REPORT

Tullow Kenya B.V.

Early Oil Pilot Scheme Phase II - Environmental and Social Impact Assessment: Volume 1

Submitted to:

Tullow Kenya B.V.
7th Floor
West End Towers
Waiyaki Way
P O Box 63298-00619
Nairobi
Kenya

Submitted by:

Golder Associates (UK) Ltd
Cavendish House, Bourne End Business Park, Cores End Road,
Bourne End, Buckinghamshire, SL8 5AS, UK

+44 0 1628 851851

1654017.718/A.6

November 2018

SIGNATURE PAGE

Prepared by:

EMC Consultants Limited

Shelter Afrique Centre, 3rd floor Wing 3A
Longonot Road, Upperhill
P.O.Box, 9648-00100, NAIROBI

Landline:+254-020-520-6162
Cell: +254-722-579272
tito@emconsultants.org

Signature: _____

Designation: Principal Director

Date: 27th November 2018

EMC CONSULTANTS LTD. 27 NOV 2018 P.O. BOX 54117 - 00200 NAIROBI

For and on Behalf of:

TKBV B.V.

West End Towers, Waiyaki Way,

P.O. Box 63298 – 00619 Nairobi, Kenya.

Telephone: Tel: + 254 (020) 428 6000

Email: info@tullowoil.com

Signature: _____

Designation: DEVELOPMENTS DIRECTOR

Date: 28/NOV/2018

TULLOW KENYA B.V. TULLOW OIL Tel: 020 428 6000 Fax: 0703 036 171

Distribution List

EMC - 1 copy (PDF)

TKBV Kenya BV - 1 copy (PDF) and 7 copies (paper)

NEMA - 1 copy (pdf) and 7 copies (paper)

Golder Associates (UK) Ltd - 1 copy (PDF)

GLOSSARY

ADM	Air Dispersion Modelling
AEWA	African-Eurasian Water-bird Agreement
AOC	Africa Oil Corporation
AQS	Air Quality Standard
ATF	Automatic Transmission Fluid
BMP	Biodiversity Management Plan
Bpd	barrels per day
CadnaA	Computer Aided Noise Attenuation
CEC	County Environmental Committees
CIDP	County Integrated Development Plan
CO	Carbon Monoxide
CRC	Community Resource Centres
CSO	Community Support Officer
CSW	Commercial Sex Worker
dBA	A-weighted decibels
DMRB	Design Manual for Roads and Bridges
E&A	Exploration and Appraisal
EBA	Endemic Bird Area
ECD	Early Childhood Development
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EIAAR	Environmental Management and Coordination Act Impact Assessment and Audit Regulations
EITI	Extractive Industry Transparency Initiative
EMC	EMC Consultants Ltd.
EMCA	Environmental Management and Coordination Act
EMP	Environment Management Plan
EOPS	Early Oil Pilot Scheme
EPF	Early Production Facility
ERC	Energy Regulatory Commission
ESD	Emergency Shut Down

EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EWT	Extended Well Test
FAO	Food and Agriculture Organization
FBO	Faith-based Organisations
FFD	Full Field Development
FSEO	Field Stakeholder Engagement Officer
GBIF	Global Biodiversity Information Facility
GIIP	Good International Industry Practice
GIS	Geographic Information System
GoK	Government of Kenya
HDPE	High Density Polyethylene
HDPE	High-Density Polyethylene
IAQM	Institute of Air Quality Management
IBA	Important Bird Area
IBAT	Integrated Biodiversity Assessment Tool
ICD	Inland Container Depot
IFC	International Finance Corporation
ILRI	International Livestock Research Institute
IPIECA	International Petroleum Industry Environmental Conservation Association
ISB	Integrated Support Base
ITCZ	Inter-Tropical Convergence Zone
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Area
KeNHA	Kenya Highways Authority
KII	Key Informant Interview
KIOSH	Kenya Institute of Safety and Health
KJV	Kenya Joint Venture
KPRL	Kenya Petroleum Refineries Ltd
KSh	Kenyan Shillings

KWS	Kenya Wildlife Service
LAeq	Equivalent Noise Level
LAP	Land Access & Resettlement Framework
LAPSSET	Lamu Port South Sudan Ethiopia Transport Corridor
LCA	Landscape Character Area
LOD	Limit of Detection
LoS	Level of Service
LSA	Local Impact Assessment Study Area
LSA	Local Study Area
MAWP	Maximum Allowable Working Pressure
MCA	Members of the County Assembly
MSCF/d	One thousand standard cubic feet per day
MWI	Ministry of Water and Irrigation
NCC	National Complaints Committee
NEC	National Environmental Council
NED	National Environmental Department
NEMA	National Environment Management Authority
NET	National Environment Tribunal
NGO	Non-Governmental Organisation
NMK	National Museums of Kenya
NNL	No-Net-Loss
NO_2	Nitrogen Dioxide
NTR	Non-Technical Risk
NTS	Non-Technical Summary
O_3	Ozone
ORP	Oxygen Redox Potential
PAH	Poly-aromatic Hydrocarbon
PAP	Project Affected People
PAYE	Pay As You Earn
PC	Process Contribution
PCP	Progressive Cavity Pumps

