively expensive (Focus Group Discussion, 30 June 2016).

13.2.8 Social Maladies

Social maladies include aspects of alcohol or drug use, crime, commercial sex work, child and forced labour and other work/occupational inequities. While limited data from local administrative units has been received on these topics, social maladies have been investigated through key informant interviews and focus groups.

According to the Sub-Location Assistant Chief of Lochwangi Kamatak, alcoholism has increased and greatly influences youth, in some cases causing them to lose jobs. Due to peer groups, he said some youth are smoking cannabis (*bhang*) and chewing khat (*miraa*), which he links to individuals becoming homeless (Key Informant Interview, 29 June 2016). In Kainuk, focus group participants said they have observed new types of drugs and alcohol being consumed, in some cases incapacitating people for up to three days. They also report the use of drugs to spike drinks and cause vulnerable women to become disoriented and vulnerable to assault (Focus Group Discussion, 01 July 2016).

Youth from the Lokichar Sub-Location also suggest that drug abuse has increased in the last three years with alcoholism, in particular, being on the increase. They state that young people in schools are most susceptible to these problems with girls being most vulnerable to abuse by those with “deep pockets”, men who seek to pay for sex. All agree that there is a more visible display of prostitution that commercial sex work attracts women from other parts of Kenya. (Focus Group Discussion, Youth of Lokichar, 29 June 2016). Similar trends were noticed by the Sub-county Administrator from Turkana Central. In addition to the increase in substance abuse, he reports that the dynamic is especially harmful in the overcrowded and growing settlements around Lodwar. These areas have suffered incidents of fire, stealing and an increase in sexually transmitted diseases (Key Informant Interview, 28 June 2016). Influx was also cited as a source of new social maladies in the Kochodin Location where the Project is located. There the Location Chief links influx to post-election violence in 2007, when ethnic Turkana from other parts of Kenya were displaced and came to the area. This change coincided with substance abuse, as well as a rise in domestic violence (Key Informant Interview, 04 July 2016).

One NGO worker in Lodwar attributes the rise in drinking and other social maladies with pressure to acquire, and the availability of more amenities. He specifically highlighted the dynamic in a place like Lokichoggio, the settlement in Turkana West that previously hosted a large number of United Nations organisations. The employment had provided people with new amenities and when the agencies left, it became a town with limited opportunities (Key Informant Interview, 25 June 2016).

Another NGO in Lodwar links social maladies, particularly the rise in HIV/AIDS with the recent infrastructure development. New accommodation facilities and transport stops for truckers have attracted commercial sex workers (Key Informant Interview, 27 June 2016). This scenario is also reported in Kainuk Settlement. There an increase in traffic creates a noticeable increase in women from nearby West Pokot, Elgeyo-Marakwet and Trans-Nzoia Counties. When there is less traffic, there is an observable drop in the number of women in the settlement. Interviewees directly attribute this to the spread of HIV (Focus Group Discussion, 01 July 2016). The Lobokat Ward Administrator, which oversees Kainuk Settlement confirmed that the truck drivers are generating an increase in commercial sex work, but suggest it is not only women from other counties who are involved. He added that school children are also affected. Pressure on them to earn money leads them to commercial sex work, dropping out of school and early pregnancies, which are said to be more common (Key Informant Interview, 01 July 2016).

13.2.8.1 Discrimination in Employment

With salaried employment being relatively limited among the predominantly pastoralist communities of Turkana, discrimination in employment, whether real or perceived, is a commonly cited problem. Frequent work interruptions in Turkana are related to accusations of unfair hiring or firing. Such protests are sometimes linked to a misunderstanding of a job's terms and conditions, however, there are other inter-ethnic issues as well. Both Turkana and Pokot communities believe that they should be given employment opportunities. For example, *kraal* elders in Turkana South describe how they have been left out of all employment opportunities at a Kenya Electricity Generating Company (KenGen) plan located in West Pokot County, but only a few kilometres from settlements in the Kaputir Location in Turkana County (Focus Group Discussion, 31 July 2016). While such local complaints are not as relevant now from the West Pokot side of the County border, key informants in other parts of West Pokot County commonly voice their expectation for employment from TKBV and other infrastructure projects in Turkana.

Another country-wide problem is related to discrimination based on HIV status. The national HIV and AIDS Tribunal issued a statement on findings in December 2016 that found HIV-positive individuals are likely to experience discrimination in the workplace due to their status. Such discrimination has included individuals being tested for the virus without their consent and in some cases a person's status has been disclosed to a third party without consent, breaching confidentiality and privacy (Daily Nation, 2016).

13.2.9 Social Capital, Security and Conflict

13.2.9.1 Overview of Security Trends

Turkana, neighbouring Counties in Kenya and pastoralists from neighbouring countries have well-known histories of conflict and violence, often associated with cattle raiding. This section will characterise some of the historical issues and provide a context for the changing environment. It will cover aspects of interethnic conflict, especially as it relates to Pokot and Turkana herders, tension between traditional community governance structures and elected leaders and banditry that has relatively less to do with ethnic differences, but rather relates to crime along roads and transportation routes.

Since Golder completed field work in July 2016, there are indications that the relative calm and decrease in violence has shifted. Security monitoring indicates the following incidents in Turkana and West Pokot Counties from March to May 2017.

- March 2017:
  - 10 Cattle raids in Turkana; and
  - One cattle raid and one inter-communal clash in West Pokot.
- April 2017:
  - 14 cattle raids and six inter-communal clashes in Turkana; and
  - One cattle raid in West Pokot.
- May 2017:
  - Six cattle raids in Turkana (Control Risks, 2017).

Figure 13-6 shows Incidents of Cattle Raids, Inter-communal Clashes and Banditry in Turkana County from January 2016 to 31 May 2017.

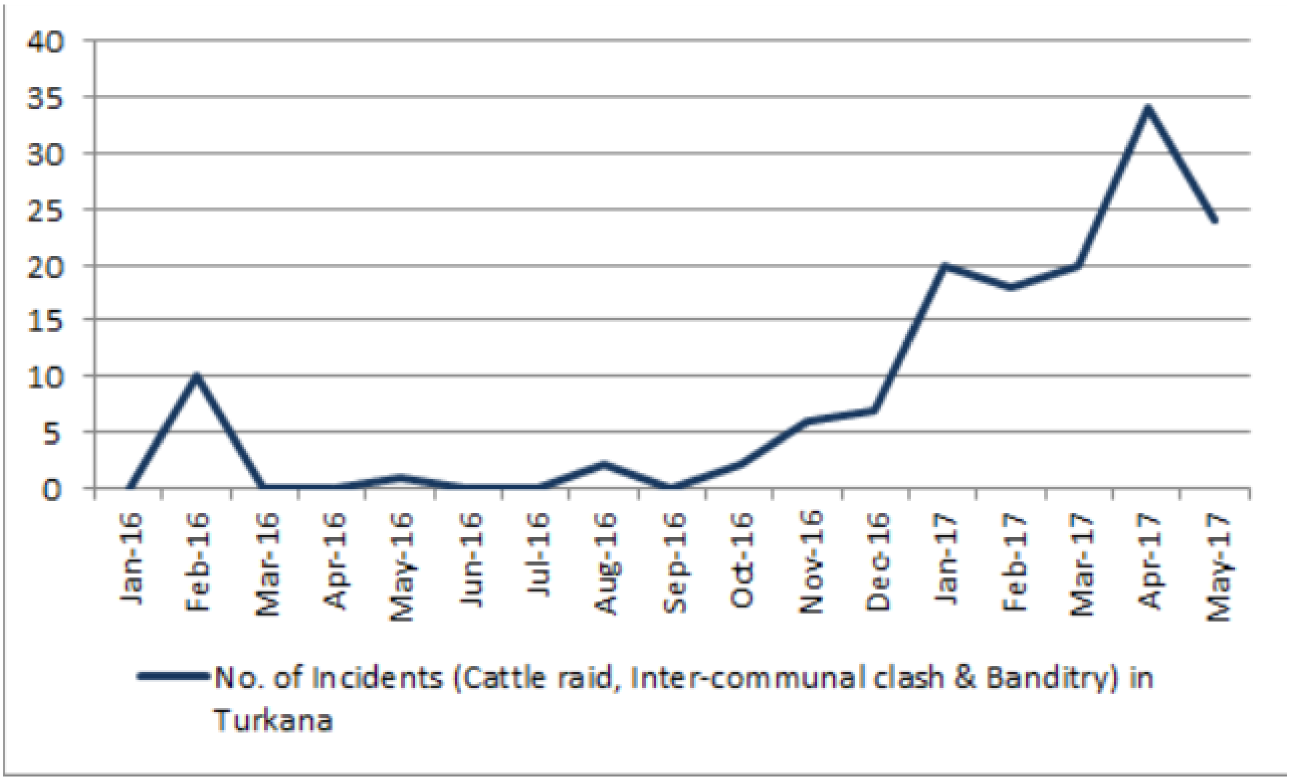

Figure 13-6: Number of incidents in Turkana

Source: Control Risks, 2017

Golder's fieldwork related to security has been conducted by the same team who previously work for TKBV and completed a 2015 study led by the NGO Small Arms Survey. This work sought to understand community perceptions of conflict in Turkana and West Pokot at a time of heightened violence. The Small Arms Survey report indicates shifts and intensification of armed conflict.

Over the past 10 years, a gradual shift has occurred in patterns of livestock raiding and attacks. While cattle raids still occur, the commercialization of livestock theft – in which individuals, and not communities, benefit from raiding – has emerged. Politicians, businessmen and other elites are alleged to be supporting and profiting from commercialized raiding, something that is believed to be eroding elders' authority (Mkutu, 2010; Kaimba, 2011; Griener, 2013; Triche, 2014). The majority of Golder's research findings support this overall general trend, but also suggest that has been a gradual slowing of cattle raiding. Rather, research shows that the current violence is more often linked to disputes over natural resources. A shift from cattle raiding to conflict over natural resources is related to more frequent and longer droughts in the country's dryland areas and the problem is exacerbated by easier access to guns, making battles more deadly. The increase in arms is attributed in part to the regions proximity to South Sudan, an area with an ongoing civil war, and the porous borders with Kenya. Aid efforts are aiming to improve access to natural resources, in particular access to water, to decrease the likelihood of different ethnic groups crossing boundaries. (Thomson Reuters Foundation News, 2016).

By late 2016, the specific violence between Turkana and Pokot had largely subsided, which was marked by a celebration in September 2016 to acknowledge 18 months without killings from cattle raids between the two groups (Finn Church Aid, 2016). However, there is still tension between Turkana, West Pokot, as well as other neighbouring counties of Baringo, Laikipia and Samburu. Despite relative calm and the Kenyan government efforts to reduce arms, the deputy president of Kenya estimates there are still 500,000 illegal fire arms in the county and most owned by pastoralists (Al Jazeera, 2016). The relative calm and improvement between pastoralist tribes is still at risk due to the number of weapons and challenge of maintaining a balanced use of natural resources.

During Golder research, one key informant explained that security among different ethnic groups began to improve in December 2015 during a key event that brought together the County governments of Baringo, West Pokot, Turkana, Elgeyo-Marakwet and Samburu. This was said to be the beginning of strong commitment by the County leadership to end interethnic conflict in the region (Key Informant Interview, 04 August 2016). This meeting led to an idea among the political leaders gathered to initiate a “peace caravan” after talks with the President and Deputy President on how to end killings in the pastoral communities. A group of leaders comprised the peace caravan in mid-2015 and they travelled through critical areas urging communities to move beyond the cultural practices of raiding that undermine development in the pastoral communities (Citizen Digital, 2015).

Prior to this initiative, the Peace Coordinator of West Pokot described a chilling picture, particularly between Pokot and Turkana pastoralists. The low point of this period was between January and May, 2015. During this time, the conflict worsened from only cattle rustling to the killing of children. This targeting of people, regardless of the potential to steal animals, prompted the government to intervene and the notable change was an ownership of the problem by regional leaders (Key Informant Interview, 04 August 2016). The low point of this phase of violence is exemplified by a particularly horrible period that left 300 people dead in the settlement of Kailoseget in the Kainuk Division of Turkana (Daily Nation, 2015). A protest in March of 2015 by many of the widows left destitute from the violence was critical in moving leaders to act. Women in a focus group confirm that this was a terrifying period, explaining that they recall it to be like a war zone with times when they were attending funerals every day (Focus Group Discussion, 01 July 2016). The Assistant Chief from the Kainuk Sub-location said certain areas were simply no-go zone prior to May 2015, including the Turkana County side of the A1 from Kainuk to Kakongu and similarly to the Sub-location of Sarmach in West Pokot County. The no-go zones also included key grazing areas, such as locations as far east around the Kalemngorok Settlement in Turkana South (Key Informant Interview, 31 July 2016). The Kakongu Sub-location Assistant Chief recalls conflict escalating from 2012, when the frequency and intensity of raids increased. At that time, Pokot groups claimed areas from a large part of Turkana County territory from Kainuk settlement on the border to area of the Kochodin Location near the Project (Key Informant Interview, 01 July 2016). It was at this time that *adakar* elders from the same Sub-location explain that they and their enemies decided to bury cattle rustling. They site recent evidence of the change being two examples where some animals were stolen, but they intervened to ensure that the animals were returned to the rightful owner before any retaliation could take place (Focus Group Discussion, 31 July 2016). Such intervention suggests that the threat of theft may remain, but numerous leaders in the area are diligent to make sure isolated instances of raiding or theft do not cause greater problems and a return to the type of violence witnessed in 2015.

The overwhelming majority of key informants and focus group participants describe an improved situation between Turkana and Pokot herders. Researchers themselves noticed obvious differences of improved security in settlements and communities they had visited only a year before. Many people confirm that the peace caravan marked the turning point in the raiding violence. Numerous interviewees explain that Turkana and Pokot are grazing animals with each other, trade and business happens regularly between the two groups and Pokot *adakar* are often residing in Turkana County. Even areas to the south such as the Kapedo Location in Turkana East report that Pokot pastoralists regularly and freely move within the Kapedo Settlement. The research team observed that people were walking along the road connecting Kapedo Settlement to Chemolingot (in Baringo County). This 30 km journey had previously been impossible and there had not been any vehicles on the road a year ago (Focus Group Discussion, 02 August 2016). With the return to peace, there are still affects from the violent period that are visible in Turkana. The Sub-county Administrator for Loima Sub-county reports that some residents from Turkana East Sub-county have remained in his area under the assumption that it is relatively safer in Loima Sub-county, under the assumption that conflict may return to Turkana East (Key Informant Interview, 24 June 2016).

This does not mean that there are no exceptions and that some tensions remain even if the active violence has greatly decreased. In the Sub-location of Lochwaangi Kamatak in Turkana South, the Assistant Chief reports a trend in overuse of natural resources, which is causing disagreements among stationary and migratory pastoralists. Specifically, people compete for pasture and plants used for animal consumption. In some situations, this has led to gun violence. The second problem he noted in this Sub-location is the shortage of Kenyan Police Reserve (KPR) officers. Their role is to provide security in the local area, but several have been engaged in the oil and gas work in the County and this has left the Sub-location with one or two KPR officers at any one time, which is not considered enough to maintain law and order (Key Informant Interview, 29 June 2016).

Areas of the Lochwaakula Location in Turkana East are also reported to have tensions over natural resources such as watering points. Even though there is a general agreement to share water between the Turkana and Pokot herders, there is tension in trying to encourage Turkana who had previously fled violence to come back to an area that is relatively worse than other migration corridors along the Turkana and Pokot border (Focus Group Discussion, 28 July 2016). While some Turkana have not returned, Pokot pastoralists use the area. Additional issues have arisen from Pokot herders occupying infrastructure, in particular a primary school located in Lochwaakula Settlement (Key Informant Interview, 29 July 2016).

Another exception to the trend of improved security is in the Katilu Location of Turkana South. There some *adakar* elders state that Pokot no longer migrate to the same areas as in the past and that this causes disruptions. They also expressed disappointment that there has not been a re-opening of the Nakwamoru Settlement (Focus Group Discussion, 29 July 2016). Nakwamoru Settlement is located in the Kalomwar Sub-Location of the Kaputir Location in Turkana South. It borders the Kapokot hills and was previously a gold mining area and an important place for commerce between the two groups. It closed in 1996 after an attack by Pokot on miners in an attempt to scare away Turkana. The dispute over the area was said to have less to do with cattle rustling, but more to do with land acquisition.

Research highlights that while raiding may have subsided from its peak in 2015, there is a persistent problem with violence and robbery along the A1 highway, particularly in areas from Kalemngorok Settlement to Kakongu Settlement. On this road, the Turkana Deputy County Commissioner states that robbers harass drivers and passengers, particularly larger trucks. This, he says, is partly to do with individuals who used to participate in cattle raids and refuse or are unable to return to herding and have no other livelihood (Key Informant Interview, 29 July 2016). Other residents near this area suggest that there still may be some involvement of pastoralists who participate in the robberies (Focus Group Discussion, 29 July 2016). Anecdotal accounts explain that pastoralists with phones can sometimes communicate with “thugs” or idle warriors. They observe vehicle movements and call ahead to hit vehicles farther along the road. Adakar elders in the Kakongu Sub-location consider the bandit in two categories. The first category are simply common criminals, but the second category includes some people who were left destitute by losing their animals in previous violence. With no animals, but still having access to their weapons, poverty induces them to crime. The elders themselves increasing see little difference between the two groups and believe that even those who lost animals can survive in aid if they need it (Focus Group Discussion, 31 July 2016).

One of the most dangerous implications of robbery on the road is the possibility that it could lead to accusations across ethnic lines. One Turkana key informant Lodwar has received information that Turkana youth have carried out some robberies and then sought to blame ethnic Pokot. He also said there are reports of collusion with police (Key Informant Interview, 08 August 2016).

The following detailed background information is provided in Appendix I:

- Causes behind Security Trends;
- Territorial Disputes: Critical Risk to Stability;
- Internal Conflict within Turkana and Key Security Organisations;
- Needs for Maintaining Security; and
- Northern Rangelands Trust.

14.0 CULTURAL HERITAGE

The purpose of the cultural heritage baseline study was to collect objective, scientifically defendable data of sufficient breadth and quality to allow the characterisation of the baseline cultural heritage conditions within the EOPS Upstream Study area.

Cultural heritage, in both tangible and intangible forms, is a unique and non-renewable resource. Tangible cultural heritage is defined as moveable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values; or unique natural features or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, and waterfalls (IFC, 2012a).

Archaeology is considered in this study to comprise all the material remains of past human occupation, land-use and associated activities, as well as any resultant environmental remains, and it covers all periods, from prehistory (before written records) to the modern period (20th century).

Cultural heritage assets[20] that are not archaeological are described in this study as 'living cultural heritage'. This includes intangible cultural heritage, which is described as elements of culture such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles (IFC, 2012a).

The archaeological time periods referred to in this baseline report, their approximate date ranges and how they relate to known geological periods[21] are outlined in Table 5 of Appendix J.

Desk based studies (secondary data gathering) and targeted archaeological field survey (primary data gathering) was undertaken at the locations of those project elements where direct ground disturbance would be required (i.e. upstream only).

Primary data gathering was completed in the form of key informant interviews (KIIs), which were conducted at nearby settlements in the upstream study area, to ascertain the location of culturally significant sites associated with those settlements.

Cultural heritage has been identified as one of the technical areas where literature and data acquired from third parties can inform the baseline of culturally sensitive sites that could potentially be affected by the project activity on the transport route. Therefore, a desk-based study (secondary data gathering) was also conducted on the midstream.

14.1 Study Area

A combination of desk-based study, field survey and KIIs was undertaken to establish the baseline cultural heritage conditions of the area considered likely to be influenced by the Early Oil Pilot Scheme (EOPS)[22].

Baseline data gathering for cultural heritage in the upstream study area was focused within a buffer area around each of the project elements. Within the Ngamia and Amosing wellfields, a 250 m buffer was applied from the boundaries of the wellpads. The size of this buffer area was considered appropriate for ensuring a robust characterisation of baseline conditions. KIIs were undertaken at a number of settlements in the upstream study area.

For the midstream study area, a buffer of 100 m was also applied to either side of the road along the entire length of the proposed transport route (desk studies only).

[20] The term 'asset' is used in this context as a generic term applied to a variety of cultural heritage site types, which range in size, nature and significance. An individual asset might, for example, be an archaeological findspot of a single isolated pottery sherd/scatter of pottery sherds or, equally, it might refer to a burial or monument.