PEC	Predicted Environmental Concentration
PM	Particulate Matter
ppm	parts per million
PSC	Production Sharing Contract
RSA	Regional Impact Assessment Study Area
RTA	Road Traffic Accidents
SEP	Stakeholder Engagement Plan
SERC	Standard and Enforcement Review Committee
SLM	Sound Level Meter
SO_2	Sulphur Dioxide
SSA	Specific Site Assessment
SSEA	Safety, Sustainability and External Affairs
STD	Sexually Transmitted Disease
STI	Sexually Transmitted Infection
TCG	Turkana County Government
TDS	Total Dissolved Solid
TIA	Traffic Impact Analysis
ToR	Terms of Reference
TPH	Total Petroleum Hydrocarbon
TPM	Total Particulate Matter
TR	Transport Route
TSP	Total Suspended Particles
TTMP	Traffic and Transport Management Plan
TVP	True Vapour Pressure
VAT	Value Added Tax
VCT	Voluntary Counselling and Testing
VOC	Volatile Organic Compound
VPSHR	Voluntary Principles on Security and Human Rights
VSO	Village Socialisation Officer
WCMA	Wildlife Conservation and Management Act
WHO	World Health Organisation

WRA	Water Resources Authority
WRI	World Resources Institute
WRMA	Water Resource Management Authority
ZTV	Zone of Theoretical Visibility

NON-TECHNICAL SUMMARY

Introduction

Tullow Kenya B.V. (TKBV) is evaluating the development of a series of oil discoveries made in the South Lokichar Basin, northwest Kenya. This document is the Non-Technical Summary (NTS) of the Environmental and Social Impact Assessment (ESIA) for Phase 2 of the Early Oil Pilot Scheme (EOPS), referred to here as 'the Project'. This document describes the main features of the Project, presents the current environmental and social conditions in the Project area and discusses the potential environmental and social impacts associated with the Project, as well as mitigation and management measures that are proposed to avoid or minimise adverse impacts and enhancement measures proposed to maximise beneficial impacts.

Background

The proposed EOPS represents an initial phase in the full commercialisation of the hydrocarbon resources that have already been discovered in the South Lokichar Basin. These resources will be fully developed during the Full Field Development (FFD) phase.

The EOPS Project is divided into two stages. Phase 1 covers the existing trucking of stored crude oil produced during the Extended Well Testing (EWT) carried out during the exploration and appraisal phase, which is covered under the existing EWT EIA licenses. Phase 2 will cover the installation of EOPS facilities, the production of limited quantities of crude oil from existing wells at Amosing and Ngamia fields and the operation of the EOPS Early Production Facility (the oil production is also known as the Upstream component of the Project, hereafter, Upstream). The oil will then be transported, using existing road infrastructure, to Mombasa for storage (the transport of the crude oil occurs in what is known as the Midstream component of the Project). No additional land will be required for realisation of the EOPS Project.

The EOPS ESIA addresses Phase 2 only. Within this document, where the term EOPS is used this refers exclusively to Phase 2 (unless explicitly stated).

The Project will be implemented by the Kenya Joint Venture (KJV): TKBV., Africa Oil Corporation and Total Oil, with support from Kenya Highways Authority (KeNHA), Kenya Petroleum Refineries Limited (KPRL) and the Government of Kenya (GoK).

Policy and Legislation

The ESIA has been prepared to meet Kenyan regulatory requirements in order to obtain necessary national approvals from the National Environment Management Authority (NEMA). For the topics assessed, the ESIA has been developed to be in-line with international standards (i.e. IFC Performance Standards on Environmental and Social Sustainability (2012) and IFC's General Environmental, Health and Safety (EHS) Guidelines (2007a, 2007b)). The ESIA also conforms to Tullow's corporate EHS standards and policies.

NEMA is the administrative body that is responsible for the coordination of environmental management activities in Kenya. NEMA is also the principal government authority for implementing all environmental policies and is responsible for reviewing and approving ESIAs.

Stakeholder Engagement

Stakeholder engagement has been undertaken to ensure that legal requirements are met, sources of information and expertise are identified, stakeholder concerns and expectations are registered and addressed and affected communities have the opportunity to discuss Project risks, impacts and proposed mitigation and monitoring measures.

The EOPS ESIA Scoping Consultations were initiated in May 2016 and included a series of meetings to disclose EOPS and to explain the ESIA process to key stakeholders. Consultations were held with the government,

international organisations, the regional media and international, national and regional NGOs. During the Scoping Consultations, a total of 212 issues, questions and concerns were documented. The following represents the most frequently raised issues (% of total issues in parenthesis):

- Engagement – 21%;
- Environment (including water, traffic, air quality and climate, biology, restoration/reinstatement, and pollution/waste) – 16%;
- General Project Updates/Enquiries – 16%;
- Community Aspects – 11%;
- General ESIA Enquiries – 11%; and
- Land Access and Acquisition – 5%.