[21] An overview of the archaeological chronology for Kenya, as defined by the NMK, is presented here: http://www.museums.or.ke/content/view/118/83/1/1/

[22] Baseline data collection was initially undertaken for the Full Field Development (FFD), of which EOPS is a preliminary, smaller scale phase. The data gathered for the FFD has been used to inform the baseline cultural heritage conditions for the EOPS project, albeit limited to the smaller scale and footprint of the proposed EOPS development. This was supplemented by EOPS specific baseline data gathering, as detailed in Sections 14.2 and 14.3.

14.2 Secondary data

Secondary data was collected through desk-based study, including an appraisal of the following:

- Existing national datasets collated and maintained by the National Museums of Kenya (NMK);
- Results of previous archaeological surveys, conducted by NMK specialists in 2014 for Tullow in association with seismic surveys; and
- Specific Site Assessments (SSAs) completed for each wellpad during Exploration and Appraisal, which included an archaeological survey, although no archaeological sites were recorded by these assessments.

A review of the available literature was also completed to identify other sites located in the cultural heritage study area and to provide regional context in which to interpret the established baseline conditions. The Lake Turkana basin, owing to its internationally recognised archaeological and palaeontological significance, has attracted a wealth of academic research, which is used to inform the NMK dataset.

The NMK archives were the main source of secondary information for sites and monuments of historic or cultural value (including any statutory protections afforded to them). They also record sites of significant national/international archaeological interest. The geographical extent of this dataset covers both the upstream and midstream components. However, this data source captures assets of higher significance only and it is likely that cultural heritage assets of local value (e.g. churches) are present and unrecorded within the midstream component where only secondary data is available.

The data captured during seismic survey activities in 2014 provided a finer-grained resolution to the archaeological dataset in this area, with sites recorded of relatively lesser significance, such as individual findspots.

The desk-based study was completed, under the direction of Golder, by a member of NMK staff and sought to identify previously recorded cultural heritage sites of all types, including:

- Archaeological;
- Palaeoenvironmental;
- Sites containing hominid remains;
- Palaeontological;
- Historic; and
- Other culturally relevant sites (e.g. religious buildings and places, burials, sacred sites).

The baseline dataset focusses on likely impacted areas; as such it includes assets identified within areas where ground disturbance is likely, but omits findspots, where no ground disturbance is likely.

14.3 Primary Data

14.3.1 Methods

This methodology was developed in accordance with Kenyan legislation and guidance pertaining to cultural heritage protection, in particular the Environmental Management and Co-ordination Act (EMCA) 1999 and the National Museums and Heritage Act 2006. It also aligns with the guidance provided in International Finance Corporation (IFC) Performance Standard 8 (PS 8): Cultural Heritage (IFC, 2012a) and IFC Guidance Note 8: Cultural Heritage (IFC, 2012b).

14.3.1.1 Archaeological Field Survey

Archaeological field survey, which involved walking over the proposed project footprint looking for evidence of past human and palaeoenvironmental activity and recording the locations of identified cultural heritage assets, was completed in two phases; the first was undertaken in April 2016 and the second in July 2016. Fieldwork was completed by NMK specialist staff under the supervision of a Golder cultural heritage specialist, and was undertaken in those areas of the upstream study area considered likely to be directly affected by the project proposals (e.g. by ground disturbance). The survey team completed the walkover survey systematically, ensuring the entire area was covered by walking regularly spaced transects. In relation to EOPS, archaeological survey was limited to the areas around the existing wellpads at Ngamia-1, Ngamia-3, Ngamia-8 and Amosing-1. These areas are highlighted in Drawing 14-1.

Each identified asset was given a unique identifier (Golder ID) and its location was recorded using a handheld global positioning system device (GPS). A short written account of the site was also made (including description, dimensions, setting and associated finds), and accompanied by digital photographs. Where finds were collected, these were placed in sealable bags and marked using indelible ink with the finds' location (GPS co-ordinates) and date of discovery. These finds were washed and processed, with a photographic record made of each. These collected finds are not a comprehensive catalogue of all materials discovered during the survey, but are a representative sample. The finds are stored in NMK's offices in Nairobi.

Although the archaeological survey was limited to remains visible at the surface and that are unobscured by vegetation or loose surface material, for the purposes of baseline data collection it is considered appropriate.

14.3.1.2 Key Informant Interviews

KIIs with community members were undertaken in 20 settlements[23] in the upstream component in order to:

- Identify sites of cultural significance (e.g. religious, sacred or ritual sites, cemeteries or burial areas), record their locations and extents, and understand how they are used/accessed;
- Record the oral history of the settlement and land use in the area; and
- Document an understanding of local traditions and practices (e.g. belief systems) that are important to the communities (intangible cultural heritage).

Of the 20 settlements in which KIIs were conducted, it is considered that 14 are relevant to EOPS (by virtue of their proximity to the cultural heritage study area). These settlements, the names and locations of which are indicated in Drawing 14-1, are:

- Amoruakwan;
- Asikiim;
- Dapar;
- Kaikol;
- Kaloucholem;
- Kapese;
- Kapetatuk;
- Lokicheda;
- Lomokamar;
- Lopuroto;

[23] As part of the FFD baseline data gathering process.

- Lotimaan;
- Lowoidapal;
- Nakukulas; and
- Nayanae-engol.

KIIs were completed in partnership with an NMK specialist, and assisted by Tullow's Social Performance Team, in two phases of fieldwork. The first was completed in April 2016 and the second in July 2016. The KII were conducted primarily in Swahili and were digitally recorded with the consent of the participants. Where interview participants did not speak Swahili, a member of the Social Performance Team translated from Swahili into the local language (Turkana). A translated summary was provided in English by the NMK specialist leading the interview.

Initial contact with community members was made by the Social Performance Team, which was followed up by an introductory meeting with the Golder cultural heritage survey team. During this introductory meeting, arrangements were made to conduct the key informant interview and an explanation provided of the objective of the interview. To maximise the data gathered from members of the community, interviews were held with different groups, including chiefs, seers, elders, women and youths. A catalogue detailing where and when KIIs were held, as well as who was in attendance, is provided in Table 4 of Appendix J.

Subsequent to KII, identified cultural sites were visited to capture precise coordinate information (using handheld GPS) and to record details of each site to allow the scale, form, function, date and relative importance of each to be ascertained.

14.3.1.3 Spatial Analysis

All the cultural heritage assets identified during the secondary and primary data gathering activities were compiled into one dataset, which was then analysed spatially using geographical information system (GIS) software in order to establish their locations in relation to the proposed project footprint. These combined results are presented in Section 14.4.

During this process, it was noted that a number of assets had been recorded during the archaeological survey which lay just outside the 250 m buffer zone. It was considered that, due to the proximity of these assets to the cultural heritage study area (within 50 m), it was prudent that they be included in the final baseline results.

14.4 Results

The results are presented in two sections – those in the upstream study area and those in the midstream study area. The combined dataset (the 'Cultural Heritage Gazetteer'), including all identified cultural heritage assets, is presented in Tables 1 and 2 in Appendix J. The locations of all identified assets are shown in Drawings 14-2, 14-3 and 14-4.

There are six sites designated by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as World Heritage Sites (WHS) in Kenya, comprising three cultural sites and three natural sites. None of these lie within the study area. The nearest WHS to the upstream component, the Lake Turkana National Parks (natural; WHS Ref – 801bis), is over 100 km from the proposed wellpads.

The existing road along which trucks are proposed to travel (midstream) passes along the Rift Valley, where the Kenya Lake System in the Great Rift Valley WHS (natural; WHS Ref – 1060rev) is located, and extends to Mombasa, where the Sacred Mijikenda Kaya Forests and Fort Jesus, Mombasa WHSs are located (both cultural; WHS Refs – 1231rev and 1295rev, respectively). None of these sites lie within the midstream study area, although the Rift Valley inscription does lie into relatively close proximity at points along route (<5 km).

The unique Golder ID for each asset includes a two letter prefix, which defines its general location, followed by a sequential numbering system. The two letter prefixes used are:

- AM – Amosing;

- NG – Ngamia; and
- TR – Transport Route (Amosing 1 to Mombasa).

14.4.1 Upstream Study Area

A total of 53 cultural heritage assets were identified in the upstream study area (26 at Amosing; 27 at Ngamia). These were all archaeological assets, wholly comprising findspots of undecorated pottery and a variety of lithic finds. The locations of these assets are shown in Drawings 14-2 and 14-3.

14.4.1.1 Archaeology

The following presents the distribution of the 53 recorded archaeological assets:

- At Amosing, the 26 assets recorded form two distinct clusters around the wellpad, with 12 to the north/north east (AM-001 – AM-012) and 14 to the west (AM-013 – AM-026).
- At Ngamia, 20 of the assets are recorded in a large cluster located to the south of Ngamia-1 and Ngamia-8 (NG-006 – NG-013 and NG-016 – NG-027). Only three assets are recorded around Ngamia-3 (NG-001 – NG-003).

Although a similar number of assets were identified at both Amosing and Ngamia, there is a marked disparity in the volume of individual finds found in each area (e.g. individual pottery sherds, stone tools/flakes), with a relatively high number of finds around the wellpads at Ngamia. A total of 451 individual finds were recorded overall, with 352 at Ngamia and 99 at Amosing. Whilst the Ngamia survey area was more extensive than that at Amosing, approximate find densities indicate that there is also a higher density of finds around the Ngamia wellpads than at Amosing (1 find per 5.7m² surveyed at Ngamia as opposed to 1 find per 8.1 m² at Amosing).

A detailed breakdown of the find type and volume recorded at each asset is presented in Table 3 in Appendix J. A summary, however, is presented in Table 14-1 and Table 14-2.

Table 14-1: Summary of finds (type, volume and relative percentages) at Amosing

	Total Pottery Finds	Total Lithic Finds	Total Finds
Volume (individual finds)	**20**	**79**	**99**
Percentage (of Amosing total)	**20%**	**80%**	**100%**
Percentage (of overall total)	**4%**	**18%**	**22%**

Table 14-2: Summary of finds (type, volume and relative percentages) at Ngamia

	Total Pottery Finds	Total Lithic Finds	Total Finds
Volume (individual finds)	**224**	**128**	**352**
Percentage (of Ngamia total)	**64%**	**36%**	**100%**
Percentage (of overall total)	**50%**	**28%**	**78%**

The pottery finds were largely concentrated in Ngamia, with 91% of pottery sherds recorded there. All the pottery recorded was undecorated, with two neck sherds and one rim sherd also identified at Ngamia. Thick-walled, undecorated pottery is generally associated with the Iron Age in Kenya, dating to between 2500 and 500 years before present (BP). It is typically younger in age than decorated pottery recorded in the area. Pottery occurs in the archaeological record of the Lake Turkana region from approximately 4500 years BP. Its earliest occurrence is recorded at a site to the east of Lake Turkana, and its appearance is associated with the presence of domesticated livestock. This early pottery type is known as 'Nderit ware' and is decorated with incised wavy lines. Another form of decorated pottery with incised lines, known as 'Ileret ware', is also present in the region around this time, but is characteristic of later pastoralists who occupied the region. Nderit and Ileret wares disappear from the archaeological record circa 3000 years BP.

There was greater diversity of lithic objects recorded, comprising a variety of flakes, cores and debitage (chunks and other waste material). There was also a variety of materials identified, with stone tools manufactured from quartz, chert, obsidian and rhyolite recorded, as well as a smaller number of tools manufactured from poorer quality materials like basalt. Overall, quartz and rhyolite tools were the most commonly recorded, accounting for 28% and 31% of all lithic remains, respectively. Chert and obsidian accounted for 14% and 17% of all lithic remains, respectively.

As with the pottery finds, however, there were some differences between the two survey areas. As summarised in Figure 14-1, the proportion of different materials recorded varies between the two areas. The different proportions of obsidian tools is particularly notable, with obsidian accounting for 26% of tools at Ngamia and just 4% at Amosing. Chert also comprised a greater proportion of the lithic finds recorded at Ngamia compared to Amosing. This compares with a much larger proportion of rhyolitic tools at Amosing.

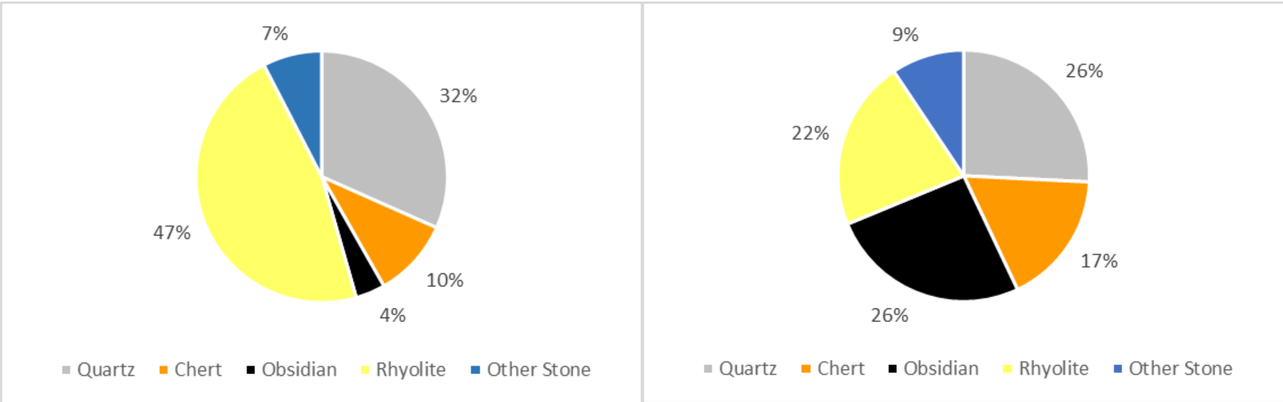

Figure 14-1: Relative proportions of lithic remains recorded at Amosing (left) and Ngamia (right)

The presence of quartz tools within the study area is explained by the relative abundance of source material in the local environment. The mountains to the west of the region are the likely origin of this material, but nodules of quartz are ubiquitous in the numerous luggas which traverse the landscape, to where they have been transported and deposited by ephemeral surface water flow.

Chert and obsidian, however, do not occur in the surrounding landscape. The nearest known source of obsidian lies 100 km to the north east, on the Central Island of Lake Turkana, although the exact provenance of the recorded finds is not currently known.

It is considered that, in the absence of definitive stratigraphic evidence, stone tools of different materials that were found in the same context should be deemed contemporaneous in date.

The 53 assets recorded within the upstream study area were all identified during primary data gathering, but are typical of the assets recorded by previous surveys undertaken throughout the Full Field Development (FFD) area. One major difference between the assets recorded within the EOPS upstream study area, and those recorded in the wider area, is that there is an absence of palaeontological or fossil remains (e.g. early hominids, ancient faunal remains).

Photographs of a representative sample of the collected materials are presented in Section 3.0 of Appendix J.

14.4.1.2 Living Cultural Heritage

No living cultural heritage assets were identified at Amosing or Ngamia.

KIIs, however, did provide a perspective on the typical type of sites which might be encountered beyond the cultural heritage study area. Generally, living cultural heritage sites in the region are found in close proximity to the semi-permanent settlements with which they are associated. Away from these settlements living cultural heritage sites are limited to individual, isolated burials. These are generally demarcated by a small pile of rocks and can be found scattered throughout the landscape. None were recorded, however, during the archaeological walkover surveys around the Amosing or Ngamia wellpads for the EOPS Project.

The most frequently recorded assets were specific 'meeting' trees, which are culturally significant to different members of the community. Some meeting trees are reserved for groups of elders, whilst others are reserved for the youth of the community. Each *ere* (described in detail in Section 14.4.1.3) has a specific tree, or a number of trees, where men meet, known as *ekitoe a ng'ikiliok*[24].Community meeting trees are used by all members of the settlement, and are used as the location for ceremonies, community events and group discussions (regarding issues of concern, like drought). Trees are also significant locations in terms of conducting weddings, initiations and other religious functions. Associated with the sacred trees are fire pits and roasting pits, which are used during feasts held at these locations. The nearest meeting tree to the upstream component is approximately 4.3 km north east of Amosing-1, and is associated with the settlement of Nakukulas. The distribution of these trees at a regional level is considered in the ecosystem services baseline report (Section 11).

The other frequently recorded living cultural heritage assets were graves, specifically those of eminent elders and group leaders. An individual's social standing within a community determines the type of burial they receive, the location and size and scale of any grave markings. The graves of respected leaders and elders are typically marked with a recognizable memorial (e.g. headstone, cross) and are located near the settlement. Often the graves of eminent leaders are in close proximity to meeting trees. Occasional instances were also recorded of fire pits associated with the graves of eminent elders, where feasts associated with consulting the deceased ancestor have been held.

14.4.1.3 Intangible Cultural Heritage

As with living cultural heritage, the KIIs provided a perspective on the typical practices and beliefs carried out in the surrounding areas.

A widespread and distinct 'Turkana culture' is evident throughout the region, comprising a number of related practices and beliefs. Widely observed practices include a nomadic pastoralist way of life and use of the local environment for subsistence. The latter includes grazing, hunting and the collection of medicinal plants, although the more general use of different tree species (such as *Ewoi, Edome* and *Ekadeli*) for a variety of functional and spiritual purposes was also recorded. Associated with this is a social structure and belief system which permeates all aspects of life and is ingrained in the culture of the local people. In addition, the local population have sincerely held religious beliefs, spanning multiple denominations of Christianity, Islam and local polytheist/animist religions, with the significance of 'seers' also recorded during the KIIs.

Although no elements of intangible cultural heritage were identified specifically within Amosing or Ngamia, Turkana culture is widespread, and practices such as nomadic pastoralism and the use of the landscape for subsistence are carried out over large geographical ranges, including the upstream study area.

A brief overview of the recorded 'Turkana culture', with supplementary information from Herlocker et al., (1994), is presented here, although this should not be considered a comprehensive or definitive description.

Turkana history, society and belief system

Turkana culture and identity is closely associated with the history of the people and the region. This history is primarily recorded and transferred between generations through the recounting of oral histories, and these histories inform how Turkana society is structured and how the relationships between the Turkana people manifest themselves.

Fundamental to Turkana social structure are the concepts of 'sections'[25] and 'clans'[26]. Sections are geographical areas of varying size, some of which overlap, which cover the entirety of the Turkana region and define different territorial boundaries. Sections provide a social identity and a sense of protection as they

[24] Alternatively known as *ekitoe a ng'ikasukou*

[25] Section - *ekitela* (single), ngitela (plural)

[26] Clan - *emacar* (single), *ngimacarin* (plural)

define limits of ownership and accessibility to resources. There are 15 sections (and 4 sub-sections) in Turkana, separated into two groups – *Ngicuro*[27] ('those of the waterfalls') and *Ngimonia*[28] ('those of the dense forest'). These comprise:

- ***Ngicuro*** – Ngikamatak; Ngilukumong; Ngiwoyakwara; Ngibilae; Ngikebootok.
- ***Ngimonia*** – Ngikwatela; Ngijie (lu Akorumwa Anarengan); Ngisiger; Ngisir; Ngiyapakuno; Ngimonia a Anyangataok; Ngiboceros; Ngikajik; Ngisonyoka; Ngiesetou.

This distinction represents two separate phases of migration into Turkana, with five sections in the earlier *Ngicuro* group (believed to have settled in Turkana in the early 16th century) and ten in the later *Ngimonia* group (believed to have settled in Turkana in the 18th century). The *Ngicuro* sections occupy the western and southern areas of Turkana, whilst the later *Ngimonia* sections are located in the central, northern and eastern areas, described in 1994 as being bounded to the north by Lothagam Hill, on the west by the Turkwell River and on the east and south-east by the Kerio River. The distinguishing feature between the two groups, as documented by Müller-Dempf (1994), is the way in which they slaughter, prepare and roast an animal for the custom known as *'akiriket'*[29]. EOPS is located within the *Ngisonyoka* section (*Ngimonia* group).

Clans are based on kinship, defined as groups of people 'related through their animals', and can be identified and distinguished from each other by slight variations in dress, customs and livestock brands. There are 29 clans in Turkana, which can be separated into three rough categories:

- Those found primarily within the *Ngicuro* sections (15 clans);
- Those found primarily within the *Ngimonia* sections (6 clans); and
- Those found throughout both *Ngicuro* and *Ngimonia* sections (8 clans).

Despite these groupings, clans are not bound to a fixed territory and so different clans can be found in any section. Clans act as units of cooperation and members ensure proper distribution of property and livestock amongst family members. This kinship system also links individuals throughout the Turkana region, and so, when a group of individuals move to a new territory, they would customarily approach their clansmen in that new area for support and guidance. Men and women of the same clan are not permitted to marry; when a woman marries a man, she joins her husband's clan. Clan membership is hereditary through the male line, with the elders of each clan the custodians of their clan's unique customs.

Elders of a clan or family (both male and female) are grouped into two alternating age-sets; the senior age set (*Ngirisae*) and the junior age set (*Ngimor*). Customarily the *Ngirisae* wear gold jewellery (such as rings or ear rings) and the *Ngimor* wear silver jewellery. The designation of senior or junior alternates each generation, so the children of *Ngirisae* are *Ngimor* and the children of *Ngimor* are *Ngirisae*. During *akiriket*, where the group sits in an arc, the senior most of each age set sit at the centre, with the *Ngirisae* seated on the right side of the arc and the *Ngimor* on the left. The *Ngirisae* make all final decisions of group affairs, with the *Ngimor* implementing those decisions. Seers are not actively involved in decision making, but do advise both age sets.

Clan membership and the section from which an individual is from can be used to identify and differentiate them from other individuals. If an individual travels and settles in a new section, they still identify themselves as being from their original section. Importantly, this links an individual back to their heritage and the history of the Turkana people, which in turn entrenches the significance and strength of Turkana culture within society. An individual's surname, derived from the grandfather's forename, also provides an insight back into their heritage and allows them to trace their lineage, reaffirming their Turkana identity.

[27] Also commonly referred to as *Ngikamataka* ('those of the Apol Nakamatanit')

[28] Also commonly referred to as *Ngisir* ('those of Apol Nasirit')

[29] Both groups cut two pieces of meat (*apol*) from the hind-quarters of the carcass, comprising a bigger piece (with the kidney attached) and a smaller piece. The *Ngicuro* cut the small *apol* from the left side of the carcass and the big *apol* from the right, whilst the *Ngimonia* do the reverse. The *Ngicuro* also remove the kidney prior to roasting, whilst the *Ngimonia* only remove it once the meat is roasted.

Other features of Turkana culture include their own calendar, special initiations, distinct burial practices and marriage customs (including 'official' and 'unofficial' marriages) and perceptions of the landscape. There are also established concepts of land ownership and wealth, which are founded on principles of communal ownership and communal obligations. As such, they do not necessarily conform to 'Western' concepts of land ownership.

Nomadic pastoralism

A significant element of Turkana culture is nomadic pastoralism, which is practised by a large proportion of the population of Turkana. This way of life, determined by seasonal fluctuations in the availability of water and grazing, has been practised for generations and is integral to Turkana culture and values. Its influence over the landscape in terms of settlement, land use and tangible cultural heritage is profound. Indeed, the Turkana pastoralists have developed robust strategies to cope with the risks inherent to survival in their arid and semi-arid environment. These include:

- Splitting livestock in smaller herds and distributing them over a wider area to reduce grazing pressure;
- Being highly mobile to exploit and react to the changing conditions of the rangeland;
- Following a seasonal grazing pattern;
- Reserving specific areas of grazing land for the dry season;
- Exploiting a wide range of natural resources to overcome food scarcity, and also pragmatically selling livestock to access the produce of agriculturalists; and
- Effective distribution of roles and responsibilities.

A key feature of nomadic pastoralism in Turkana is the distinct social structure and settlement pattern it has engendered. At the smallest scale communities are based on an extended family unit. This is headed by the male leader of the household (*elope*), and would include his wives and children, as well as, potentially, any younger brothers and their families. Each wife and her children would typically have their own individual home[30] which would be clustered together, along with pens for livestock, within a homestead[31]. The *elope* (and any other men within the homestead) would typically sleep outside to protect the animals.

During the wet season, the homestead is established in the family's 'home area' (known as an '*ere*'). This is an area of land which is recognised as being owned by the family and to which they have historic and ancestral ties. It can be passed down through generations, with each *ere* containing a water point, accessible grazing in the vicinity and, typically, an ancestor grave. It is during this period, typically, that social activities such as marriages take place. Multiple homesteads may be established within an e*re* by different family members. Each *ere* is different in terms of size and shape, and typically there is overlap between neighbouring *eres*. The process for establishing a new *ere* is overseen and organised by clan and family elders.

During the dry season, when grazing and water at the *ere* becomes sparse, households must move their herds to other areas to find sufficient food and water. During this time, the elderly (potentially including the *elope*) and the very young may stay at the *ere* with a small number of livestock, whilst the remainder of the household move to other areas. Those who remain at the *ere* are referred to as the '*eegos'*, literally meaning 'baggage'. Throughout this time the household lives more transiently in the landscape, moving from location to location in search of grazing. During this transient period, households may establish temporary homesteads[32] within the *ere* of another family, with some households following an established route, developed over multiple years, through a number of different *eres*. In this sense *ere* boundaries are widely acknowledged and understood but they are permeable – it is accepted by the Turkana people that others may temporarily settle and use an

[30] Home/shelter – *ekol* (singular), *ng'ikolia* (plural)

[31] Homestead – *awi* (singular), *ng'awiyei* (plural)

[32] Temporary homestead – *abor* (singular), *ng'aborin* (plural)

area, but this is done so in consultation with each other so as to avoid conflict. The ultimate ownership of an *ere* by a specific family is recognised by all Turkana people.

Multiple homesteads from the same area will often come together to form a larger mobile unit, known as an *adakar*[33], when moving herds to new grazing. When travelling long distances, a number of adakar will often merge to form a larger group known as an *arumrum*[34]. This is for the purposes of security.

Environmental subsistence

As a traditional practice, environmental subsistence is an element of intangible cultural heritage and is recognised as such. Details of the specific materials gathered (plant and animal species and soil and mineral types), where they are collected and how they are used by the local people is provided in the ecosystem services baseline (Section 11). This practice is carried out throughout the region and is not specific to any single settlement or location.

14.4.2 Midstream Study Area

A total of 16 assets were identified along the midstream study area, comprising 5 buildings and 11 archaeological sites. Of these, six of the assets are recognised by the NMK (i.e. recorded in their archives at the national level) as 'monuments', indicative of their relative size or significance. Where the road route is in close proximity to the upstream study area (e.g. near the wellpads at Ngamia and Amosing), the desk-study data is of higher resolution as a result of previous archaeological surveys conducted during seismic operations, and so a number of smaller scale archaeological assets (e.g. individual burials) were also recorded. The locations of all the assets recorded within the midstream component are shown in Drawing 14-4.

14.4.2.1 Archaeology

Of the 11 archaeological assets recorded, 7 are undated burials that were identified during previous archaeological surveys (TR-004 to TR-010). Five of these burials were located in proximity to Lokichar, with the other two located between Lokichar and Amosing.

Of the four remaining archaeological assets that are recorded in the NMK archives, three are located near Mombasa and one is located approximately 135 km north west of Nairobi. Of these, three are recorded as prehistoric, although they vary in antiquity, scale and form (TR-012, TR-015 and TR-016). Specific dates provided range from the Middle Stone Age (MSA) up to the Neolithic (Later Stone Age (LSA)). The one remaining archaeological asset had no further information available in the NMK archives, beyond a name and location (TR-014).

14.4.2.2 Living Cultural Heritage

The buildings recorded along the route are culturally significant for a combination of different reasons. Primarily, however, they are culturally significant for their historical, architectural and/or religious values. Three of the buildings, two churches and one mosque, are located in Lokichar and were identified during primary data gathering (TR-001 to TR-003). Another church (TR-013), built for and by Italian Prisoners of War, is located approximately 40 km north west of Nairobi.

One further building was recorded, a colonial period prison built in Kapenguria (Pokot County) to incarcerate Mau Mau freedom fighters (TR-011).

14.5 Discussion

14.5.1 Upstream Study Area

No living cultural heritage assets were recorded within the upstream component. It is expected that any potential project effects resulting from EOPS in this area will, therefore, only be considered for intangible cultural heritage and archaeological receptors.

[33] ng'adakarin - plural

[34] ng'arumrumio - plural

The following observations were made during the archaeological survey:

- The archaeological finds recovered during the survey were limited to pottery and lithics. No structural evidence of settlements was evident above the surface. The potential for undiscovered settlements to exist below the surface within the study area is considered to be low. On the assumption that use of the land was transient, buildings would have been constructed from organic materials and therefore insubstantial evidence for their existence is left for preservation. This is consistent with a nomadic pastoralist way of life, which is known to have existed in the region for several thousands of years;
- There is a correlation between the areas of the landscape that are currently productive for pastoral farming and settlement and those used and occupied in antiquity, suggesting that past conditions have persisted throughout the last several millennia.
- The areas where higher numbers of archaeological finds were recovered lay within relative proximity to the major luggas. As the recorded finds were found on the surface, it is considered that the major luggas have not migrated significantly from their current alignments (otherwise remains would have been transported away);
- It is considered, based on typological evidence and Holocene surface deposits, that the majority of the finds date to the Later Stone Age onwards, although the possibility of earlier stone tools within the assemblage cannot be discounted; and
- Surface sediments appear to be Holocene in date with older Pleistocene, Pliocene and Miocene sediments absent or deeply buried. It is within these earlier sediments that significant hominid discoveries have been made previously at Loperot, Lothagam and Nuchukui.

Provenancing of the obsidian finds, through X-Ray Fluorescence (XRF) analysis, may provide an insight into the movements and trading networks of prehistoric communities in the region, whilst Obsidian Hydration Dating (OHD) could be used to provide more exact dates for obsidian finds and thereby help inform the archaeological mitigation strategy. The latter technique, however, is destructive.

14.5.2 Midstream Study Area

There are a number of assets identified along the transport route. The secondary dataset acquired will provide enough data to guide qualitative impact analyses and management plans for EOPS in the midstream study area.

15.0 ACRONYMS AND ABBREVIATIONS

%	percentage
°	degree
°C	degrees Celsius
AQS	Air Quality Standard
BP	before present
EDC	Environmental Design Criteria
EMCA	Environmental Management and Co-ordination Act (1999)
EOPS	Early Oil Pilot Scheme
EOPS	Early Oil Pilot Scheme
EPF	Early Production Facility
ESIA	Environmental and Social Impact Assessment
EWT	Extended Well Test
FFD	Full Field Development
GIS	geographic information system
GPS	global positioning system
GTZ	German Agency for Technical Cooperation
IFC	International Finance Corporation
kg	kilogram
km	kilometre
LSA	Later Stone Age
m	metre
m/s	metres per second
m^2	metres squared
mbar	millibar
mg	milligram
MJ /m^2	Mega joules per square metre
mm	millimetre
MSA	Middle Stone Age
NMK	National Museums of Kenya
OHD	Obsidian Hydration Dating
PS	performance standard
PSD	Particle Size Distribution
QA	quality assurance
RH	relative humidity
UNESCO	United Nations Educational, Scientific and Cultural Organization
UTM	Universal Transverse Mercator (co-ordinate system)
W/m^2	Watts per square metre
WHS	World Heritage Site
XRF	X-Ray Fluorescence

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Report Signature Page

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4.0 EOPS PHASE II ESIA TERMS OF REFERENCE

31 October 2016

Project No. 1654017.501/A.1

Director General
National Environment Management Authority
P.O. Box 67839 - 00200
Popo Road
Nairobi
Kenya

ENVIRONMENTAL IMPACT AND SOCIAL ASSESSMENT (ESIA) TERMS OF REFERENCE FOR THE PROPOSED SOUTH LOKICHAR EARLY OIL PILOT SCHEME

The following presents a redrafted Terms of Reference (ToR) for the Environmental and Social Impact Assessment (ESIA) for the proposed South Lokichar Early Oil Pilot Scheme (EOPS).

The ToR should be read in conjunction with the Project Report (1654017.502/A.0, date July 2016), which contains significant detail on the Project Description of the Upstream component, the proposed ESIA methodology and the Policy, Legal and Institutional Framework, all of which are still applicable to the EOPS.

The Midstream component of the project has changed since delivery of the Project report. The Project report described a midstream component which comprised road transport from the Upstream component in the South Lokichar Basin to Eldoret and rail transport between Eldoret and Mombasa. This has now changed to road transport from the Upstream component in the South Lokichar Basin to Mombasa.

The project description to be assessed in the EOPS ESIA will include the following proposed route:

- Junction from an existing well pad (Amosing 1) along the C46 towards Lokichar;
- A1 from Lokichar to Kitale;
- B2 from Kitale to Eldoret;
- A104 from Eldoret to Nairobi / Athi River;
- A109 from Athi River to Mombasa; and
- From the A109 into the Changamwe Refinery – using the Refinery Road from the A109 to the main gate.

It was agreed between NEMA (David Ongare, Reagan Awino) and Tullow Kenya B.V.(Paul Coward, Kenneth Kamau) in a meeting held 16 September 2016 that the above change of project description could be captured in the ESIA ToR and ESIA and there would be no need to update the EOPS ESIA Project Report, which had already been reviewed by NEMA.

The objective of the attached ToR is to present the approach to the ESIA for the proposed South Lokichar EOPS. The ESIA will be prepared in compliance with national legislation for permitting and other authorization purposes of the proposed Project. The ESIA will describe impacts of the proposed project activities and infrastructure.

The ESIA will present environmental and social impacts associated with the proposed development and show how stakeholders have been effectively consulted and how mitigation, management and future monitoring has been agreed.

In accordance with Kenyan law, Tullow Kenya B.V. held a number of scoping consultations in May and June 2016. Since these consultations, in accordance with the agreement with NEMA on 16 September 2016, Tullow has sent letters to stakeholders, that had previously been consulted and whom may be directly affected by the aforementioned change to the project description, informing them of this proposed change.

Attached please find the draft ToR for your review and approval

Yours Faithfully

Tito Kodiaga
Assistant ESIA Project Manager

1.0 INTRODUCTION

Tullow Kenya B.V. (TKBV), a subsidiary of Tullow Oil plc (Tullow), is evaluating the Development of a series of oil discoveries in the South Lokichar Basin, northeast Kenya. Tullow is planning to develop its discoveries to enable production and further exploration to proceed in parallel. The South Lokichar EOPS is not an alternative to the Full Field Development (FFD) Project, rather it represents an intermediate step on the road to the full commercialisation of discovered resources. Within the context of Turkana, the pilot scheme involves the use of existing well pads and existing wells at Amosing and Ngamia fields in South Lokichar, with oil transported for export into oil storage tanks in Mombasa using existing road infrastructure.

In accordance with the *Environmental (Impact Assessment & Audit) Regulations 2003 (as amended)* TKBV requires approval from the National Environment Management Authority (NEMA) before the project can proceed. In order to obtain this approval, an Environmental Impact Assessment (EIA) is required.

2.0 PROJECT DESCRIPTION

Description of the Project and Project Components

This Project Description in the ESIA will follow a similar approach to the presentation of project description in the Project Report. It will focus on production wells, the infield transportation, an Early Production Facility (EPF) and associated infrastructure.

The Project Description will describe the following:

- The environmental and social setting;
- Design parameters;
- Infrastructure during site preparation (construction) and operations;
- Decommissioning; and
- Associated facilities.

Justification for the Project

As a demonstration of the ability of Kenya to successfully deliver an oil-exporting project, the Early Oil Pilot Scheme (EOPS) will act to improve international investor sentiment for key future components of Kenya's Oil & Gas industry. EOPS represents an intermediate step on the road to the full commercialisation of discovered resources.

The use of local content to the maximum extent possible during the ESIA, completion of technical studies and during construction and operation of the EOPS is in alignment with national government policy.

Glossary of Terms

A glossary of technical project terms, acronyms and abbreviations included in the ESIA will be provided before the main text of the ESIA report.

Project Proponent

This section of the ESIA will provide details of the project proponent including details of joint venture partners associated with the project.

Project Objectives and Scope

This section of the ESIA will outline the project objectives and events which have contributed to the formation of the project including: project alternatives, the timescale for implementation, the projected project life time, site preparation (construction) and establishment costs.

3.0 METHODOLOGY OF PREPARING FULL ESIA STUDY

The ESIA methodology will describe each stage of the project and the process, timing and decisions involved at each stage. A brief description of studies which have been undertaken to develop the project and inform the ESIA will be provided. Baseline studies undertaken before the ESIA process started will be described.

This section will ensure that the relevant legislation is addressed, that the process to be followed by the reader is clear, and that stakeholders are aware of opportunities for input and participation.

The ESIA and the scope of work under these ToR also will be carried out through two phases and will have two main deliverables: **(i) Project Report); (ii) Environmental and Social Impact Assessment (ESIA)**

4.0 PROJECT REPORT

The Project report (1654017.502) has been completed and is delivered to NEMA along with this ToR.

Table of Contents of the Project Report

6.1.6 Air and Climate

6.1.7 Noise and Vibration

6.1.8 Landscape and Visual

6.1.9 Cultural Heritage

6.1.10 Social

6.2 Oil Trucking Component

7.0 Emergency Preparedness and Response to Unplanned Events

Identification of Potentially Significant Effects

Under each of the subsections in Section 6 of the Project Report, potentially significant effects are described based on a literature search and current understanding of the project description and likely environmental and social effects of the Project. Section 6 of the Project Report also presents the next steps for baseline data gathering and impact analysis of the potentially significant effects identified.

Stakeholder Engagement

The objective of this engagement is to ensure that legislative requirements are met; sources of information and expertise are identified; stakeholder concerns and expectations are registered and addressed in the ESIA; and affected communities have the opportunity to discuss Project risks and impacts, and proposed mitigation and monitoring measures.

This section of the Project Report describes the project report stage consultation and provides results. It includes the identification of the relevant stakeholders, identifying the range of community, public and (international) stakeholders concerns about the proposed project as recorded in consultations.

5.0 BASELINE ENVIRONMENTAL AND SOCIAL INFORMATION AND DATA

Table 1 presents a summary of the likely approach to the ESIA Baseline per technical topic.

Table 1: likely approach to ESIA baseline data gathering

Topic	Potentially significant effects	Likely Approach
Traffic	Increase in traffic could lead to change in noise, air quality, biodiversity populations and/or effects on communities and cultural heritage	Collect primary and secondary traffic data along the road route Evaluate likely change in traffic due to emergency maintenance on the road route
Biodiversity and Ecology	Indirect/induced loss/conversion of natural habitat Mortality of ecological populations due to project activities Indirect/induced loss/conversion of preferred habitat through sensory disturbance	Seasonal vegetation and flora surveys Vegetation community mapping, including mapping of modified and natural habitat Seasonal bird surveys Wet season herpetofauna surveys Seasonal terrestrial invertebrate surveys Seasonal large mammal transect surveys Seasonal small mammal trapping surveys Seasonal bat acoustic monitoring surveys Invertebrate and wetland surveys Review of secondary data on protected areas along the road route and known effects of existing traffic on species of conservation concern
Ecosystem Services	All potential effects presented above for biodiversity Ecosystems affecting capacity to supply services	Relevant baseline data will be gathered from review of baseline biodiversity, water, and soil studies to assess the condition and capacity of ecosystems to deliver services

Topic	Potentially significant effects	Likely Approach
	Changes to cultural heritage links and socio-economic patterns relevant to ecosystem services	
Soil, Terrain and Geomorphology	Soil quality	Terrain descriptions and existing data gathered
Water	Groundwater level and quality Surface water runoff regime	Groundwater level and quality monitoring by Tullow and hydrogeological conceptual model owned by Tullow Surface water rainfall-runoff characterisation
Seismicity and Geology	Built structures Infrastructure	Desk based study using existing data from national institutions and other secondary sources
Air and Climate	Change to Air quality and Fugitive dust deposition Odour nuisance	Air quality monitoring of key pollutants: fine particulates, combustion gases and VOCs Monitoring of dust deposition rates Estimate likely baseline air quality at key receptors based on traffic baseline for projected traffic numbers following emergency maintenance on the road route
Noise and Vibration	Noise for human and ecological receptors, inc livestock Vibration causing structural damage	Measured ambient noise levels at representative locations including diurnal variation Estimate likely baseline noise at key receptors based on traffic baseline for projected traffic numbers following emergency maintenance on the road route
Landscape and Visual	Existing views and visual amenity of receptors	Mapping the location and type of visual receptors
Cultural Heritage	Indirect impact on areas containing buried remains, above-ground features and/or sacred or historic places Changes to culturally distinct patterns of life and traditional cultures	Review of available information and Field survey in EOPS study area Consultations with local communities and leaders to identify culturally or historically significant sites and traditional practices and beliefs. Review of secondary data along the road route
Social	Influx and migration. Changes in taxes, profit sharing and other payments Inflation, and hence changes in prices for goods, services and labour Resettlement and economic displacement Indirect impacts from changes to the environment Direct and indirect employment for skilled and non-skilled labour Business opportunities/local content Impacts on indigenous peoples, and vulnerable groups Changes in community health, safety and security provision Changes in social capital, security provision and conflict	Review information gathered during stakeholder engagement Collect primary data and information on existing baseline conditions through focus group, key informant interviews at the community and non-community levels and secondary literature research Collect local and regional health data through database research by medical practitioners and focused key local informant interviews Review of secondary data along the road route

6.0 POLICY LEGAL AND ADMINISTRATIVE FRAMEWORK

This section will describe the applicable legislation, regulations, policies and standards which will apply to the project including:

- Governance and Administrative Structure;

- Kenyan Policy and Legislative Requirements;
- International Guidance and Standards;
- International Conventions;
- TKBV Policy; and
- Required Authorisations.