The EOPS ESIA Consultations were started in June 2018. Interruptions to operations at the Kapese Camp then forced the majority of the meetings to be postponed until late September 2018. In each meeting, the consultation team sought to:

- Provide information on the EOPS Project and review the EOPS ESIA process to key stakeholders;
- Explain how the ESIA approach addressed both national regulations and international lender requirements;
- Document issues, questions and concerns; and
- Solicit feedback from key national and regional stakeholders for future consultation.

During the meetings, a total of 327 issues, questions and concerns were documented. The following represents the most frequently raised issues (% of total issues in parenthesis):

- Community Aspects (health, safety and security, benefits, cultural heritage and social maladies) - 21%;
- Environment (including water, air quality, biology, pollution, traffic, visual and soil) – 20%;
- Engagement – 18%;
- Project Updates/Inquiries – 14%;
- ESIA General Inquiries – 7%;
- National Content – 6%;
- Land Access & Acquisition – 6%; and
- Security – 4%.

Impact Assessment Methodology

The ESIA process provides an opportunity to ensure that commitments can be made and designs can be developed to minimise potential negative environmental and social impacts and maximise positive impacts. The following describes the key phases of an ESIA project.

- Scoping stage: The aim of scoping is to determine which impacts should become the main focus of the ESIA. Scoping also identifies data availability, data gaps and suitable data gathering methods. The primary output is the Terms of Reference for the ESIA, which is approved by NEMA and defines the contents and approach to the ESIA, plus a supporting Project (Scoping) Report.

- Baseline: A baseline report describes baseline data collection, which is undertaken to characterise the existing environmental and social conditions within a defined study area, and to identify trends in such conditions.
- Impact Assessment: The impact assessment process comprises the following main stages:
  - Identification of receptors (e.g. receiving environment, ecosystems or communities) that could be affected by the Project and study areas or areas of influence that the Project may have;
  - Analysis of effects on receptors using modelling or other analyses to determine the magnitude of the effect of the Project and different aspects of the environment;
  - Impact determination and classification using a standard methodology;
  - Development of mitigation measures and management processes; and
  - Where necessary, analysis of residual effects, which incorporate proposed mitigation or management.
- Environment and Social Management Plans: A series of documents which define the commitments to mitigation and management by the Project proponent to minimise negative effects and maximise benefits of the Project.

Summary of Existing Environmental and Social Conditions

Introduction

The ESIA baseline describes in detail the existing environmental and social conditions in the Project area and likely area of influence, so that impacts can be predicted with reference to the existing situation and so that the pre-project situation has been recorded for management and monitoring purposes throughout the Project's life.

Climate

Meteorological stations established at Kapese Camp and the Ngamia oil field are located approximately 80 to 100 km south of Lodwar, which is the primary reference station, and provides historic context (with a dataset of 34 years), as well as an understanding of meteorological trends.

The Upstream area has a warm desert climate with high average temperatures (>20°C) and little change in temperature throughout the year. Humidity is relatively low in the dry season (<30%) and much higher in the wet season (>50%). There are two rainy seasons, one between April and June and the other between October and December. Wind speeds are generally low with little variation throughout the year. Winds are predominantly easterly in direction. The measurements from the on-site meteorological stations, as well as the Lodwar dataset, are reflective of the meteorological conditions within the Upstream area.

Soils, Geology and Seismicity

Soils in the Upstream area are generally nutrient-poor and prone to rapid erosion by wind and water. Soils contain very few rocks or stones and are generally sandy with very little organic content.

Air Quality

Baseline air quality data (dust, emissions and particles in the air or particulates) was undertaken at Amosing, Ngamia, Kapese Camp and Lokichar. For the majority of emissions, the baseline values are lower than Air Quality Standards (AQS). The baseline values for particulates are higher than the AQS, indicating that the levels of particulates are high in the Upstream area, possibly due to anthropogenic activities.

The Traffic Impact Analysis (TIA) did not indicate that baseline air quality data would need to be collected along the EOPS road route (the Midstream component), due to the relatively low number of additional vehicle movements associated with the Project.

Noise and Vibration

Baseline data gathering was completed during three separate field surveys in four monitoring locations (Lokichar, Amosing, Ngamia and Kapese Camp). Noise data was gathered to calculate an average daytime and night time noise level for each of the four locations.

Noise levels are generally low and dominated by natural noise sources, such as watercourses and wind blowing through vegetation. Higher noise levels were recorded in Lokichar, where noise from human activities, including road traffic, human interaction and light engineering/construction activities, contributed to the baseline noise levels.

Vibration sources in the environment are limited to road traffic, which only affects the area immediately next to the source. Baseline vibration levels were not measured but are assumed to be similar to the natural environment.