This section will outline procedures, which will be followed to obtain the relevant permits to begin construction and define future steps including the timeline of the permitting process.

7.0 ENVIRONMENTAL AND SOCIAL ISSUES

Table 2 presents a summary of the likely approach to the impact analysis per technical topic.

Table 2: likely approach to impact assessment

Topic	Potentially significant effects	Likely Approach
Biodiversity and Ecology	Indirect/induced loss/conversion of natural habitat Mortality of ecological populations due to project activities Indirect/induced loss/conversion of preferred habitat through sensory disturbance	The impact assessment will be based on analysis of population effects and habitat-area based analysis using GIS, and will focus on small mammal species of concern identified during the baseline that will be measurably affected by the Project Specific analysis will be conducted for species of concern identified in the baseline Qualitative analysis on likely impacts of changes to traffic along the road route
Ecosystem Services	All potential effects presented above for biodiversity Ecosystems affecting capacity to supply services Changes to cultural heritage links and socio-economic patterns relevant to ecosystem services	Identification of priority ecosystem services Analysis of changes to priority ecosystem services
Soil, Terrain and Geomorphology	Soil quality	The impact assessment will take a qualitative approach and assess comparative impacts from indirect changes to soil quality
Water	Groundwater level and quality Surface water runoff regime	Evaluation of change in runoff regime Analysis of changes to groundwater quality and level Evaluation of changes to community water supplies
Seismicity and Geology	Built structures Infrastructure	Identification of risks and mitigation required from the engineering design team
Air and Climate	Air quality Change to Air quality and Fugitive dust deposition Odour nuisance	Evaluate impact to air quality through predictive air dispersion modelling Evaluate impact of additional dust deposition Evaluate impact of odour emissions and sources Qualitative analysis on likely impacts of changes to traffic along the road route
Noise and Vibration	Noise for human and ecological receptors, inc. livestock Vibration causing structural damage	Evaluate effects on noise environment through predictive modelling Identification of potential vibration sources and prediction of vibration levels Qualitative analysis on likely impacts of changes to traffic along the road route
Landscape and Visual	Existing views and visual amenity of receptors	Qualitative analysis of impacts

Cultural Heritage	Indirect impact on areas containing buried remains, above-ground features and/or sacred or historic places Changes to culturally distinct patterns of life and traditional cultures	Evaluate effects based on baseline findings and develop cultural heritage management plan Intangible impact analysis will inform the socio economic impact analysis Qualitative analysis on likely impacts of changes to traffic along the road route
Social	Direct and indirect employment for skilled and non-skilled labour Business opportunities/local content Impacts on indigenous peoples, and vulnerable groups Changes in community health, safety and security provision Changes in social capital, security provision and conflict	Using baseline information and stakeholder inputs, conduct analysis of how the potential effects will impact project-affected people Qualitative analysis on likely impacts of changes to traffic along the road route

8.0 MITIGATION / MONITORING AND ALTERNATIVE DEVELOPMENT

The section will present a comprehensive description of the mitigation and monitoring measures and alternatives that will be considered for project activities and infrastructure.

Environmental Management Plan

The consultant will prepare an Environmental Management Plan (EMP) for construction, operational and decommissioning phases to identify:(a) these to mitigation responses to potentially adverse impacts;(b) management processes and benefit enhancement to be developed throughout construction, operation and at closure to manage adverse impacts; and(c) the monitoring program to implement to verify compliance with the recommended mitigation, and measure the level of impacts produced by the proposed project.

9.0 PUBLIC CONSULTATIONS AND COMMUNICATION

A Stakeholder Engagement Plan (SEP) will be prepared for EOPS.

10.0 ESIA TABLE OF CONTENTS

The following presents an indicative Table of Contents of the Early Oil Pilot Scheme ESIA Study:

- Non-Technical Executive Summary;
- Introduction;
- Project Description;
- Project Need and Alternatives;
- Approach to the ESIA;
- Scoping;
- Policy, Legal and Institutional Framework;
- Stakeholder Engagement;
- Environmental including:
  - Traffic;
  - Climate;
  - Soils and Terrain;
  - Seismicity and Geology;
  - Air Quality;

  - Noise and Vibration;
  - Water Quantity and Quality;
  - Landscape and Visual;
  - Biodiversity, Ecology and Protected Areas;
  - Ecosystem Services;
- Social, including;
  - Administrative Divisions and Governance Structure;
  - Demographics;
  - Infrastructure and Services;
  - Economics, employment and livelihoods;
  - Land Use and Ownership;
  - Community Health and Safety;
  - Education;
  - Social Maladies;
  - Social Capital and Conflict; and
  - Cultural Heritage;
- Waste Management;
- Occupational Health;
- Emergency, Accidental and Non-Routine Events Accidents;
- Summary of Impacts and Proposed Mitigation;
- Conclusion; and
- Environmental and Social Management Plans.

11.0 TIME SCHEDULE OF EXECUTING THE ESIA

The environmental and baseline data collection required for the ESIA will take place up until December 2016. Following this, the ESIA report will be developed in parallel with detailed engineering design.

12.0 QUALIFICATIONS AND EXPERIENCE REQUIRED

Experts to execute the Environmental and Social Impact Assessment should comply with NEMA requirements. Key staff in the technical complement may include but not limited to the following:

- **Environmental Specialist/Team Leader** - (with 10 yrs experience). He/she will be well familiar with IFC and World Bank Environmental and Social safeguards policies;
- **Social Development expert** (with 10 yrs experience). She/he will establish the socio-economic environment of the proposed project area, including land use; assess likely impact of the project and proposed mitigation or management;
- **Ecologist/Natural Resources Management expert** (with 10 yrs experience) - will review the ecosystem, and other biophysical aspects of the project area and assess the likely impact of the project, including cumulative, induced ecosystem wide impacts within the area of influence; and

- **Road and traffic specialist** (with > 20 years' experience) – will review and supervise the traffic baseline and impact assessment associated to the change in movement on the route between Lokichar and Eldoret.

We attach a selection of CVs for key specialists in the ESIA team.

EMC/GOLDER ASSOCIATES (UK) LTD

Tito Kodiaga
Assistant ESIA Project Manager

Andrew Morsley
ESIA Project Manager/Associate

AJM/ke

Attachments: Curriculum Vitae

5.0 EOPS PHASE II ESIA IMPACT ANALYSIS METHODS

IMPACT ANALYSIS METHODS

Effects Analysis

The term *"effect"* will be used when describing a change the Project may have to the receiving environment. The term *"impact"* will be used to describe an effect that results in a change to a receptor taking into account the nature of the effect, i.e. the duration, frequency and scale. The term "consequence" will be used to describe the result of the impact taking into account the sensitivity or importance of the receptor.

The types of effect that will be considered in the ESIA include:

- Direct – an effect that arises directly from activities that form an integral part of the Project (e.g. new infrastructure) and is within the control of the developer;
- Indirect – an effect that arises from activities not explicitly forming part of the Project but as a "*knock on effect*" of it, which may not be within the control of the developer; and
- Combined – the combination of multiple direct or indirect effects of the Project on any one or group of receptors.

Incorporated environmental and social measures

Incorporated environmental and social measures are those measures that have been incorporated into the design of the Project. These may include:

- Design changes undertaken to remove or minimise effects that are not considered to be mitigation in terms of ESIA; and
- Good operational practice or construction.

The impact assessment will be undertaken assuming that the above are applied as an integral element of the Project design. These measures will be set out clearly within the Environmental and Social Management Plans (ESMP).

Environmental Impact Classification

The environmental impact classification will be determined by taking into account several parameters. These will vary by technical discipline, but generally include the following:

- Magnitude of effect;
- Geographic extent of effect;
- Duration of effect; and
- Frequency.

The magnitude of effect varies by topic (generally in relation to change from baseline conditions or with reference to the Project Standards and is defined in the relevant section. Geographic extent, duration and frequency are defined in Table 1and are used consistently across the disciplines so that the resulting impact classifications are consistent. The parameters are combined to achieve an impact classification, by following the decision matrix presented in Table 2.

Table 1: Definition of impact classification parameters

Geographic Extent	Duration	Frequency
Local: occurs within the biophysical local study area **Regional:** occurs within the biophysical regional study area **Beyond regional:** occurs outside the biophysical regional study area or crosses an international boundary	**Short-term:** Effect is reversible at end of groundworks and installation **Medium-term:** Effect is reversible at end of operations **Long-term:** Effect is reversible within a defined length of time or beyond decommissioning **Permanent:** Effect is not reversible	**Infrequent:** Effect occurs intermittently but not continuously over the assessment period **Frequent:** Effect occurs repeatedly or continuously over the assessment period

Table 2: Decision matrix for impact classification

Magnitude	Geographic Extent	Duration	Frequency	Impact Classification
Negligible	All	All	All	Negligible
Low	Local	Short-term	Infrequent/Frequent	Negligible
Low	Local	Medium-term	Infrequent	Negligible
Low	Local	Medium-term	Frequent	Low
Low	Local	Long-term	Infrequent/Frequent	Low
Low	Local	Permanent	Infrequent	Low
Low	Local	Permanent	Frequent	Moderate
Low	Regional/ Beyond Regional	Short-term	Infrequent	Negligible
Low	Regional/ Beyond Regional	Short-term	Frequent	Low
Low	Regional/ Beyond Regional	Medium-term	Infrequent/Frequent	Low
Low	Regional/ Beyond Regional	Long-term	Infrequent	Low
Low	Regional/Beyond Regional	Long-term	Frequent	Moderate
Low	Regional/Beyond Regional	Permanent	Infrequent	Low
Low	Regional/Beyond Regional	Permanent	Frequent	Moderate
Moderate	Local	Short-term	Infrequent/Frequent	Low
Moderate	Local	Medium-term	Infrequent	Low
Moderate	Local	Medium-term	Frequent	Moderate
Moderate	Local	Long-term	Infrequent/Frequent	Moderate

Magnitude	Geographic Extent	Duration	Frequency	Impact Classification
Moderate	Local	Permanent	Infrequent	Moderate
Moderate	Local	Permanent	Frequent	High
Moderate	Regional	Short-term	Infrequent	Low
Moderate	Regional	Short-term	Frequent	Moderate
Moderate	Regional	Medium-term	Infrequent/Frequent	Moderate
Moderate	Regional	Long-term	Infrequent	Moderate
Moderate	Regional	Long-term	Frequent	High
Moderate	Regional	Permanent	Infrequent/Frequent	High
Moderate	Beyond Regional	Short-term	Infrequent/Frequent	Moderate
Moderate	Beyond Regional	Medium-term	Infrequent/Frequent	High
Moderate	Beyond Regional	Long-term	Infrequent/Frequent	High
Moderate	Beyond Regional	Permanent	Infrequent/Frequent	High
High	Local	Short-term	Infrequent/Frequent	Moderate
High	Local	Medium-term	Infrequent	Moderate
High	Local	Medium-term	Frequent	High
High	Local	Long-term	Infrequent/Frequent	High
High	Local	Permanent	Infrequent/Frequent	High
High	Regional	Short-term	Infrequent	Moderate
High	Regional	Short-term	Frequent	High
High	Regional	Medium-term	Infrequent/Frequent	High
High	Regional	Long-term	Infrequent/Frequent	High
High	Regional	Permanent	Infrequent/Frequent	High
High	Beyond Regional	Short-term	Infrequent/Frequent	High
High	Beyond Regional	Medium-term	Infrequent/Frequent	High
High	Beyond Regional	Long-term	Infrequent/Frequent	High
High	Beyond Regional	Permanent	Infrequent/Frequent	High

Receptor importance and sensitivity

The term ‘receptors’ will be used to describe features of the environment such as water resources, habitats and species which are valued by society for their intrinsic worth and/or their social or economic contribution.

The importance of a receptor will be determined by a range of criteria depending on the topic under consideration, including: the economic, social and cultural value of the receptor at local, national and international scales; any local, national or international designations; the rarity of the receiving environment; and the benefits or services provided.

Receptor sensitivity will be determined by the consideration of a receptors’ ability to resist or adapt to changes and its resilience to change. The category of the importance or sensitivity of a receptor will be determined based on the professional judgement of technical topic leads. Table 3 provides an example of categories of importance and/or sensitivity.

Table 3: Illustrative Example for Determining Receptor Importance and/or Sensitivity

<table>
<tr><th>Importance/ Sensitivity of Receptor</th><th>Example of importance of receptors</th><th>Example of sensitivity of receptors</th></tr>
<tr><td>Very high</td><td>An attribute with a high quality and rarity on an international, regional or national scale with little or no potential for substitution.</td><td rowspan="2">Sensitive area or receptor with little resilience to imposed stresses.</td></tr>
<tr><td>High</td><td>An attribute with a high quality and rarity on a local scale with little or no potential for local substitution, or with a medium quality or rarity on a regional or national scale with limited potential for substitution.</td></tr>
<tr><td>Medium</td><td>An attribute with a medium quality and rarity on a local scale with limited potential for substitution, or an attribute of low quality and rarity on a regional or national scale.</td><td>The receiving environment or receptor has a moderate natural resilience to imposed stresses.</td></tr>
<tr><td>Low</td><td>An attribute of low quality and rarity on a local scale with potential for substitution locally.</td><td>The receiving environment or receptor has a high natural resilience to imposed stresses.</td></tr>
</table>

Impact consequence using receptor sensitivity or importance

Table 4 presents the matrix to be used to determine impact consequence by combining the impact classification with receptor sensitivity, where relevant (primarily for ecological and social receptors).

Table 4: Determination of impact consequence by taking sensitivity into account

		Impact classification*			
		High	**Moderate**	**Low**	**Negligible**
Receptor Sensitivity or importance	**Very High**	Major	Major	Moderate	Minor
	High	Major	Moderate	Minor	Negligible
	Medium	Moderate	Minor	Minor	Negligible
	Low	Minor	Minor	Negligible	Negligible

**Determined by combining magnitude, geographic extent, duration and frequency.*

Probability is not considered in the effects analysis for most technical disciplines. An analysis of hazards associated with malfunctions or accidents will be reported in Section 5.11 (Environmental Risks and Accidents) and will feed into the Emergency Preparedness and Response Plan.

Social Impact classification

The evaluation of social impacts will differ from the evaluation of environmental impacts. The significance of a social impact will not depend on a characterisation of the magnitude of the effect and the definition of sensitivity or importance. Most social impacts will not be evaluated in the same quantitative way that can be applied to physical and biological impacts. Evaluation of social impacts will rely on a narrative which will bring together the evaluation of the following four criteria to reach a conclusion for the overall social impact:

- Direction, i.e.
  - Positive direction– impact provides a net benefit to the affected person(s);
  - Negative direction – impact results in a net loss to the affected persons(s); and
  - Mixed direction – mixed directions or no net benefit or loss to the affect person(s).
- Consequence, i.e.
  - Negligible consequence – no noticeable change anticipated;
  - Low consequence – predicted to be different from baseline conditions, but not to change quality of life of the affected person(s);
  - Moderate consequence – predicted to change the quality of life of the affected person(s); and
  - High consequence – predicted to seriously change quality of life.
- Geographic extent of change; and
- Duration.

Each impact will be considered in relation to other impact topics and sub-topics. The objective of the narrative in the evaluation of social impacts is to show the relative importance of social impacts.

Mitigation

Should the results of the impact analysis show unacceptable results (e.g. unacceptable exceedance of the Project Standards or baseline conditions; negative effects outweighing positive effects), mitigation will be identified according to the mitigation hierarchy:

- Avoid - make changes to the Project's design or location to avoid adverse effects.
- Minimise - reduce adverse effects through sensitive environmental treatments/design.
- Restore - measures taken during or after construction to repair/reinstate and return a site to the situation prior to unacceptable long term impacts.
- Compensate/offset - where avoidance or reduction measures are not available, it may be appropriate to provide compensatory/offsetting measures. Compensatory measures do not eliminate the original adverse effect; they merely seek to offset it with a comparable positive one.
- Improvement measures - projects can have positive effects as well as negative ones and the Project preparation stage presents an opportunity to enhance these positive features through innovative design.

Mitigation will be included for all impacts that are classified as moderate or high/major. These mitigations may also be effective in reducing low/minor impacts, however low/minor impacts will not be the focus of specific or targeted mitigations.

Residual Impacts

Residual impacts are those that remain following the implementation of the proposed mitigation. These will be identified for each of the specialist topics by reviewing the predicted impacts against the mitigation measure proposed and then identifying any residual impacts. Residual impacts will be defined based on the same process applied to the evaluation of impacts.

Cumulative Impact Assessment

Cumulative impacts are defined as impacts that result from the incremental impact, on areas or resources used or directly impacted by the Project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted. Cumulative impacts will be assessed as part of an analysis of the Project and will be prepared as a separate chapter alongside the technical chapters.

The assessment of cumulative impacts will consider the effects of other developments in the vicinity of the Project which are operating, under construction or have been consented which, when combined with the effects of the Project, may have an incremental effect.

Environmental and Social Management System

An Environmental and Social Management System (ESMS) framework and series of Management Plans have been developed to guide the implementation of mitigation measures and project commitments.

6.0 ADDITIONAL TECHNICAL INFORMATION IN SUPPORT OF THE EOPS PHASE II ESIA

REPORT

TKBV Kenya B.V.

Volume II EOPS Phase 2 ESIA Supporting Information

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1.0 AIR DISPERSION MODELLING

1.1 Introduction

This report provides information on the air dispersion modelling (ADM) of atmospheric emissions from the Amosing and Ngamia wellpads as a result of the Early Oil Pilot Scheme (EOPS). ADM was conducted to support the air quality impact assessment.

The report is organised as follows:

- Section 1.2 describes the background to the assessment (modelling approach and scenario, baseline air quality, and the air quality standards (AQS) to be applied);
- Section 1.3 provides a general summary of the emission sources and rates;
- Section 1.4 describes the atmospheric pathways for pollutant transport;
- Section 1.5 describes the receptors used in the modelling;
- Section 1.6 presents the assessment of emissions at receptors; and
- Section 1.7 Conclusions.

This modelling assessment draws on information in the EOPS ESIA baseline report (Volume 3 of the ESIA) to establish existing baseline conditions.

1.2 Background

1.2.1 Modelling Approach and Scenario

This modelling study assesses the potential air quality effects of EOPS on human health and habitats due to predicted air emissions during operations. Ground level air pollutant concentrations are predicted based on detailed ADM using AERMOD (ADM software, version 7.12.1.0). Modelled emissions from the Project include gases (nitrogen oxides (NOx), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO), carbon dioxide (CO_2), total volatile organic compounds (VOCs), as well as fine particulates (PM_{10} and $PM_{2.5}$).

The first model scenario, "normal operating scenario" assumes that all equipment (flares, gas engine and generators at Amosing and Ngamia) will be operational constantly for a whole year. A second scenario, "power generator scenario", has also been modelled. This scenario accounts for the Amosing-1 gas engine not being operational straight away and, therefore, a power generator being required during the first few months of operation. Due to a limitation in the modelling software, this second scenario is modelled with the power generator assumed to be operational constantly for a whole year.

The ADM predicts the potential effect of emissions on air quality across the model domain and at sensitive receptors. Sensitive human receptor locations considered in this assessment include homesteads identified as part of the Land baseline. The model domain is also covered by receptor grids.

The ADM predicts the process contribution (PC) to ambient air quality as a ground level concentration attributable to the modelled project source. For the assessment of each pollutant considered, the ambient air PC concentration is added to the existing background concentration, to calculate the predicted environmental concentration (PEC). The PEC is then compared to the adopted AQS for the Project. The AQS indicates the degree of environmental effect that can be considered acceptable for a particular pollutant at a receptor.

The potential impacts of dust emissions have been assessed for both the construction and operation phases using a qualitative approach. No modelling of dust deposition has been undertaken.

The findings of this modelling study have been used in the air quality impact assessment.

1.2.2 Project Adopted Air Quality Standards

The AQS adopted for the Project are based on AQS and guidelines from both Kenyan and International Finance Corporation (IFC) guidance and legislation. The AQS relevant to the ADM assessment are summarised in Table 1-1. Results are calculated and reported at the appropriate assessment percentile (%ile). For example the 24 hour average (daily average) AQS for PM_{10}, taken from IFC guidance, states that the assessment should be undertaken at the 99th percentile. All other emissions are calculated and reported at the 100th percentile.