Taking the results of the TIA into consideration, it was considered that baseline noise surveys would not be required along the EOPS road route.

Water Quantity

Groundwater is typically encountered at 5 m to 20 m below ground level and groundwater flows towards the northeast, which corresponds with drainage towards the Kalabata (the main water course in the Project area).

Surface water does not flow in luggas (local term for ephemeral water courses) all year round; it only flows periodically, following intense rainfall events and there was no known existing flow data for luggas.

Field survey work completed by Golder gathered surface water level data in the Kalabata River, which was interpreted into flow data using hydrological techniques. Data was also gathered on infiltration rates. Using this information, it was estimated that for the Kalabata catchment approximately 23% of rainfall forms surface water flow in the river and the rest of the rainfall either infiltrates, evaporates or is lost to other sources.

Water Quality

Water quality across the study area can be described as good with no inexplicable exceedances of water quality standards. Levels of fluoride and chloride were naturally higher than water quality standards due to rock type and natural environment conditions. Metals and hydrocarbons were low. Surface water and groundwater samples have a typical temperature of 30°C to 35°C. Surface water samples and groundwater samples have neutral pH (i.e. they are not strongly acidic or alkaline).

Landscape and Visual

The aesthetic quality of the landscape was ascertained through the baseline study. The landscape is predominantly desert, with some denser vegetation and rockier terrain on higher ground.

The desktop analysis identified 14 homesteads that had the potential to be visually impacted by EOPS. A photographic field assessment was subsequently carried out to record the views from these locations.

Biodiversity, Ecology and Protected Areas

Golder completed a number of field surveys (vegetation, invertebrates, reptiles, mammals and birds) to characterise the biodiversity baseline. Kenyan specialists worked with Golder specialists to develop an understanding of the existing ecological environment.

Three distinct vegetation types were identified – bushland/thicket, riparian forest and wooded ephemeral streams. A wide range of invertebrates were identified, particularly in the riparian forest and wooded ephemeral streams, as well as 14 reptile species, one amphibian species, 29 mammal species and numerous bird species (over 100).

Along the EOPS road route, it was identified that three internationally and/or nationally designated or protected areas will be traversed by the proposed route: Kinangop Grasslands Important Bird Area (IBA), Kikuyu Escarpment IBA, and Tsavo West National Park and IBA.

Ecosystem Services

Ecosystem Services are natural products and processes that contribute to human well-being and the personal and social enjoyment derived from nature.

The ecosystem services data was captured during the baseline surveys for biophysical and social disciplines and, in combination with existing datasets, has been used to develop the ecosystem services baseline. Key features include:

- Three broad vegetation communities exist in the Upstream area, which have been affected by a combination of human and natural factors;
- The keeping of livestock is the dominant livelihood in the Upstream area, and therefore the dominant ecosystem service is 'provisioning services' (i.e. using the environment to provide resources to support pastoral activities, such as grazing);
- Trees are socially important and form an integral part of Turkana culture; and
- The Project is reliant on a number of ecosystem services, including the continued regulation of water flows.

Social

The social baseline used literature research and key informant interviews to develop an understanding of the social environment under nine different elements: 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 Conflicts.

The vast majority of land within the South Lokichar area is unregistered, community land. The most recent census (2009) counted a total population of 855,399 in Turkana County. The census also indicated that 86% of people identifying as of Turkana ethnicity reside within Turkana County.

The infrastructure and service provisions of Turkana County, including waste management and access to power and potable water, are generally poor. In addition, the low literacy levels (22.2%) across the County can be attributed to diverse causes.

The majority of Turkana County depends on nomadic pastoralism (i.e. raising livestock nomadically across the landscape). Cultivation of crops, fishing and weaving are also common sources of income. Efforts are being made to encourage diversification, primarily through activities complementary to pastoralism, such as livestock trading.

Many of the health indicators reflect the poor access to, or utilisation of, public healthcare facilities at the County level. The most common diseases are malaria, respiratory infections, diarrhoeal diseases, malnutrition and HIV/AIDS. Road traffic accidents (RTAs) and domestic or other forms of violence are of particular relevance in this setting.

Inter-ethnic conflict has been a concern, related to access to land, grazing areas, boundary disputes, and cattle rustling.

Cultural Heritage

The status of cultural heritage in the Project area was established through a combination of a desk-based study, key informant interviews (KIIs) and a field survey.

53 archaeological discoveries were made in the Upstream area, with 26 at Amosing and 27 at Ngamia. These were all pottery and stone tool scatters. The number and density of individual artefacts was higher at Ngamia than at Amosing. Eleven archaeological sites were identified in the Midstream area, comprising seven undated burials and four monuments recorded in the National Museums of Kenya (NMK) archives.

No living cultural heritage sites were recorded in the Upstream area, and five were recorded in the Midstream area (three churches, one mosque and a former colonial era prison).

Elements of intangible cultural heritage were recorded in the Upstream area, including general Turkana culture, nomadic pastoralism and the use of the local environment for subsistence.

Traffic

Existing background traffic data along the route was obtained from the Kenya National Highways Authority (KeNHA) and Golder Teams collected additional data during field surveys at 10 locations along the proposed transport route. Golder used an internationally recognised criterion of Project traffic contributing ≥5% of road design capacity to define where field survey and impact analyses needed to focus. The section of the route between Amosing and Eldoret was identified as being the most sensitive to potential Project effects and this was the area where effort was subsequently focussed.

Traffic counts and road conditions were recorded along the route between Amosing and Eldoret and the existing Level of Service (LoS) was found to be good along the route, with congestion in Kitale during the peak hours.

Project Description

The Project is located in Turkana County, in South Lokichar, with proposed infrastructure located in the two sub-county administrative units, or Constituencies, of Turkana East and Turkana South, within land where TKBV is currently permitted to undertake exploration activities under exploration permit no. PR 7764/0001253.

The proposed EOPS Project represents an initial phase in the full commercialisation of discovered hydrocarbon resources (otherwise known as Full Field Development). EOPS involves the production of limited quantities of crude oil from existing wells at the Amosing and Ngamia fields in South Lokichar. No additional land will be required to realise the EOPS Project.

An Early Production Facility (EPF) will be located at the Amosing-1 wellpad to de-gas and stabilise the oil, before being loaded into tanktainers and transported by road to KPRL facilities in Mombasa for storage and subsequent sale on the international oil market. EOPS is planned to last approximately two years. The Project location is presented in Figure 1 (Upstream and Midstream) and Figure 2 (Upstream) and summarised schematically in Figure 3. Degassing, storage and truck loading facilities will be located in each of the Ngamia sites (Ngamia 3, 6 and 8).