Table 1-1: Summary of AQS adopted for human health

Emission	Time weighted average	Concentration ($\mu g/m^3$)
SO_2	Annual	50
	24 hours	20
	10 minute	500
NO_2	Annual	40
	24 hours	188
	1 hour	200
NO_x	Annual	60
	24 hours	80
PM_{10}	Annual	20
	24 hours	50
$PM_{2.5}$	Annual	10
	24 hours	25
CO	8 hours	2000
	1 hour	4000
Total VOC	24 hours	600

Abbreviations; CO = carbon monoxide; $\mu g/m^3$ = micrograms per cubic metre; NO_x = nitrogen oxides; NO_2 = nitrogen dioxide; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns; PM_{10} = particulate matter less than or equal to 10 microns; SO_2 = sulphur dioxide; VOC = volatile organic compounds.

1.2.3 Estimated Background Air Quality

Background ambient air concentrations and dust deposition were derived from the findings of the EOPS ESIA baseline study (Volume 3).

1.3 Project Emissions

Atmospheric emissions from activities during groundwork, installation, operations and decommissioning can be categorised into two groups: combustion emissions and fugitive emissions. Combustion processes emit most of the gaseous emissions, including NO_2, SO_2, and CO. Combustion processes include those emitted from the flares, generators and gas engine. Fugitive emissions include dust and odour.

1.3.1 H2S Screening

Golder has adopted a conservative screening methodology (England Environment Agency H1 Database v2.76 02/02/16) to establish potential ambient air impacts from venting (H_2S) and flaring (SO_2). The methodology returns a conservative estimate of annual (long-term) and 1-hour (short-term) process contributions (PCs) based on flare height, exit velocity and flow and pollutant concentration which can be used for screening purposes.

The results for the screening process are detailed in Table 1-2. All estimated PCs, as based on the inputs detailed above, were less than 1% of the applicable long-term AQS and less than 5% of the applicable short-term AQS. They are, therefore, all screened out as they can be deemed insignificant.

Table 1-2: Screening results for SO2 from flaring and H2S from venting at Amosing-1

	Estimated Screening PCs (µg/m^3)	AQS (µg/m^3)	PC % of AQS	Screening Result
Annual SO_2	0.08	50	0.16	Insignificant
24 Hour SO_2	0.66	20	3.32	Insignificant
10 Minute SO_2	2.74	500	0.55	Insignificant
Annual H_2S	0.22	140	0.16	Insignificant
Hourly H_2S	4.51	150	3.01	Insignificant

The presence of H_2S was noticed during flowback from the Amosing-2A well, which is thought to have been present due to acid injection. Xodus (2017) have provided Worst Case estimates for hydrogen sulphide (H_2S) and sulphur dioxide (SO_2) concentrations likely to occur at the Amosing-1 flare. Flare venting is associated with H_2S emissions and flare combustion is associated with SO_2 emissions (following the oxidation of H_2S).

Golder has undertaken a screening assessment based on the flare parameters in the ESIA and the SO_2 and H_2S provided by TKBV for worst case flare venting and combustion. However, SO_2 and H_2S concentrations estimated appear to relate to the flare fuel. During the combustion process, the fuel is mixed with air at an air to fuel ratio ensuring sufficient oxygen for complete combustion. The exit flow used here represents this combined fuel and airflow rendering the screening assessment highly conservative. The screening criteria stipulate that the PCs can be screened out and deemed insignificant if the following two criteria are met:

- The short-term PC is less than 10% of the short-term AQS; and
- The long-term PC is less than 1% of the long-term AQS.

Long-term and short-term SO_2 from flaring and long-term and short-term H_2S from flare venting were assessed to be less than 1% of the applicable long-term and less than 5% of the applicable short-term AQS. Therefore they were all screened out as insignificant and do not require further assessment using detailed air dispersion modelling (ADM).

1.3.2 Emission Quantification

Emissions from the operations were estimated using a combination of data supplied by Tullow, information available from manufacturer's specification sheets and IFC emissions limits data. Details of the emissions data used and the data source is supplied in Tables 1-3 to 1-6 below. All data is as supplied by Tullow, unless otherwise specified. All emissions sources are modelled as being operational for 100% of the time and corrected for temperature only (i.e. moisture and oxygen content have not been accounted for). Standard conservative assumptions have also been applied, including:

- Assuming 100% of NO_x is NO_2 in the long-term and 50% in the short-term; and
- Assessing particulate emissions in two scenarios, the first assuming 100% of particulate emissions are PM_{10} and the second assuming 100% of particulate emissions are $PM_{2.5}$.

1.3.3 Source Emissions Data

1.3.3.1 Amosing-1

Table 1-3: Table 1-3: Source and emissions data for Amosing-1

Parameter	Flare	Gas Engine	Well heater generator	Temporary diesel generator
Stack Height (m)	9.14	4.5	2.32	2.32
Stack Diameter (m)	0.076	0.3	0.2	0.2
Discharge velocity (m/s)	25.0	11.8	38.2 [1]	49.8
Discharge Temperature (°C)	950	552	630	500
NO_x Emission Rate (g/s)	0.5	1.77	0.15 [1]	0.31 [3]
CO Emission Rate (g/s)	1.87	0.88	-	-
VOC Emission Rate (g/s)	3.23	0.1	-	-
SO_2 Emission Rate (g/s)	-	-	0.0002 [2]	0.0003 [2]
PM_{10}/ $PM_{2.5}$ Emission Rate (g/s)[1]	0.05	0.0091	0.0073 [1]	0.0105 [3]

1. Calculated based on manufacturers specifications (corrected for temperature only);
2. Calculated based on unit and fuel specification;
3. Calculated based on IFC small combustion facilities emissions guidance for 3-50 MWth engine using liquid fuel (corrected for temperature only).

1.3.3.2 Ngamia-3

Table 1-4: Source and emissions data for Ngamia-3

Parameter	Flare	Well heater generator	Diesel generator
Stack Height (m)	9.14	2.32	1.82
Stack Diameter (m)	0.076	0.2	0.12
Discharge velocity (m/s)	8.0	38.2 [1]	35.2
Discharge Temperature (°C)	950	630	484
NO_x Emission Rate (g/s)	0.14	0.15 [1]	0.21 [3]

Parameter	Flare	Well heater generator	Diesel generator
CO Emission Rate (g/s)	0.54	-	-
VOC Emission Rate (g/s)	0.93	-	-
SO_2 Emission Rate (g/s)	-	0.0002 [2]	0.0001 [2]
PM_{10}/ $PM_{2.5}$ Emission Rate (g/s)[1]	0.01	0.0073 [1]	0.0072 [3]

1. Calculated based on manufacturers specifications (corrected for temperature only);
2. Calculated based on unit and fuel specification;
3. Calculated based on IFC small combustion facilities emissions guidance for 3-50 MWth engine using liquid fuel (corrected for temperature only).

1.3.3.3 Ngamia-1

Table 1-5: Source and emissions data for Ngamia-1

Parameter	Flare	Well heater generator	Diesel generator
Stack Height (m)	9.14	2.32	1.82
Stack Diameter (m)	0.076	0.2	0.12
Discharge velocity (m/s)	8.0	38.2 [1]	35.2
Discharge Temperature (°C)	950	630	484
NO_x Emission Rate (g/s)	0.14	0.15 [1]	0.21 [3]
CO Emission Rate (g/s)	0.54	-	-
VOC Emission Rate (g/s)	0.93	-	-
SO_2 Emission Rate (g/s)	-	0.0002 [2]	0.0001 [2]
PM_{10}/ $PM_{2.5}$ Emission Rate (g/s)[1]	0.01	0.0073 [1]	0.0072 [3]

1. Calculated based on manufacturers specifications (corrected for temperature only);
2. Calculated based on unit and fuel specification;
3. Calculated based on IFC small combustion facilities emissions guidance for 3-50 MWth engine using liquid fuel (corrected for temperature only).

1.3.3.4 Ngamia-8

Table 1-6: Source and emissions data for Ngamia-8

Parameter	Flare	Well heater generator	Diesel generator
Stack Height (m)	9.14	2.32	1.82
Stack Diameter (m)	0.076	0.2	0.12
Discharge velocity (m/s)	16.0	38.2 [1]	35.2
Discharge Temperature (°C)	950	630	484

Parameter	Flare	Well heater generator	Diesel generator
NO_x Emission Rate (g/s)	0.29	0.15 [1]	0.21 [3]
CO Emission Rate (g/s)	1.08	-	-
VOC Emission Rate (g/s)	1.86	-	-
SO_2 Emission Rate (g/s)	-	0.0002 [2]	0.0001 [2]
PM_{10}/ $PM_{2.5}$ Emission Rate (g/s)[1]	0.02	0.0073 [1]	0.0072 [3]

1. Calculated based on manufacturers specifications (corrected for temperature only);
2. Calculated based on unit and fuel specification;
3. Calculated based on IFC small combustion facilities emissions guidance for 3-50 MWth engine using liquid fuel (corrected for temperature only).

1.4 Atmospheric Pathway

1.4.1 Atmospheric Dispersion Model

AERMOD (ADM software, version 7.12.1.0) was used for the ADM. This model predicts ground-level concentrations in ambient air as well as particulate deposition, and can account for multiple emission sources.

1.4.2 Meteorology

The pathway by which emissions to air may impact upon sensitive receptor locations is through atmospheric dispersal. Emissions to air from the identified sources will be transported by the wind to potential downwind receptors. The distance and dilution of emissions dispersed will be dependent on the prevailing meteorological conditions.

At the time the ADM model was completed, less than one year of meteorological data from the upstream area was available, therefore data from an alternative station was utilised in the analysis. The closest meteorological station with appropriate data coverage was identified to be Eldoret meteorological station, approximately 190 km to the southwest of the upstream area. The assessment is based on five years of meteorological data (2011-2015) and the parameters included are presented in Table 1-7. Wind roses for Kapese, Ngamia, Eldoret and Lodwar are presented in Figure 1 and all indicate a prevalence of easterly winds. The prevalence of easterly winds is associated with the distinct monsoon pattern observed over equatorial eastern Africa and shared with the wider region (including Eldoret).

Table 1-7: Hourly sequential readings used in the meteorological dataset

Parameter	Units
Wind speed	m/s
Wind direction	Degrees measured clockwise from north
Cloud cover	oktas
Surface temperature	C˚
Relative humidity	%
Rainfall	mm

Abbreviations: % = percent; C° = degree Celsius; mm = millimetre; m/s = metre per second.

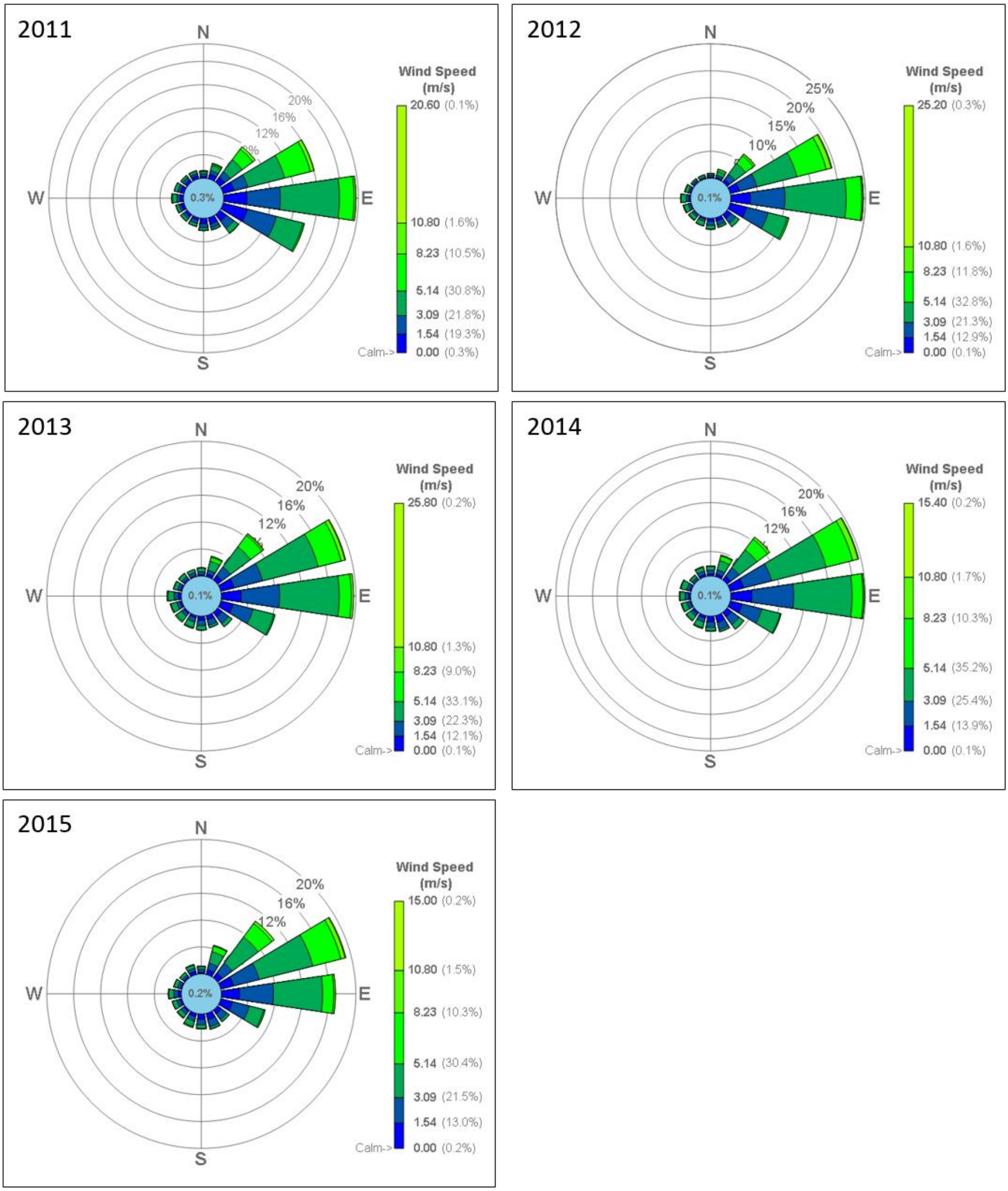

Figure 1-1: Windroses for Eldoret meteorological station (2011 to 2015)

1.4.3 Terrain and Land Use

It is not necessary to include terrain data in this assessment due to the lack of topographically significant features. A number of sensitivity tests have been undertaken to assess the impact of the bunds surrounding the wellpads on the dispersion of emissions and predicted results. The bunds have no impact as emissions come from sources at height and are emitted in directions which are unaffected by the presence of the bund. Therefore the bunds have not been included in the ADM.

The meteorological data set was processed into a suitable format for dispersion modelling using the surface roughness values and albedo and bowen ratio, shown in Tables 1-8 and 1-9, respectively. The surface roughness values were based on land use within a 1 km radius of each wellpad, as described by the AERMET model methodology. The albedo/bowen ratios consider a 10 km^2 area centring on the each wellpad, following the AERMET methodology for classifying albedo/bowen ratios.

Table 1-8: Surface roughness values used to process the meteorological data

Start (degrees)	End (degrees)	Category	Surface Roughness Length
0	360	Grassland	0.5

Table 1-9: Albedo and Bowen ratio values used to process the meteorological data

Parameter	Value
Albedo	0.28
Bowen Ratio	0.75

1.4.4 Buildings

Table 1-10 details the buildings and other structures that have been included in the assessment in order to include potential obstructions to pathways.

Table 1-10: Obstructions included in ADM

Description	Height (m)
Amosing-1 oil tanks	9.1
Ngamia-8 oil tanks	9.1
Amosing-1 gas engine	3
Amosing-1 back-up generator	2.15
Amosing-1 welfare cabin 1	2.5
Amosing-1 welfare cabin 2	2.5
Amosing-1 well heater generator	2.15
Ngamia-1 well heater generator	2.15

Description	Height (m)
Ngamia-1 power generator	1.82
Ngamia-8 well heater generator	2.15
Ngamia-8 power generator	1.82
Ngamia-3 well heater generator	2.15
Ngamia-3 power generator	1.82

1.4.4.1 Receptor Grid

Two Cartesian receptor grids have been utilised in the model, focussed on the Ngamia and Amosing areas.

The first receptor grid (Ngamia) extends over an area of 16 km^2 at a resolution of 50 m (SW corner: E 804562.9, N 243804 (UTM 36N)).

The second receptor grid (Amosing) extends over an area of 19 km^2 at a resolution of 50 m (SW corner: E 807698.9, N 237603 (UTM 36N)).

1.4.4.2 Receptors

Indicative sensitive receptors (high sensitivity) are considered to be any specific locations where people live or spend long periods of time, whilst non-sensitive receptors (low sensitivity) are general locations where people have access (e.g. for the purposes of grazing) but do spend long periods of time there.

1.5 Emission Assessment

1.5.1 Human Health

Contour plots for all emissions are included in the Drawings section of the ESIA. The ADM predicts that there will be exceedances beyond the Amosing-1 wellpad fenceline of the AQS for NO2 annual, 24 hour and 1 hour averaging periods and NOx annual and 24 hour averaging periods.

The predicted area of exceedance of the AQS is a small area outside of the Amosing-1 wellpad, located between the Amosing-1 wellpad and the access road.

There is a predicted exceedance of the annual AQS for PM_{10} at all wellpads but this is due to the high background levels of PM_{10} recorded during the baseline monitoring at Kapese Camp. The PC from the facility is only 17% of the AQS and therefore the exceedance is considered to be driven by the existing high background levels. Elevated particle concentrations (PM_{10} and $PM_{2.5}$) could relate to the dusty environment or meteorological events, such as periods of high wind speeds or dry periods. They could also be related to elevated source conditions at the Kapese Camp, including burning and exhaust emissions. The camp is well established and has multiple potential emissions sources. The baseline data recorded at Kapese Camp may therefore be an overestimate of the background concentration at Amosing and Ngamia wellpads and may therefore not be representative of these locations. It is recommended that a snapshot of PM_{10} baseline data for 24 hours is acquired at Amosing-1 and the Ngamia wellpads prior to commencement of the Project, in order, to confirm this assertion.

Nevertheless, the ADM predicts that at the closest receptor to the Amosing-1 wellpad (an unoccupied homestead identified in the May 2017 land baseline, 315 m from the fenceline) the annual PM_{10} is 22 $\mu g/m^3$, which is only marginally above the background concentration presented in Table 1-11.

Table 1-11: ADM results - maximum concentrations in the modelled domain outside of the Amosing-1 wellpad perimeter

Emission	Time weighted average	PC (µg/m³)	Estimated background concentration (µg/m³)	PEC (µg/m³)	AQS (µg/m³)	PC % AQS	PEC % AQS	Predicted exceedance of AQS outside wellpad fenceline
NO_2	Annual	62	0.8	62	40	154	156	See drawing 5.3-18
	24 hour	87	0.9	88	188	46	47	See drawing 5.3-17
	1 hour	287	1.5	288	200	143	144	See drawing 5.3-16
SO_2	Annual	<1	1.1	1	50	<1	2	no
	24 hour	<1	1.3	1	20	<1	6	no
	10 minute	<1	3.6	4	500	<1	1	no
NOx	Annual	62	-	178	60	103	297	See drawing 5.3-20
	24 hour	599	-	599	80	749	749	See drawing 5.3-19
PM_{10}	Annual	3	21.7	25	20	17	125	See drawing 5.3-23
	24 hour	7	25.6	32	50	14	65	no
$PM_{2.5}$	Annual	3	5	8	10	33	83	no
	24 hour	8	5.9	14	25	33	57	no
CO	8 hour	415	-	415	2000	21	21	no
	1 hour	677	-	677	4000	17	17	no
Total VOC	24 hour	534.3	-	534	600	89	89	no

Abbreviations: % = percent; µg/m³ = microgram per cubic metre; AQS = air quality standard; CO = carbon monoxide; NOx = nitrogen oxidesNO₂ = nitrogen dioxide; PC = process contribution; PEC = predicted environmental concentration; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns; PM_{10} = particulate matter less than or equal to 10 microns; SO_2 = sulphur dioxide.

1.6 Impact Classification and Determination of Impact

Using the impact assessment criteria presented in the ESIA chapter, the expanded impact assessment classification and determination of impact is presented in Table 1-12. This is summarised in the ESIA chapter.