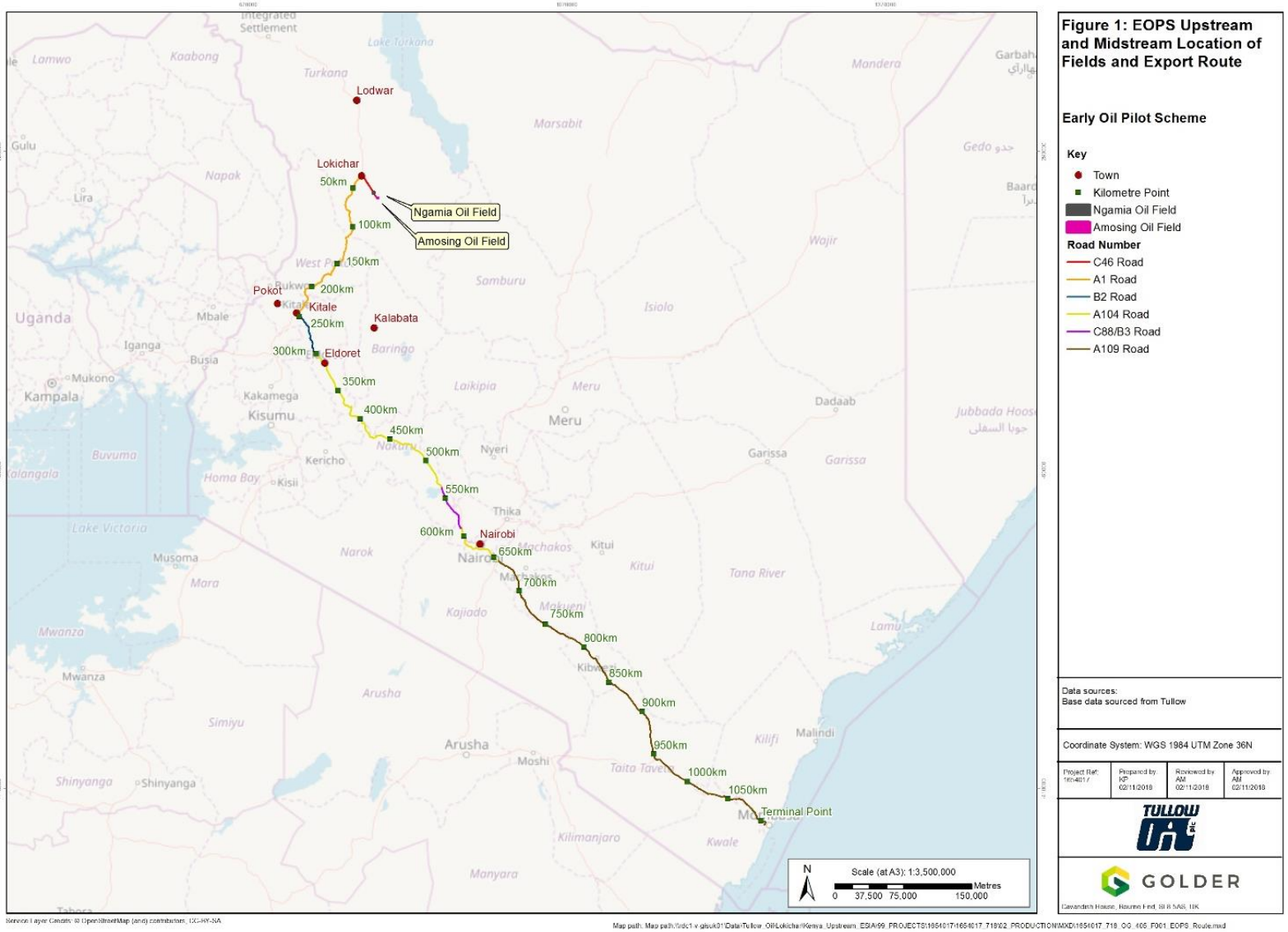


Figure 0-1: Upstream and Midstream Locations

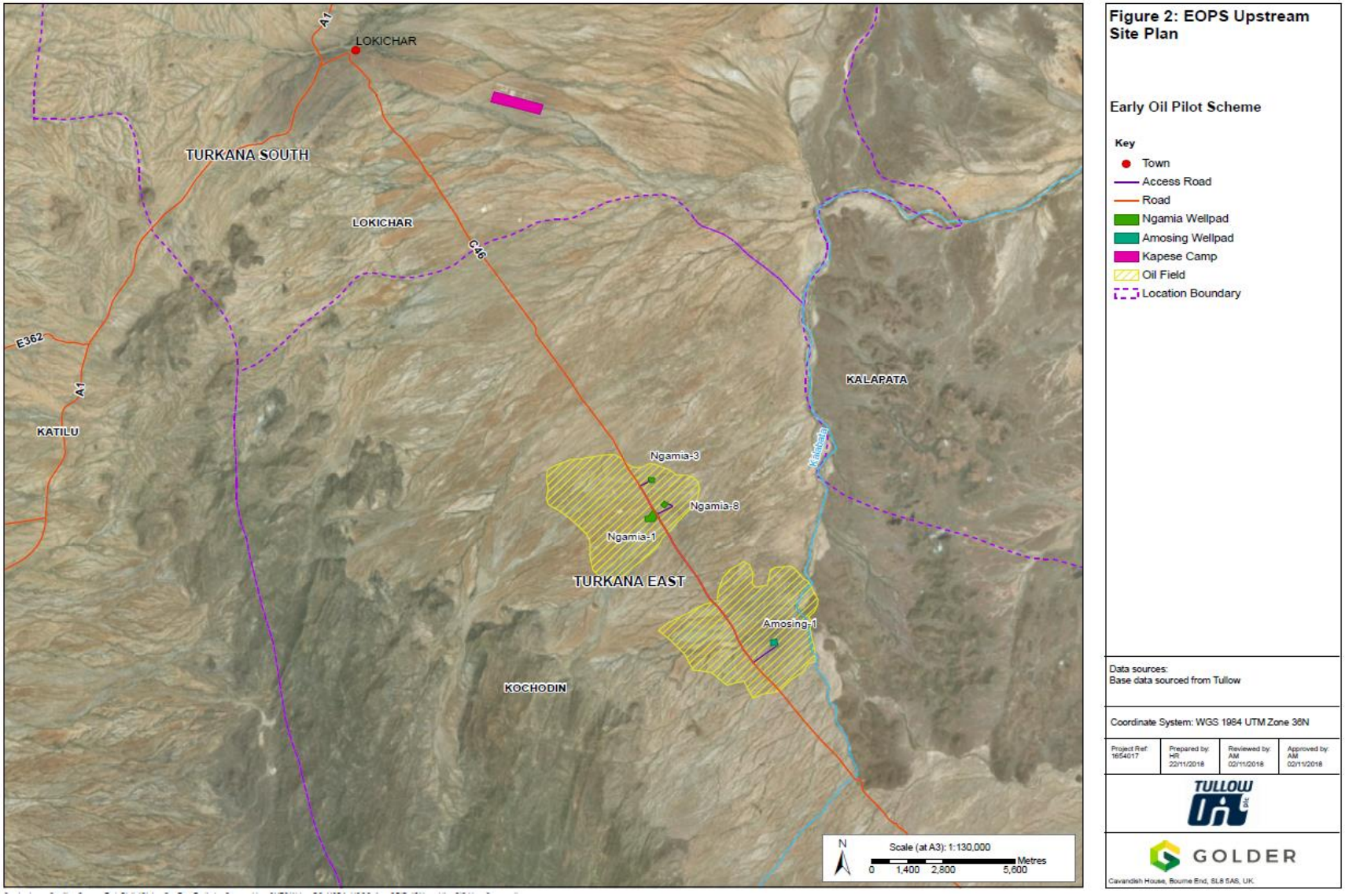


Figure 0-2: Upstream Location Plan

Groundworks and Maintenance

Existing wellpad site preparation activities will require minor earthworks of grading, compaction and installation of foundations for the equipment and drainage. Some groundworks and maintenance are permitted under the existing exploration permits and will be undertaken in advance of EOPS and will take approximately 3 months to complete.