Table 1-12: Impact classification matrix

Receptor	Phase of the Project	Source of impact	Magnitude	Geographic extent	Duration	Frequency	Impact classification	Receptor Sensitivity	Impact Consequence
Indicative sensitive receptors (homesteads identified from May 2017 Land survey)	Operation	Emissions of NO_2	Low	Local	Medium	Frequent	Low	High	Minor
		Emissions of SO_2	Low	Local	Medium	Frequent	Low	High	Minor
		Emissions of NO_x	Low	Local	Medium	Frequent	Low	High	Minor
		Emissions of PM_{10}	Moderate	Local	Medium	Frequent	Moderate	High	Moderate
		Emissions of $PM_{2.5}$	Low	Local	Medium	Frequent	Low	High	Minor
		Emissions of CO	Low	Local	Medium	Frequent	Low	High	Minor
		Emissions of Total VOCs	Low	Local	Medium	Frequent	Low	High	Minor
Areas of land for non-residential use (e.g. grazing, access	Operation	Emissions of NO_2	Moderate	Local	Medium	Frequent	Moderate	Low	Minor
		Emissions of SO_2	Low	Local	Medium	Frequent	Low	Low	Negligible

Receptor	Phase of the Project	Source of impact	Magnitude	Geographic extent	Duration	Frequency	Impact classification	Receptor Sensitivity	Impact Consequence
to other natural resources		Emissions of NO_x	Moderate	Local	Medium	Frequent	Moderate	Low	Minor
		Emissions of PM_{10}	Moderate	Local	Medium	Frequent	Moderate	Low	Minor
		Emissions of $PM_{2.5}$	Low	Local	Medium	Frequent	Low	Low	Minor
		Emissions of CO	Low	Local	Medium	Frequent	Low	Low	Minor
		Emissions of Total VOCs	Low	Local	Medium	Frequent	Low	Low	Minor

1.7 Qualitative Assessment

1.7.1 Assessment Scope

A qualitative assessment was undertaken to assess the effect of EOPS emission sources and activities that are considered to be minor fugitive emissions or those for which a quantifiable, reliable source is not available. This includes dust and odour emissions, which were assessed using a source-pathway-receptor approach.

This qualitative assessment considers emission sources associated with the Project that have the potential to generate emissions of either dust or odour to air. The following sources have been included:

- Minor earthworks (compaction, foundations) at the wellpads;
- Traffic on service roads between wellpads (non-sealed road surface);
- Traffic on highway between Amosing-1 and Mombasa (sealed road surface); and
- Use of water storage ponds at the Amosing-5 wellpad.

The spatial extent of the qualitative assessment is based on the distance between any potential emission source and receptors. Potential effects were considered up to a maximum of 250 m from any potential emission source[1], except for roads where a maximum distance of 50 m was used[2].

1.7.2 Source-Pathway-Receptor Assessment

1.7.2.1 Source

Table 1-13 presents the activities deemed to release dust or odour emissions during groundworks and installation, operations, and decommissioning.

Table 1-13: Potential fugitive dust and odour generating activities during groundworks/installation, operations, and closure

Phase	Activity/Process	Emission
Groundworks and installation	Minor earthworks (compaction, foundations)	Dust
	Concreting	Dust
Operation	Traffic on service roads between wellpads (non-sealed road surface) - Upstream	Dust
	Use of water storage ponds at the Amosing-1 and (potentially) Amosing-5 wellpads	Odour
	Traffic on highway between Amosing and Mombasa (sealed road surface) - Midstream	Dust and combustion emissions
Decommissioning	Minor earthworks	Dust

[1]Based on UK best practice as described in *Guidance on the Assessment of Mineral Dust impacts for Planning* (Institute of Air Quality Management (IAQM), 2016), in lieu of international or national guidance.

[2] Based on UK best practice as described in *Tag Unit A3: Environmental Impact Appraisal* (Department for Transport, 2015), in lieu of international or national guidance.

Concreting

A small amount of concreting will be undertaken for the tanktainer loading area at the Amosing-1 wellpad. The concrete will be imported and there will be no concrete batching plant associated with this.

Minor Earthworks

Compaction will be required to prepare the ground for the wellpads and set down areas. Foundations will be required for the wellpad and some minor infrastructure.

Traffic on roads between wellpads

Road traffic will be present on the existing roads between the wellpads and Kapese Camp. Infield roads will not be sealed.

Traffic on highway between Amosing-1 and Mombasa - Dust Emissions

There is the potential for dust to be generated from the roads, although the road will be sealed along the entire route.

Traffic on highway between Amosing and Mombasa - Combustion Emissions

The impact of road traffic emissions associated with the operation phases of the proposed development are assessed in accordance with United Kingdom Design Manual for Roads and Bridges (DMRB) guidance on assessing air quality impacts (DMRB, 2007). The assessment method allows for a screening assessment of road traffic emissions based on the percentage change in vehicle movements on any road to be considered.

For the purposes of assessing the potential effects resulting from EOPS related traffic, estimations of traffic flows were made for the operation phase of the Project. The assumed number of Heavy Duty Vehicles (HDV) movements are:

- During operation, an average of 28 trip generations per day (14 tanktainers leaving Amosing-1; 14 tanktainers leaving Mombasa) will be required for the transport of 2,000 bbls/day (tanktainers are classified as HDVs).

The estimated peak increases in traffic movements do not exceed the daily movements identified by the DMRB assessment criteria and are therefore below the threshold (5%) at which it could be considered adverse effects on air quality could occur.

The traffic Impact assessment (TIA), presented in Appendix B shows that the maximum percentage change in traffic is predicted to be no more than 0.02%, based on the existing level of service on the roads and the baseline traffic counts. The TIA states that the existing roadway network has sufficient capacity in many areas to accommodate tanktainer traffic during EOPS and the Project will not cause additional congestion in Kitale. As such, combustion emissions from traffic on the transport route has not been considered further in the impact assessment.

Storage of used water

There will be an evaporation pond at Amosing-1 to accept produced water. There is also a possibility that an evaporation pond could be located at the Amosing-5 wellpad, if required. There is a potential for odour to be generated from both ponds.

1.7.2.2 Pathway

Fugitive dust and odours from the identified sources have the potential to be emitted directly to air and therefore have the potential to be transported to identified sensitive receptors by air dispersion. The dispersion of air pollutants will largely be influenced by weather conditions, in particular wind speed and the direction at the time that any fugitive emissions become airborne.

1.7.2.3 Receptors

For the purpose of this assessment it was assumed that receptors include the homesteads located within 250 m of potential fugitive dust or odour sources from the wellpads, within 50 m of the service road and within 50 m of the transport route from Amosing to Mombasa. The homesteads may be currently occupied or vacated and homestead locations are likely to change in the future.

1.7.3 Impact Classification and Determination of Impact

1.7.3.1 Magnitude of Potential Effects

The magnitude of change associated with emissions from each identified source of potential fugitive dust and odour emissions was established based on professional judgement and taking into account:

- The duration and frequency of each activity;
- The area of each wellpad potentially affected by groundworks;
- The volume of earthworks required;
- The surface conditions of the roads (sealed versus non-sealed); and
- The potential scale of the odour release and how inherently odorous the compounds are as well as the unpleasantness of the odour.

The established magnitude of change assumes that dust and odour management practices are applied at industry standards should fugitive dust and odour emissions arise, and that dust and odour management practices will take into account the distance and location (upwind/downwind) of any homesteads occupied at the time when the fugitive releases occur.

Table 1-14 summarises the magnitude of potential effects related to each source of potential fugitive dust or odour releases.

Table 1-14: Magnitude of Potential Emission Effects

Source	Emission	Magnitude
Concreting	Dust	Negligible
Minor earthworks (compaction, foundations)	Dust	Negligible
Traffic on service roads between wellpads (non-sealed road surface)	Dust	Low
Traffic on highway between Amosing-1 and Mombasa (sealed road surface)	Dust	Negligible
Use of water storage ponds at the Amosing-1 and (potentially) Amosing-5 wellpad	Odour	Negligible

1.7.3.2 Impact Classification

Table 1-15 summarises the impact classification for homesteads near to the wellpads or service roads as well as properties located along the Amosing-1 to Mombasa transport route. The impact classification is negligible for all receptors and potential impact sources. As such, the impact consequence is negligible for all.

Table 1-15: Impact classification matrix

Receptor	Phase of the Project	Source of impact	Magnitude	Geographic extent	Duration	Frequency	Impact classification	Receptor Sensitivity	Impact Consequence
Homesteads within 250 m of a wellpad	Groundworks and installation	Dust from Concreting	Negligible	Local	Short-term	Infrequent	Negligible	High	Negligible
		Dust from minor earthworks	Negligible	Local	Short-term	Infrequent	Negligible	High	Negligible
	Operation	Odour from storage of used water (Amosing 1, possibly Amosing 5)	Negligible	Local	Medium-term	Infrequent	Negligible	High	Negligible
	Decomissioning	Dust from minor earthworks	Negligible	Local	Short-term	Infrequent	Negligible	High	Negligible
Homesteads within 50 m of the service road	Operation	Dust from traffic on service roads	Low	Local	Medium-term	Infrequent	Negligible	High	Negligible
Properties within 50 m of the Amosing to Mombasa highway.	Operation	Dust from traffic on Amosing to Mombasa highway	Negligible	Local	Medium-term	Infrequent	Negligible	High	Negligible
		Combustion emissions from	Negligible	Local	Medium-term	Infrequent	Negligible	High	Negligible

Receptor	Phase of the Project	Source of impact	Magnitude	Geographic extent	Duration	Frequency	Impact classification	Receptor Sensitivity	Impact Consequence
		traffic on Amosing to Mombasa highway							

2.0 NOISE

2.1 Noise Terms and Units

Acoustic values can be described in terms of noise or sound. While noise is defined as unwanted sound, the terms noise and sound are often used interchangeably. An introduction to key concepts used in the assessment of outdoor acoustics is provided below:

- "**Noise**" or "**noise levels**" refers to the levels that can be heard or measured at a receptor;
- A noise "**receptor**" is a location where an assessment, measurements or predictions of noise levels are made;
- The "**level**" of a noise is expressed on a logarithmic scale, in units called decibels (dB). Since the scale is logarithmic, a noise that is twice the noise level as another will be three decibels (3 dB) higher. **"Sound pressure level"** is the physical quantity that is measured in the environment that describes sound waves quantitatively. It is a ratio of the absolute pressure relative to a reference (i.e., 20 µPa). This ratio of pressures is converted to a decibel scale (dB);
- Noise emissions and noise levels have an associated frequency. The human ear does not respond to all frequencies in the same way. Mid-range frequencies are most readily detected by the human ear, while low and high frequencies are harder to hear. Environmental noise levels used in this assessment are presented as "**A-weighted decibels**" (or dBA), which incorporates the frequency response of the human ear;
- For steady-state noise levels, an increase or decrease of 1 dBA is not perceptible to most people under normal conditions, although this may be perceptible under laboratory conditions. An increase of 3 dBA is normally just perceptible under normal conditions, while an increase of 10 dBA is equivalent to a doubling of the perceived loudness;
- The "**percentile noise level"**, designated L_n, is the noise level exceeded "n" percent of a specified time period and is measured in dBA. The L_{90}, for instance, is the noise level exceeded 90% of the time. It is a noise level index that commonly refers to the baseline noise level and is most often referenced in a rural setting;
- Outdoor noise is usually expressed as an "**equivalent noise level**" ($L_{eq,\,T}$), which is a logarithmic average (i.e., energy average) of the measured or predicted noise levels over a given period of time (T). An equivalent noise level measured or predicted over the night-time period would be referred to as $L_{eq,\,night}$.; and
- Environmental noise levels vary throughout the day and it is therefore important to distinguish between the time of day (i.e., daytime / night-time). For the purposes of this assessment as described in Section 5.4, the day is divided into two periods for which noise is evaluated. The "**daytime**" noise levels occur for the period from 07:00 to 22:00, a total of 15 hours. The "**night-time**" noise levels occur for the period from 22:00 to 07:00, a total of 9 hours.

2.2 Detailed Effects Analysis Results – Operational phase

Tables 2-1, 2-2 and 2-3 provide details of the noise effects analysis described in Section 5.4 of the EOPS ESIA. Table 2-1 presents the predictable worst case hour and average daytime/nighttime noise levels that will be experienced during operations at the specified receptors, as predicted by the noise model. The noise modelling used the equipment emissions rates provided by TKBV and the information presented in Table 5.4-3 of the EOPS ESIA to calculate the values shown in Table 2-1. Table 2-2 compares the predictable worst case hour with the hourly IFC noise limits to determine if there are any exceedances of the Project standards, regardless of baseline noise. Table 2-3 considers the average daytime and nighttime predicted noise levels in conjunction with the recorded baseline noise levels to determine any exceedances of period average limits, which may occur below the IFC hourly limits. Both tables present the magnitude of any potential effects.

Table 2-1: Effects Analysis – Operation Phase Predicted Noise Levels - Operation Phase Period Average

Wellpad	Receptor ID	Overall Sound Pressure Level – Operation Phase Predictable Worst Case Hour ($L_{eq,1hr}$) (dBA)	Overall Sound Pressure Level – Operation Phase Period Average (dBA)	
			Daytime (Leq,day)	Nighttime (Leq,night)
1. Amosing-1	2. M64H-1	3. 34.5	4. 33.1	5. 33.8
	6. M74H-1	7. 35.5	8. 34.6	9. 34.9
	10. M63H-1	11. 34.1	12. 33.2	13. 33.6
14. Ngamia-3	15. M97H-1	16. 24.2	17. 22.5	18. 23.4
	19. M16H-1	20. 27.6	21. 26.8	22. 27.1
	23. M41H-1	24. 30.9	25. 29.2	26. 30.1
27. Ngamia-1	28. M53H-1	29. 34.0	30. 32.1	31. 33.1
	32. M54H-1 (1)	33. 31.0	34. 27.9	35. 29.6
	36. M72H-1	37. 25.3	38. 23.3	39. 24.3
	40. M63H-1	41. 28.4	42. 26.4	43. 27.4
44. Ngamia-8	45. M41H-4	46. 39.7	47. 38.3	48. 39.0
	49. M55H-3	50. 29.1	51. 27.4	52. 28.2
	53. M53H-4	54. 36.2	55. 34.2	56. 35.2

(1) M54H-1 is a potential receptor both to the east of Ngamia- and to the south of Ngamia-8

Table 2-2: Effects Analysis – Operation Phase Predicted Noise Levels – Predictable worst case hour

Wellpad	Receptor ID	Overall Sound Pressure Level – Operation Predictable Worst Case Hour ($L_{eq,1hr}$) (dBA)	IFC Noise Guideline Limit (dBA)		Magnitude of Effect	
			57. Daytime ($L_{eq,1hr}$)	58. Nighttime ($L_{eq,1hr}$)	59. Daytime ($L_{eq,1hr}$)	60. Nighttime ($L_{eq,1hr}$)
61. Amosing-1	62. M64H-1	63. 34.5	64. 55	65. 45	66. Negligible	67. Negligible
	68. M74H-1	69. 35.5	70. 55	71. 45	72. Negligible	73. Negligible
	74. M63H-1	75. 34.1	76. 55	77. 45	78. Negligible	79. Negligible
80. Ngamia-3	81. M97H-1	82. 24.2	83. 55	84. 45	85. Negligible	86. Negligible
	87. M16H-1	88. 27.6	89. 55	90. 45	91. Negligible	92. Negligible
	93. M41H-1	94. 30.9	95. 55	96. 45	97. Negligible	98. Negligible
99. Ngamia-1	100.M53H-1	101.34.0	102.55	103.45	104.Negligible	105.Negligible
	106.M54H-1 (1)	107.31.0	108.55	109.45	110.Negligible	111.Negligible

Wellpad	Receptor ID	Overall Sound Pressure Level – Operation Predictable Worst Case Hour ($L_{eq,1hr}$) (dBA)	IFC Noise Guideline Limit (dBA)		Magnitude of Effect	
			57. Daytime ($L_{eq,1hr}$)	58. Nighttime ($L_{eq,1hr}$)	59. Daytime ($L_{eq,1hr}$)	60. Nighttime ($L_{eq,1hr}$)
	112.M72H-1	113.25.3	114.55	115.45	116.Negligible	117.Negligible
	118.M63H-1	119.28.4	120.55	121.45	122.Negligible	123.Negligible
124.Ngamia-8	125.M41H-4	126.39.7	127.55	128.45	129.Negligible	130.Negligible
	131.M55H-3	132.29.1	133.55	134.45	135.Negligible	136.Negligible
	137.M53H-4	138.36.2	139.55	140.45	141.Negligible	142.Negligible

(1) M54H-1 is a potential receptor both to the east of Ngamia-1 and to the south of Ngamia-8

Table 2-3: Effects Analysis – Change in Daytime and Night-time Operation Phase Noise Levels

Wellpad	Receptor ID	Overall Sound Pressure Level – Operation Phase Period Average (dBA)		Baseline Noise Levels[1] (dBA)		Predicted Project Operation Phase + Baseline Noise Levels (dBA)		Change in Baseline Noise Levels (dBA)		Magnitude of Effect	
		143.Daytime ($L_{eq,day}$)	144.Nighttime ($L_{eq,night}$)	145.Daytime ($L_{eq,day}$)	146.Nighttime ($L_{eq,night}$)	147.Daytime ($L_{eq,day}$)	148.Nighttime ($L_{eq,night}$)	149.Daytime ($L_{eq,day}$)	150.Nighttime ($L_{eq,night}$)	151.Daytime	152.Nighttime
153.Amosing-1	154.M64H -1	155.33.1	156.33.8	157.46.2	158.34.4	159.46.4	160.37.1	161.<1	162.<3	163.Negligible	164.Negligible
	165.M74H -1	166.34.6	167.34.9	168.46.2	169.34.4	170.46.5	171.37.7	172.<1	173.>3 (3.3)	174.Negligible	175.Low
	176.M63H -1	177.33.2	178.33.6	179.46.2	180.34.4	181.46.4	182.37.0	183.<1	184.<3	185.Negligible	186.Negligible
187.Ngamia-3	188.M97H -1	189.22.5	190.23.4	191.59.9	192.43.4	193.59.9	194.43.4	195.<1	196.<1	197.Negligible	198.Negligible
	199.M16H -1	200.26.8	201.27.1	202.59.9	203.43.4	204.59.9	205.43.5	206.<1	207.<1	208.Negligible	209.Negligible
	210.M41H -1	211.29.2	212.30.1	213.59.9	214.43.4	215.59.9	216.43.6	217.<1	218.<1	219.Negligible	220.Negligible
221.Ngamia-1	222.M53H -1	223.32.1	224.33.1	225.59.9	226.43.4	227.59.9	228.43.8	229.<1	230.<1	231.Negligible	232.Negligible
	233.M54H -1 [2]	234.27.9	235.29.6	236.59.9	237.43.4	238.59.9	239.43.6	240.<1	241.<1	242.Negligible	243.Negligible
	244.M72H -1	245.23.3	246.24.3	247.59.9	248.43.4	249.59.9	250.43.5	251.<1	252.<1	253.Negligible	254.Negligible

Wellpad	Receptor ID	Overall Sound Pressure Level – Operation Phase Period Average (dBA)		Baseline Noise Levels[1] (dBA)		Predicted Project Operation Phase + Baseline Noise Levels (dBA)		Change in Baseline Noise Levels (dBA)		Magnitude of Effect	
		143.Daytime ($L_{eq,day}$)	144.Nighttime ($L_{eq,night}$)	145.Daytime ($L_{eq,day}$)	146.Nighttime ($L_{eq,night}$)	147.Daytime ($L_{eq,day}$)	148.Nighttime ($L_{eq,night}$)	149.Daytime ($L_{eq,day}$)	150.Nighttime ($L_{eq,night}$)	151.Daytime	152.Nighttime
	255.M63H-1	256.26.4	257.27.4	258.59.9	259.43.4	260.59.9	261.43.5	262.<1	263.<1	264.Negligible	265.Negligible
266.Ngamia-8	267.M41H-4	268.38.3	269.39.0	270.59.9	271.43.4	272.59.9	273.44.7	274.<1	275.<1	276.Negligible	277.Negligible
	278.M55H-3	279.27.4	280.28.2	281.59.9	282.43.4	283.59.9	284.43.5	285.<1	286.<1	287.Negligible	288.Negligible
	289.M53H-4	290.34.2	291.35.2	292.59.9	293.43.4	294.59.9	295.44.0	296.<1	297.<1	298.Negligible	299.Negligible

(1) Baseline noise levels for EOPS were established at two sampling locations, Amosing-5 and Ngamia-5/6, and these have been used to characterise the baseline noise levels across the wider wellfield areas.

(2) M54H-1 is a potential receptor both to the east of Ngamia-1 and to the south of Ngamia-8

2.3 Impact Assessment Classification and Determination of Impact

Table 2-4: Table 2-4: Impact classification matrix

Wellpad	Receptor ID	Phase of the Project	Source of impact	Magnitude	Geographic extent	Duration	Frequency	Impact classification	Receptor Sensitivity	Impact Consequence
Amosing-1	M64H-1	Operation	Amosing-1	Negligible	Local	Medium-term	Frequent	Negligible	High	Negligible
	M74H-1	Operation	Amosing-1	Low	Local	Medium-term	Frequent	Low	High	Minor
	M63H-1	Operation	Amosing-1	Negligible	Local	Medium-term	Frequent	Negligible	High	Negligible
Ngamia-3	M97H-1	Operation	Ngamia-3, Ngamia-1, Ngamia-8	Negligible	Local	Medium-term	Frequent	Negligible	High	Negligible
	M16H-1	Operation	Ngamia-3, Ngamia-1, Ngamia-8	Negligible	Local	Medium-term	Frequent	Negligible	High	Negligible
	M41H-1	Operation	Ngamia-3, Ngamia-1, Ngamia-8	Negligible	Local	Medium-term	Frequent	Negligible	High	Negligible
Ngamia-1	M53H-1	Operation	Ngamia-3, Ngamia-1, Ngamia-8	Negligible	Local	Medium-term	Frequent	Negligible	High	Negligible
	M54H-1 (1)	Operation	Ngamia-3, Ngamia-1, Ngamia-8	Negligible	Local	Medium-term	Frequent	Negligible	High	Negligible
	M72H-1	Operation	Ngamia-3, Ngamia-1, Ngamia-8	Negligible	Local	Medium-term	Frequent	Negligible	High	Negligible
	M63H-1	Operation	Ngamia-3, Ngamia-1, Ngamia-8	Negligible	Local	Medium-term	Frequent	Negligible	High	Negligible
Ngamia-8	M41H-4	Operation	Ngamia-3, Ngamia-1, Ngamia-8	Negligible	Local	Medium-term	Frequent	Negligible	High	Negligible
	M55H-3	Operation	Ngamia-3, Ngamia-1, Ngamia-8	Negligible	Local	Medium-term	Frequent	Negligible	High	Negligible
	M53H-4	Operation	Ngamia-3, Ngamia-1, Ngamia-8	Negligible	Local	Medium-term	Frequent	Negligible	High	Negligible

(1) M54H-1 is a potential receptor both to the east of Ngamia-1 and to the south of Ngamia-8

3.0 BIODIVERSITY

3.1 Identification of Receptors

Table 3-1: Species Receptors for Impact Assessment

Receptor group	Scientific Name	Common name	Kenya WCMA	KWS priority species	IUCN Red List*	CMS	CITES	Other	Occurrence in Upstream Study Area
Invertebrates	*Omophron* sp.	unnamed ground beetle	-	-	-	-	-	New to science	Confirmed
	Samba turkana	new bee species	-	-	-	-	-	New to science	Possible
Amphibians	*Sclerophrys turkanae*	Lake Turkana Toad	-	Y	DD	-	-	-	Confirmed
Terrestrial Reptiles	*Eryx colubrinus*	Kenya Sand Boa	Protected	Y	-	-	II	-	Confirmed
	Philochortus rudolfensis	Southern Shield-backed Lizard	-	-	DD	-	-	Restricted range	Possible
	Python sebae	Rock Python	Endangered	Y	-	-	II	-	Probable
Raptors	*Aquila heliaca*	Eastern Imperial Eagle	Vulnerable	Y	VU	I/II	I	-	Possible
	Aquila nipalensis	Steppe Eagle	-	-	EN	II	II	-	Confirmed

Receptor group	Scientific Name	Common name	Kenya WCMA	KWS priority species	IUCN Red List*	CMS	CITES	Other	Occurrence in Upstream Study Area
	Buteo buteo	Steppe Buzzard	-	-	LC	II	III		Confirmed
	Circus macrourus	Pallid Harrier	Near Threatened	-	NT	II	II	-	Confirmed
	Clanga clanga	Greater Spotted Eagle	Vulnerable	Y	VU			-	Possible
	Falco cherrug	Saker Falcon	Endangered	Y	EN	I/II	II	-	Possible
	Falco concolor	Sooty Falcon	Near Threatened	-	NT	II	II	-	Possible
	Falco naumanni	Lesser Kestrel	Vulnerable	Y	LC	I/II	II	-	Confirmed
	Falco subbuteo	Eurasian Hobby	-	-	LC	II	II		Confirmed
	Melierax poliopterus	Eastern Chanting-Goshawk	-	-	LC	II	II	-	Possible
	Milvus migrans	Black Kite	-	-	LC	II	II	-	Confirmed
	Polemaetus bellicosus	Martial Eagle	Protected	-	VU	II		-	Possible

Receptor group	Scientific Name	Common name	Kenya WCMA	KWS priority species	IUCN Red List*	CMS	CITES	Other	Occurrence in Upstream Study Area
	Polihierax semitorquatus	African Pygmy Falcon	-	-	LC	II	II	-	Confirmed
	Polyboroides typus	African Harrier Hawk	-	-	LC	-	II		Confirmed
	Stephanoaetus coronatus	Crowned Eagle	Protected	-	NT	II	II	-	Possible
	Terathopius ecaudatus	Bateleur	-	-	NT	II	II	-	Confirmed
Vultures	*Gyps africanus*	White-backed Vulture	Near Threatened	-	CR	II	II	-	Confirmed
	Gyps rueppelli	Ruepell's Vulture	Near Threatened	-	CR	II	II	-	Possible
	Necrosyrtes monachus	Hooded Vulture	-	-	EN	II	II	-	Possible
	Neophron percnopterus	Egyptian Vulture	Endangered	Y	EN	I/II	II	-	Possible
	Torgos tracheliotos	Lappet-faced Vulture	Vulnerable	Y	EN	II	II	-	Confirmed

Receptor group	Scientific Name	Common name	Kenya WCMA	KWS priority species	IUCN Red List*	CMS	CITES	Other	Occurrence in Upstream Study Area
	Trigonoceps occipitalis	White-headed Vulture	Vulnerable	Y	VU	II	II	-	Possible
Large ground birds	*Ardeotis kori*	Kori Bustard	-	-	NT	-	II	-	Confirmed
	Ciconia abdimii	Abdim's Stork	-	-	LC	II	-	-	Confirmed
	Neotis denhami	Denham's Bustard	Near Threatened	-	NT		II	-	Possible
	Sagittarius serpentarius	Secretarybird	-	-	VU	-	II	-	Possible
	Coracias garrulus	European Roller	Near Threatened	-	NT	I		-	Possible
Medium-sized mammals	*Canis aureus*	Golden Jackal	-	-	LC	-	II	-	Probable
	Civettictis civetta	African Civet	-	-	LC	-	III	-	Confirmed
	Leptailurus servalis	Serval	-	-	LC	-	II	-	Confirmed
	Mellivora capensis	Honey Badger	-	-	LC	-	III	-	Probable

Receptor group	Scientific Name	Common name	Kenya WCMA	KWS priority species	IUCN Red List*	CMS	CITES	Other	Occurrence in Upstream Study Area
	Papio anubis	Olive baboon	-	-	LC	-	II	-	Possible
Large mammals	*Hyaena hyaena*	Striped Hyaena	Endangered	Y	NT		III	-	Confirmed
	Panthera pardus	Leopard	Endangered	Y	NT	-	II	-	Probable
	Tragelaphus imberbis	Lesser Kudu	Protected	-	NT	-	-	-	Possible
Volent small mammals	*Neoromicia helios*	Samburu Pipistrelle bat	-	-	DD	-	-	Congregatory	Possible
	Otomops martiensseni	Large-eared Free-tailed Bat	Vulnerable		NT			Congregatory	Possible
	Scotoecus albofuscus	Light-winged Lesser House Bat	-	-	DD	-	-	Congregatory	Possible
	Tadarida ventralis	African Giant Free-tailed Bat	-	-	DD	-	-	Congregatory	Possible
	Taphozous hamiltoni	Hamilton's Tomb Bat	Protected	-	DD	-	-	Congregatory	Possible

Receptor group	Scientific Name	Common name	Kenya WCMA	KWS priority species	IUCN Red List*	CMS	CITES	Other	Occurrence in Upstream Study Area
	Taphozous hildegardeae	Hildegarde's Tomb Bat	Protected	-	VU	-	-	Congregatory	Possible

3.2 Sensitivity and/or Importance of Receptors

The sensitivity and/or importance of species and habitat receptors is presented in Table 2. For species receptor groups, the individual species in that group with the highest sensitivity determined the overall group's sensitivity. For example, for vultures, Ruepell's Vulture is internationally listed as critically endangered, and, therefore, the group's sensitivity becomes very high. Based on the sensitivities defined in Table 2, Table 3 presents the sensitivity/importance rating for each receptor group.

Table 3-2: Species and habitat receptor importance and/or sensitivity

Receptor type	Importance and/or sensitivity of the receptor
Species	**Very high:** ▪ Globally threatened species - includes internationally recognised IUCN Red-Listed critically endangered (CR), endangered (EN) and vulnerable (VU) species, as defined by the IUCN Red List guidelines; ▪ Restricted range species – terrestrial vertebrates with global ranges (i.e., extents of occurrence (EOO)) of less than 50,000km^2, freshwater species with extent of occurrence of <20,000km^2 (crabs, fish, and mollusks), and odonates (dragonflies and damselflies with extent of occurrence of <50,000km^2; and ▪ For raptors, those species that are obligate perch hunters, that is, rely primarily on elevated perches to scan for prey whilst hunting. (Note: if species is threatened, as per categories above, these take precedence for sensitivity rating).
	High: ▪ Nationally threatened species - includes species listed as *endangered, vulnerable* and *near-threatened* under the sixth schedule of the *Kenyan Wildlife Conservation and Management Act (2013)*; priority species listed in the *Kenya National Biodiversity Strategy and Action Plan* (NBSAP) (Ministry of Environment and Natural Resources, 2000), species identified by Kenya Wildlife Service (KWS) as priorities for conservation action (KWS, 2017); ▪ Migratory/congregatory species: Species listed on Appendix I and II of the Convention on Migratory Species (CMS), also known as the Bonn Convention; and ▪ For raptors, those species that are occasional perch hunters, that is, rely occasionally on elevated perches to scan for prey, yet will also employ other hunting methods. (Note: if species is threatened, as per categories above, these take precedence for sensitivity rating).
	Medium: ▪ Species listed as *protected* under the sixth schedule of the *Kenyan Wildlife Conservation and Management Act (2013)*; ▪ Species that are regionally endemic but not restricted range; ▪ Species listed as Near-Threatened or Data Deficient (under the IUCN's RedList), or little known to science; ▪ Species listed on CITES Appendix II and III; and ▪ For raptors, those species that do not employ elevated perches to hunt. (Note: if species is threatened, as per categories above, these take precedence for sensitivity rating).

Receptor type	Importance and/or sensitivity of the receptor
	Low: ▪ Common and ubiquitous species with no specific conservation management requirements.
Habitats	**Very high:** ▪ Internationally recognised sites of biodiversity importance, including IBA, Ramsar sites, EBA, KBA; and ▪ National Parks.
	Medium: Important natural habitats outside of protected areas – they may support high biodiversity in a local or regional context, or supporting populations of species that are uncommon in the locality.
	Low: ▪ Degraded or ubiquitous habitats with some local importance in wildlife support and habitat linkages.

Table 3-3: Sensitivity/importance of receptor groups, and raptor receptors (on basis of conservation status, and/or reliance on perches for hunting*/**

Receptor Group	Importance and/or sensitivity of the receptor
Invertebrates	Medium
Amphibians	Medium
Terrestrial Reptiles	Medium
Raptors	Very high
Eastern Imperial Eagle (*Aquila heliaca*)	Very high *
Steppe Eagle (*Aquila nipalensis*)	Very high
Pallid Harrier (*Circus macrourus*)	Medium
Greater Spotted Eagle (*Clanga clanga*)	Very High *
Saker Falcon (*Falco cherrug*)	Very high **
Sooty Falcon (*Falco concolor*)	High**
Lesser Kestrel (*Falco naumanni*)	High*
Martial Eagle (*Polemaetus bellicosus*)	Very high *
Crowned Eagle (*Stephanoaetus coronatus*)	High*

Receptor Group	Importance and/or sensitivity of the receptor
Bateleur (*Terathopius ecaudatus*)	Medium
Vultures	Very High
Large ground birds	High
Medium-sized mammals	Medium
Large mammals	High
Volent small mammals	High

3.3 Impact Assessment classification and Determination of Impact

Table 3-4: Impact classification matrix

Phase of the Project	Receptor	Source of impact	Magnitude	Geographic extent	Duration	Frequency	Impact classification	Receptor Sensitivity	Impact Consequence
Groundworks and Installation, and Decommissioning	Northern Acacia-Commiphora bushlands and thickets	Road widening – loss of extent of habitat	Low	Local	Permanent	Infrequent	Low	Medium	Minor
	Riparian Forest		Low	Local	Permanent	Infrequent	Low	Medium	Minor
	Northern Acacia-Commiphora bushlands and thickets	Introduction/ spread of invasive plant species	Moderate	Local	Long-term	Infrequent	Moderate	Medium	Minor
	Riparian Forest		Moderate	Local	Long-term	Infrequent	Moderate	Medium	Minor
	Invertebrates	Road upgrade works presenting barrier to	Moderate	Local	Short-term	Frequent	Low	Medium	Minor
	Amphibians		Moderate	Local	Short-term	Frequent	Low	Medium	Minor
	Terrestrial reptiles		Moderate	Local	Short-term	Frequent	Low	Medium	Minor

Phase of the Project	Receptor	Source of impact	Magnitude	Geographic extent	Duration	Frequency	Impact classification	Receptor Sensitivity	Impact Consequence
	Medium-sized mammals	movement to species receptors	Low	Local	Short-term	Frequent	Negligible	Medium	Negligible
	Large mammals		Low	Local	Short-term	Frequent	Negligible	High	Negligible
	Amphibians	Road upgrade works causing noise disturbance to species receptors	Low	Local	Short-term	Frequent	Negligible	Medium	Negligible
	Raptors (as a group)		Low	Local	Short-term	Frequent	Negligible	Very high	Minor
	Vultures		Low	Local	Short-term	Frequent	Negligible	Very high	Minor
	Large ground birds		Low	Local	Short-term	Frequent	Negligible	High	Negligible
	Medium-sized mammals		Low	Local	Short-term	Frequent	Negligible	Medium	Negligible
	Large mammals		Low	Local	Short-term	Frequent	Negligible	High	Negligible
	Volent small mammals		Low	Local	Short-term	Frequent	Negligible	High	Negligible
	Invertebrates		Moderate	Regional	Short-term	Infrequent	Low	Medium	Minor

Phase of the Project	Receptor	Source of impact	Magnitude	Geographic extent	Duration	Frequency	Impact classification	Receptor Sensitivity	Impact Consequence
	Amphibians	Vehicle movements presenting collision risk	Moderate	Regional	Short-term	Infrequent	Low	Medium	Minor
	Terrestrial reptiles		Moderate	Regional	Short-term	Infrequent	Low	Medium	Minor
	Greater Spotted Eagle		Moderate	Regional	Short-term	Infrequent	Low	Very high	Moderate
	Bateleur		Moderate	Regional	Short-term	Infrequent	Low	Medium	Minor
	Vultures		Moderate	Regional	Short-term	Infrequent	Low	Very high	Moderate
	Large ground birds		Moderate	Regional	Short-term	Infrequent	Low	High	Minor
	Medium-sized mammals		Moderate	Regional	Short-term	Infrequent	Low	Medium	Minor
	Large mammals		Moderate	Regional	Short-term	Infrequent	Low	High	Minor
Operation	Invertebrates	Upgraded road, plus increased	Low	Regional	Medium-term	Frequent	Low	Medium	Minor
	Amphibians		Low	Regional	Medium-term	Frequent	Low	Medium	Minor

Phase of the Project	Receptor	Source of impact	Magnitude	Geographic extent	Duration	Frequency	Impact classification	Receptor Sensitivity	Impact Consequence
	Terrestrial reptiles	traffic movements causing barrier to movement	Low	Regional	Medium-term	Frequent	Low	Medium	Minor
	Large ground birds		Low	Regional	Medium-term	Frequent	Low	High	Minor
	Medium-sized mammals		Low	Regional	Medium-term	Frequent	Low	Medium	Minor
	Large mammals		Low	Regional	Medium-term	Frequent	Low	High	Minor
	Volent small mammals		Low	Regional	Medium-term	Frequent	Low	High	Minor
	Northern Acacia-Commiphora bushlands and thickets	Improved vehicular access stimulating charcoal production for transport by Project vehicles to local markets, resulting in	Moderate	Local	Medium-term	Frequent	Moderate	Medium	Minor
	Riparian Forest		Moderate	Local	Medium-term	Frequent	Moderate	Medium	Minor

Phase of the Project	Receptor	Source of impact	Magnitude	Geographic extent	Duration	Frequency	Impact classification	Receptor Sensitivity	Impact Consequence
		habitat degradation							
	Invertebrates	Site lighting at night, affecting faunal species movement patterns and foraging habits	Moderate	Regional	Medium-term	Frequent	Moderate	Medium	Minor
	Amphibians		Moderate	Regional	Medium-term	Frequent	Moderate	Medium	Minor
	Medium-sized mammals		Moderate	Regional	Medium-term	Frequent	Moderate	Medium	Minor
	Large mammals		Moderate	Regional	Medium-term	Frequent	Moderate	High	Moderate
	Volent small mammals		Moderate	Regional	Medium-term	Frequent	Moderate	High	Moderate
	Invertebrates	Elevated NO_x beyond project footprint, affecting species survival	Moderate	Local	Medium-term	Frequent	Moderate	Medium	Minor
	Tsavo National Park	Increased traffic in	Low	Local	Medium-term	Infrequent	Negligible	Very High	Minor

Phase of the Project	Receptor	Source of impact	Magnitude	Geographic extent	Duration	Frequency	Impact classification	Receptor Sensitivity	Impact Consequence
	Kinangop Grasslands IBA	Midstream Study Area presenting collision risk to species in protected areas	Low	Local	Medium-term	Infrequent	Negligible	Very High	Minor
	Kikuyu Escarpment Forest IBA		Low	Local	Medium-term	Infrequent	Negligible	Very High	Minor
	Invertebrates	Increased traffic risk in Upstream Study Area presenting collision risk to species receptors	Moderate	Local	Medium-term	Infrequent	Low	Medium	Minor
	Amphibians		Moderate	Local	Medium-term	Infrequent	Low	Medium	Minor
	Terrestrial reptiles		Moderate	Local	Medium-term	Infrequent	Low	Medium	Minor
	Greater Spotted Eagle		Moderate	Local	Medium-term	Infrequent	Low	Very High	Moderate
	Bateleur		Moderate	Local	Medium-term	Infrequent	Low	Medium	Minor
	Vultures		Moderate	Local	Medium-term	Infrequent	Low	Very High	Moderate
	Large ground birds		Moderate	Local	Medium-term	Infrequent	Low	High	Minor

Phase of the Project	Receptor	Source of impact	Magnitude	Geographic extent	Duration	Frequency	Impact classification	Receptor Sensitivity	Impact Consequence
	Medium-sized mammals		Moderate	Local	Medium-term	Infrequent	Low	Medium	Minor
	Large mammals		Moderate	Local	Medium-term	Infrequent	Low	High	Minor
	Volent small mammals		Moderate	Local	Medium-term	Infrequent	Low	High	Minor
	Invertebrates	Gas flares – attraction to light/heat, change in population dynamics, possible mortality	Moderate	Local	Medium-term	Frequent	Moderate	Medium	Minor
	Steppe Eagle		Moderate	Regional	Medium-term	Frequent	Moderate	Very high	Major
	Pallid Harrier		Moderate	Regional	Medium-term	Frequent	Moderate	Medium	Minor
	Bateleur		Moderate	Regional	Medium-term	Frequent	Moderate	Medium	Minor
	Eastern Imperial Eagle	Gas flares – use of stacks as perches for hunting, resulting in injury/ mortality	Moderate	Regional	Medium-term	Frequent	Moderate	Very high	Major
	Greater Spotted Eagle		Moderate	Regional	Medium-term	Frequent	Moderate	Very high	Major
	Saker Falcon		Moderate	Regional	Medium-term	Frequent	Moderate	Very high	Major

Phase of the Project	Receptor	Source of impact	Magnitude	Geographic extent	Duration	Frequency	Impact classification	Receptor Sensitivity	Impact Consequence
	Sooty Falcon		Moderate	Regional	Medium-term	Frequent	Moderate	High	Moderate
	Lesser Kestrel		Moderate	Regional	Medium-term	Frequent	Moderate	High	Moderate
	Martial Eagle		Moderate	Regional	Medium-term	Frequent	Moderate	Very high	Major
	Crowned Eagle		Moderate	Regional	Medium-term	Frequent	Moderate	High	Moderate
	Invertebrates	Produced water ponds attract species receptors; consumption and/or bathing in water has negative health effects	Moderate	Local	Medium-term	Infrequent	Low	Medium	Minor
	Amphibians		Moderate	Local	Medium-term	Infrequent	Low	Medium	Minor
	Terrestrial reptiles		Moderate	Local	Medium-term	Infrequent	Low	Medium	Minor
	Raptors		Moderate	Local	Medium-term	Infrequent	Low	Very High	Moderate
	Vultures		Moderate	Local	Medium-term	Infrequent	Low	Very High	Moderate
	Large ground birds		Moderate	Local	Medium-term	Infrequent	Low	High	Minor
	Medium-sized mammals		Moderate	Local	Medium-term	Infrequent	Low	Medium	Minor

Phase of the Project	Receptor	Source of impact	Magnitude	Geographic extent	Duration	Frequency	Impact classification	Receptor Sensitivity	Impact Consequence
	Volent small mammals		Moderate	Local	Medium-term	Infrequent	Low	High	Minor

4.0 ECOSYSTEMS

4.1 Receptor Sensitivity/Importance

The sensitivity/importance of each priority ecosystem service is ranked according to their importance to beneficiaries' livelihoods, health, safety and culture, and the availability of alternatives to the ecosystem service in the context of the predicted effects. Based on the sensitivities defined in Table 4-1, Table 4-2 presents the sensitivity/importance rating for each receptor group.