Traffic movements and weathering at the existing wellpads and on the access roads may result in the road surface becoming loose and rutted. Infield roads will therefore be re-graded and then re-compacted. The C46 road to the EPF at the Amosing-1 wellpad junction will be surfaced by KeNHA by laying a bitumen seal; a process that is outside of the scope of the ESIA and has been permitted separately.

Infrastructure and Operation

Amosing-1: Early Production Facility (EPF) and Wellpad

A single EPF will be located at the Amosing-1 wellpad and will carry out the required processing of the produced fluids from the Amosing production wells (Amosing-1 and Amosing-2A), plus the degassed fluids from the Ngamia satellite degassing units. The incoming infield tankers from the Ngamia wellpads will offload the partially stabilised crude/water into a storage tank at Amosing-1 wellpad, before being pumped into the EPF. The EPF separates the water and stabilises the oil for storage. The produced water will be stored in a settling tank before being pumped to an onsite evaporation pond at Amosing-1. The design is expected to utilise the available produced gas for all power generation and process heating requirements. Any excess gas will be sent to a flare at the Amosing-1 wellpad.

Amosing-5 Contingency Evaporation Wellpad

The evaporation capacity at the Amosing-1 evaporation pond is expected to be sufficient at the commencement of the operations, however it might be necessary for excess produced water to go to an evaporation pond located at the Amosing-5 wellpad.

Management of Produced Gas

Any excess gas at Amosing-1 that is not used for power generation will be sent to a vertical flare. At each of the Ngamia wellpads all the associated gas will be sent to a vertical flare (9 metres high). There will be the same Micoda vertical flares at all four locations, with one flare at each location. The flare system is designed to safely dispose of hydrocarbon gases released from both the degassing wellpads and generated at the EPF during both normal operation and under emergency situations.

Storage Tanks

There are nine existing crude storage tanks at the Amosing-1 wellpad, each of nominal 5,000 barrel capacity. Of these, six will not be used for EOPS and three will be used for contingency storage or produced water storage.

In addition, seven 400 barrel bitutainers will be installed at Amosing-1 wellpad. All the bitutainers will be the primary storage for the processed crude, except one tank, which will also be used for temporary storage of crude oil which does not meet the correct specification.

At the Ngamia wellpads, the existing and new crude storage tanks will be used as contingency storage if required. At each Ngamia wellpad, there will be two bitutainers to which the degassed oil/water will flow.

Water

The water demand during site preparation will not exceed the existing permitted abstraction rates from existing TKBV water boreholes (Nakukulas 9 and Ngamia East). The existing permit to abstract was approved by the Water Resource Management Authority (WRMA) and will be valid for the duration of the EOPS Project.

During site preparation, water will be used for soil compaction, dust suppression and hydrotesting the tanks. Water demand for offices/cabins at wellpads associated with EOPS will be of a minimal quantity of 10-20 m^3/day.

Power Generation and Supply

Each wellpad requires power on a standalone basis for the production wells, PCPs, well heating and other power requirements associated to the wellpad. At Amosing-1, gas produced through degassing from the wells will be used for power generation and process heating. Supplementary power and heating may be required depending on the volume of gas available. At Amosing-1 wellpad, the first three months of operation will be powered by a diesel generator to allow TKBV to assess the volume and composition of the produced gas. In addition, during the remaining months of operation, a back-up diesel generator will be used to provide uninterruptable emergency power supplies to allow for Emergency Shut Down (ESD) and controlled shutdown.

At the Ngamia wellpads, it is anticipated that only low volumes of gas will be produced, as such, a gas engine will not be feasible and diesel generators will be required for power generation.

Hazardous and Non-hazardous Materials

A total of 2 trucks will be required per month to transport hazardous materials (such as chemicals) and other equipment to the Amosing and Ngamia wellpads. All hazardous materials will be stored in designated areas with adequate secondary containment.

Waste Management

Solids generated from preparatory ground works will be segregated and stored on site and collected by a NEMA accredited contractor for disposal. No hazardous waste is anticipated for the civil works. During groundworks and installation, it is envisaged that portable toilets will be used and all waste water will be treated at the site, and only treated water meeting NEMA effluent discharge standards will be discharged to the environment. No untreated liquid waste products will be discharged to the environment.