Table 4-1: Table 4-1: Ecosystem service receptor importance and sensitivity

Category	Importance and/or sensitivity of the receptor
Low	Ecosystem service is readily substitutable or replaceable[3], there is a high likelihood beneficiaries can adapt to loss in the ecosystem service benefit.
Medium	Ecosystem service is substitutable or replaceable, there is a moderate or partial likelihood beneficiaries can adapt to loss in the ecosystem service benefit. The ecosystem service plays a role in the livelihoods, health, safety and culture of the beneficiaries.
High	Ecosystem service is not readily substitutable, there is a low or limited likelihood beneficiaries can adapt to loss in the ecosystem service benefit. The ecosystem service is important to the livelihoods, health, safety and culture of the beneficiaries.
Very high	Ecosystem service is irreplaceable, beneficiaries are unlikely to be able to adapt to loss in the ecosystem service benefit. The ecosystem service is critical to the livelihoods, health, safety and culture of the beneficiaries.

Table 4-2: Sensitivity/importance of receptors

Receptor Group	Importance and/or sensitivity of the receptor
Provisioning services	
Food – grazing/browsing resources for livestock	High
Food – wild foods	Medium
Medicinal plants	High
Biomass fuel	Medium
Wood and fibre	Medium
Freshwater	High
Cultural services	

[3] Beneficiaries are considered to have viable alternatives to an ecosystem service benefit, if they can obtain the same benefit from (1) a non-ecosystem level solution (e.g. obtain medicine from a clinic in lieu of medicinal plants) or (2) an ecosystem service supplied by another ecosystem (e.g. freshwater from another lugga or source in the area), without unacceptable physical, economic or psychological burden (Landsberg *et al.*, 2013).

Receptor Group	Importance and/or sensitivity of the receptor
Cultural sites (including sacred trees)	Very high
Educational and inspirational values (including elder trees)	High
Regulating services	
Pollination	High
Regulation of water flows and timing	Medium
Soil stability and erosion control	High

4.2 Impact Assessment Classification and Determination of Impact

Table 4-3: Impact classification matrix

Phase of the Project	Receptor	Source of impact	Magnitude	Geographic extent	Duration	Frequency	Impact classification	Receptor Sensitivity	Impact Consequence
Groundworks and installation, and decommissioning	Educational and inspirational values	Road upgrade works causing noise disturbance to beneficiaries	Low	Local	Short-term	Frequent	Negligible	High	Negligible
	Food – grazing/browsing resources for livestock	Deposition of dust on vegetation supplying wild foods and medicinal plants	Low	Local	Short-term	Frequent	Negligible	High	Negligible
	Food – wild foods		Low	Local	Short-term	Frequent	Negligible	Medium	Negligible
	Medicinal plants		Low	Local	Short-term	Frequent	Negligible	High	Negligible
	Regulation of water flows and timing	Changes in surface water runoff and flooding regimes due to the physical presence of project infrastructure/footprint	Low	Local	Short-term	Frequent	Negligible	Medium	Negligible
	Soil stability and erosion control		Low	Local	Short-term	Frequent	Negligible	High	Negligible
	Educational and inspirational values	Changes in the visual amenity of the landscape and people's sense of place, due to construction activities and machinery	Moderate	Local	Short-term	Infrequent	Low	High	Minor
Operation	Food – grazing/browsing resources for livestock	Population influx to nearby settlements, for people seeking to use natural resources for subsistence and livelihoods. Subsequent increases in demand for natural resources, and degradation of ecosystems supplying resources	Moderate	Local	Long-term	Frequent	Moderate	High	Moderate
	Food – wild foods		Moderate	Local	Long-term	Frequent	Moderate	Medium	Minor
	Medicinal plants		Moderate	Local	Long-term	Frequent	Moderate	High	Moderate
	Biomass fuel		High	Local	Long-term	Frequent	High	Medium	Moderate
	Wood and fibre		Moderate	Local	Long-term	Frequent	Moderate	Medium	Minor

Phase of the Project	Receptor	Source of impact	Magnitude	Geographic extent	Duration	Frequency	Impact classification	Receptor Sensitivity	Impact Consequence
	Freshwater supply		Low	Local	Medium-term	Frequent	Low	High	Minor
	Soil stability and erosion control		Low	Local	Medium-term	Frequent	Low	High	Minor
	Freshwater supply – beneficiaries	Long-term abstraction of groundwater for Project	Low	Local	Medium-term	Frequent	Low	High	Minor
	Freshwater supply - Project		Low	Local	Medium-term	Frequent	Low	High	Minor
	Food – grazing/browsing resources for livestock	Deposition of dust on vegetation supplying wild foods and medicinal plants	Low	Local	Short-term	Frequent	Negligible	High	Negligible
	Food - Wild foods		Low	Local	Short-term	Frequent	Negligible	Medium	Negligible
	Medicinal plants		Low	Local	Short-term	Frequent	Negligible	High	Negligible
	Pollination	Elevated NOx beyond project footprint	Low	Local	Medium-term	Frequent	Low	High	Minor
	Educational and inspirational values		Negligible	Local	Medium-term	Frequent	Negligible	High	Negligible
	Wild Foods	Increased traffic presenting collision risk to species that may be hunted for meat	Negligible	Local	Medium-term	Infrequent	Negligible	Medium	Negligible
	Regulation of water flows and timing	Changes in surface water runoff and erosion potential due to the physical presence of project infrastructure/ footprint	Low	Local	Medium-term	Frequent	Low	Medium	Minor
	Soil stability and erosion control		Low	Local	Medium-term	Frequent	Low	Medium	Minor
	Educational and inspirational values	Changes in the visual amenity of the landscape and people's sense of place, due to the physical presence of the Project	Moderate	Local	Medium-term	Infrequent	Low	High	Minor

Table 4-4: Residual impact classification matrix

Receptor	Phase of the Project	Source of impact	Impact classification before mitigation	Mitigation	Magnitude	Geographic extent	Duration	Frequency	Residual impact classification	Receptor Sensitivity	Impact Significance
Food – grazing/browsing resources for livestock	Operation	Population influx to nearby settlements for people seeking to harvest natural resources for subsistence and livelihoods. Subsequent increases in demand for natural resources, and degradation of ecosystems supplying resources	Moderate	▪ Influx management plan ▪ Specialist livestock assessment ▪ Support local communities in developing sustainable herding practises, ecotourism or other activities that provide alternative food sources and income	Low	Local	Medium Term	Frequent	Low	High	Minor
Food – wild foods			High	▪ Influx management plan ▪ Support local communities in developing sustainable herding practises, ecotourism or other activities that provide alternative food sources and income	Low	Local	Medium Term	Frequent	Low	Medium	Minor
Medicinal plants			Moderate	▪ Tullow to support research into a focussed medicinal plant survey within the Upstream Study Area, with a view to mapping and/or propagation of species of particular value ▪ Should degradation be identified, a plan for developing nurseries or similar to improve availability of medicinal plants should be implemented	Low	Local	Medium Term	Frequent	Low	High	Minor
Biomass fuel			High	▪ Supply of cheap fuel alternatives to charcoal	Moderate	Local	Medium Term	Frequent	Moderate	Medium	Minor

Receptor	Phase of the Project	Source of impact	Impact classification before mitigation	Mitigation	Magnitude	Geographic extent	Duration	Frequency	Residual impact classification	Receptor Sensitivity	Impact Significance
				to local markets (e.g. gas, as a by-product of oil production) should be investigated, should biomass fuel supply be significantly affected							
Wood and fibre			High	▪ Influx management plan	Moderate	Local	Medium Term	Frequent	Moderate	Medium	Minor

5.0 SOCIAL IMPACT ASSESSMENT

5.1 Land Use Receptors

Table 5-1: Summary of Land user receptor Importance/Sensitivity

Receptors:	Importance and/or Sensitivity of the Receptor:
Households living in long term homesteads in the study area	**High** – due to the fact that people tend to live in these homesteads all year round, and although the precise location of long term homesteads can vary, households often do not move very far (e.g. within an area of a few hundred metres).
Households living in short term (seasonal) homesteads in the study area	**Medium** – due to the fact that the location of short term seasonal homesteads can vary from year to year, and households do not always return to the same seasonal location.
Households living in very short term (migratory) homesteads in the study area	**Low** – due to the fact that the location of very short term homesteads varies greatly and people only use a homestead for a few nights before moving on.
Users of land in the study area but not living in the study area	**Low** – due to the fact that the study areas are not used intensively and because people also access similar natural resources across other large areas of land outside the study areas.

5.2 Land Effect Evaluation

Table 5-2: Summary on Impacts on Receptors

Receptor:	Importance of receptor/ sensitivity:	Magnitude of effect
Households living in long term homesteads in the study area	High	**Low** – EOPS will have negligible effect on long term homesteads. No homesteads have been observed nor are expected to be located in the future within the modelled noise and NO_2 contours required to meet Project stands.

Receptor:	Importance of receptor/ sensitivity:	Magnitude of effect
		Some existing homestead locations are within areas modelled at NO_2 levels of 50-100 µg/m^3 – although these are significantly lower than the 200 µg/m^3 standard and therefore whilst there would not be health hazards there may be some minor nuisance effects on homesteads resulting from generator exhaust emissions.
Households living in short term (seasonal) homesteads in the study area	Medium	**Negligible** – EOPS will have negligible impact on short term (seasonal) homesteads. No homesteads have been observed nor are expected to be located in the future within the modelled noise and NO_2 contours required to meet Project stands. Some existing short term homestead locations are within areas modelled at NO_2 levels of 50-100 µg/m^3 although these would not be associated with any health hazards there may be some minor nuisance effects on homesteads – however, the impact on short term homesteads would be negligible since these frequently change location in any case depending on other factors such as quality of grazing, insecurity issues.
Households living in very short term (migratory) homesteads in the study area	Low	**Negligible** - EOPS will have negligible impact on very short term (migratory) homesteads. No homesteads have been observed nor are expected to be located in the future within the modelled noise and NO_2 contours required to meet Project stands. Because these very short term homesteads are only used for a few nights, the effects of the NO_2 levels below the Project standard would be negligible.
Users of land in the study area but not living in the study area	Low	**Negligible** - EOPS will have negligible impact on peoples' use of land or use of natural resources because the size and extent of areas outside of well pads where NO_2 standards exceed the project standard is extremely small compared with the extent of land areas and natural resources in the close vicinity of EOPS well pads.

5.3 Impact Assessment Classification and Determination of Impact

Table 5-3: Impact significance matrix

Impact topic	Phase of the Project	Direction	Consequence	Geographic extent	Duration	Impact consequence	Residual impact consequence
Influx and migration	Commissioning/ Operations	Mixed	Moderate	Local	Medium-term	Minor	Minor
Taxes and other payments	Commissioning/ Operations	Mixed	Low	National	Medium-term	Positive	Positive
Contract (indirect) employment	Commissioning/ Operations	Mixed	Moderate	Regional	Medium-term	Positive	Positive
Business opportunities and local content	Commissioning/ Operations	Mixed	Moderate	Regional	Medium-term	Positive	positive
Inflation	Commissioning/ Operations	Negative	Low	Local	Short-term	Minor	Minor
Road traffic accidents and injuries	Commissioning/ Operations	Negative	Moderate	Local	Medium-term	Moderate	Minor
Sexually transmitted infections	Commissioning/ Operations	Negative	Moderate	Regional	Long-term	Moderate	Minor
Project Induced In-migration (Health)	Commissioning/ Operations	Negative	Low	Local	Medium-term	Minor	Minor

Impact topic	Phase of the Project	Direction	Consequence	Geographic extent	Duration	Impact consequence	Residual impact consequence
Camp facilities management	Commissioning/ Operations	Negative	Low	Local	Medium-term	Minor	Negligible
Environmental modification and vector-related disease	Commissioning/ Operations	Negative	Low	Local	Medium-term	Minor	Negligible
Social maladies	Commissioning/ Operations	Negative	Moderate	Local	Medium-term	Moderate	Minor
Inter-ethnic conflict	Commissioning/ Operations	Negative	Low	Local	Medium-term	Minor	Minor
Community cohesion in Turkana County	Commissioning/ Operations	Negative	Moderate	Local	Medium-term	Moderate	Minor

6.0 CULTURAL HERITAGE

6.1 Receptor Sensitivity

Table 6-1 details the considerations for determining the sensitivity of cultural heritage receptors.

Table 6-1: Considerations for determining receptor sensitivity for cultural heritage

Importance/ sensitivity of receptor	Example of sensitivity of cultural heritage receptors
Very high	Cultural sites of international or national importance with significant cultural or touristic value. Sites which cannot be moved because they are natural features and are critical[4] and/or rare at the national or international level. Intangible cultural heritage with the greatest social[5] and/or historic[6] and/or scientific[7] and/or environmental[8] value. Intangible cultural heritage which is recognised and designated at a national or international level. Intangible cultural heritage endemic to a certain place or group of people (and therefore 'rare'), and which is widely representative of that specific toponym or group. Intangible cultural heritage which is non-replicable. Archaeological and historic sites of national or international importance, with the highest potential for further, significant discoveries to be made. Archaeological and historic sites with rare and/or previously unstudied or understudied features with a high potential for crucial further research. Archaeological and historic sites which are afforded protection and where no intrusion is permitted.
High	Cultural sites of national or regional importance with significant cultural value. Non-replicable cultural sites which are not critical and/or rare, or cultural sites which are potentially replicable and which could be moved in highly exceptional circumstances (in consultation with the affected communities). Intangible cultural heritage with significant social and/or historic and/or scientific and/or environmental value. Intangible cultural heritage which is endemic to a certain place or group of people (and therefore 'rare'), and which is representative of a significant proportion of that specific toponym or group. Non-replicable intangible cultural heritage or that which are difficult to replicate. Archaeological and historic sites of regional or national importance, with high potential for further discoveries to be made. Archaeological and historic sites with understudied features and/or high potential for further research.
Medium	Cultural sites of local importance with significant cultural value. Cultural sites which are replicable and which can be moved in certain extenuating circumstances (in consultation with the effected communities). Intangible cultural heritage with social and/or historic and/or scientific and/or environmental value. Intangible cultural heritage which is common and widely representative of the

[4] 'Critical cultural heritage consists of one or both of the following types of cultural heritage: (i) the internationally recognized heritage of communities who use, or have used within living memory, the cultural heritage for long-standing cultural purposes; or (ii) legally protected cultural heritage areas, including those proposed by host governments for such designations' (IFC, 2012a).

[5] Value to society in the present.

[6] Value to our understanding of the human past.

[7] Value to our understanding of people and their environment.

[8] Value to our understanding of the environment.

Importance/ sensitivity of receptor	Example of sensitivity of cultural heritage receptors
	population as a whole, and therefore potentially replicable, through community engagement. Archaeological and historic sites of local importance, with some potential for further discoveries to be made. Archaeological and historic sites with features which have been comprehensively studied and/or are poorly preserved, with limited potential for further research.
Low	Cultural sites of limited local importance and cultural value. Cultural sites which are defunct and/or have little or no historic value. Cultural sites which are replicable and which can be moved, or destroyed (in consultation with the affected communities). Intangible cultural heritage with limited social and/or historic and/or scientific and/or environmental value. Intangible cultural heritage which is common and widespread, but only representative of a limited proportion of the population. Intangible cultural heritage which has the greatest potential to be replicated, through community engagement. Archaeological and historic sites of limited local importance, with low or no potential for further discoveries to be made. Archaeological and historic sites with features which have been comprehensively studied and/or are poorly preserved/destroyed, with no potential for further research.

6.2 Magnitude of Effect Criteria (Expanded Definitions)

Expanded definition of low magnitude:

- ‘Living’ cultural heritage receptors, or component parts thereof, are altered such that their value and/or functionality/setting/accessibility are slightly changed, but no modification of receptor use is required;
- Intangible cultural heritage receptors are slightly changed, but traditional beliefs, practices or behaviours are not modified; and
- Archaeological receptors or their settings are slightly altered, but their integrity is maintained or archaeological receptors are altered but no information is lost (through archaeological excavation and recording).

Expanded definition of moderate magnitude:

- ‘Living’ cultural heritage receptors, or component parts thereof, are altered such that their value and/or functionality/setting/accessibility are changed, and modification of receptor use is required;
- Intangible cultural heritage receptors are changed, and traditional beliefs, practices or behaviours are modified; and
- Archaeological receptors or their settings are altered and key elements are changed such that the resource value is modified and/or information is lost.

Expanded definition of high magnitude:

- ‘Living’ cultural heritage receptors, or component parts thereof, are altered, removed or damaged such that their value and/or functionality/setting/accessibility are entirely changed or lost. Receptor use is prevented, or significantly limited;

- Intangible cultural heritage receptors are entirely changed, and traditional beliefs, practices or behaviours cannot continue and are lost, or are severely inhibited; and
- Archaeological receptors or their settings are altered and key elements are changed such that the resource value is entirely altered or lost.

6.3 Impact Assessment Classification and Determination of Impact

Table 6-2: Impact classification matrix

Receptor	Phase of the Project	Source of impact	Magnitude	Geographic extent	Duration	Frequency	Impact classification	Receptor Sensitivity	Impact Consequence
Archaeology									
TR-006 (Burial)	All Phases (Groundworks/Installation and Operations and Decommissioning)	All sources of impact (AQ, Noise and Visual)	Negligible	Local	Medium-term	Infrequent	Negligible	High	Negligible
TR-007 (Burial)	All Phases (Groundworks/Installation and Operations and Decommissioning)	All sources of impact (AQ, Noise and Visual)	Negligible	Local	Medium-term	Infrequent	Negligible	High	Negligible
Living Cultural Heritage									
TR-001 (Lokichar Mosque)	All Phases (Groundworks/Installation and Operations and Decommissioning)	All sources of impact (AQ, Noise and Visual)	Negligible	Local	Medium-term	Infrequent	Negligible	Medium	Negligible
TR-002 (Full Gospel Church of Kenya)	All Phases (Groundworks/Installation and Operations and Decommissioning)	All sources of impact (AQ, Noise and Visual)	Negligible	Local	Medium-term	Infrequent	Negligible	Medium	Negligible
TR-011 (Kapenguria Cells)	All Phases (Groundworks/Installation and Operations and Decommissioning)	All sources of impact (AQ, Noise and Visual)	Negligible	Local	Medium-term	Infrequent	Negligible	High	Negligible
TR-013 (Italian Church for Prisoners of War)	All Phases (Groundworks/Installation and Operations and Decommissioning)	All sources of impact (AQ, Noise and Visual)	Negligible	Local	Medium-term	Infrequent	Negligible	High	Negligible
Intangible Cultural Heritage									

Receptor	Phase of the Project	Source of impact	Magnitude	Geographic extent	Duration	Frequency	Impact classification	Receptor Sensitivity	Impact Consequence
Turkana Culture	All Phases (Groundworks/Installation and Operations and Decommissioning)	All sources of impact (AQ, Noise and Visual)	Negligible	Local	Medium-term	Infrequent	Negligible	Very High	Minor
Nomadic pastoralism	All Phases (Groundworks/Installation and Operations and Decommissioning)	All sources of impact (AQ, Noise and Visual)	Negligible	Local	Medium-term	Infrequent	Negligible	Very High	Minor
Use of the local environment for subsistence	All Phases (Groundworks/Installation and Operations and Decommissioning)	All sources of impact (AQ, Noise and Visual)	Negligible	Local	Medium-term	Infrequent	Negligible	Very High	Minor

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