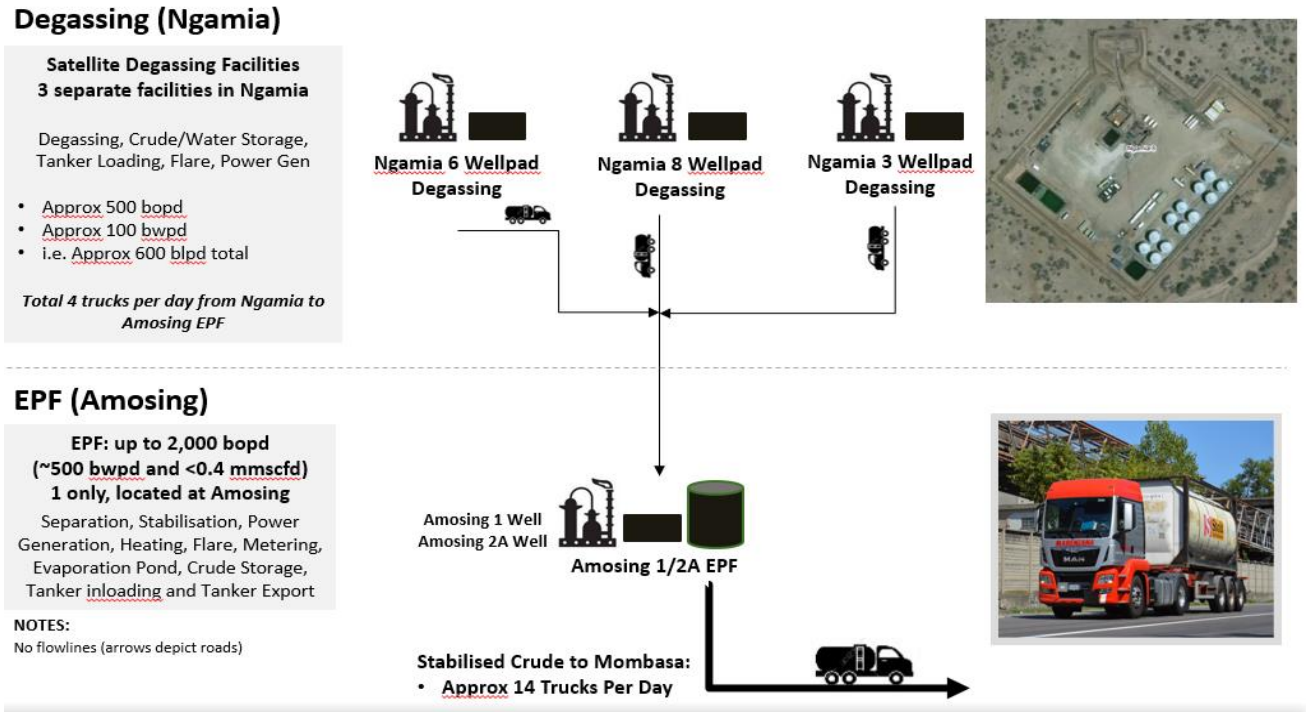


Figure 0-3: Summary Schematic of the EOPS Project including aerial image of Amosing-1 and articulated truck loaded with tanktainer (From Tullow EOPS ESIA Consultation Presentation)

Production

Profiles for oil production throughout EOPS have been estimated using two scenarios; one of high flow rate and one of low flow rate. The ranges of the resultant oil, gas and water production from all EOPS facilities can be summarised as follows:

- Monthly oil production estimates range from 2000 barrels per day (bpd) to 1289 bpd;
- Monthly gas production estimates range from 250 MSCF/d to 401 MSCF/d; and
- Monthly water production estimates range from 37 bpd to 587 bpd.

Employment

There will be a total of 61 opportunities for employment as result of EOPS, which include 44 HGV drivers, 3 patrol of bus drivers, 6 administrators, assistant marshals or security personnel and 8 operations trainees.

Decommissioning

EOPS wellpads will be used for FFD where possible. Decommissioning and closure of FFD will comply with international best practice, IFC Standards, NEMA requirements, Tullow's environmental and social policies and also Kenyan legislative and regulation requirements. As part of FFD, a Site Closure and Restoration Plan will be developed.

Transportation

Infield Transportation (Upstream)

It is estimated that three road movements will occur each day to move Ngamia crude to the EPF at Amosing. Infield tankers will use existing infield access roads and the existing section of the C46 road.

All workers that are accommodated at Kapese ISB or in local accommodation will be transported every day from Kapese ISB to the wellpads (totalling 30 – 60 people for construction and 20 – 25 people during operations).

Oil Trucking to Mombasa (Midstream)

Special ISO-Tanktainers will be used to transport crude oil from the EPF to KPRL facilities in Mombasa. Tanktainers have a maximum of 25,000 litres capacity (approximately 150 barrels of oil).

Routine loading for transportation is planned to be undertaken between 4pm and 6am, however, where operationally necessary, loading may also take place during the day. All trucks will be parked at Amosing-1 or the Ngamia wellpads.

It is anticipated that an average of 14 tanktainers per day will be used, 7 days a week, for a one-way journey. This equates to an average of 28 road movements each day during EOPS along the proposed route shown in Figure 1.

Vehicles will adhere to the designated speed limit for the roads being used by Project traffic. These are:

- 80 kmph on sealed national roads;
- 50 kmph on infield roads;
- 40 kmph on the Kapese ISB access road; and
- 10 kmph within wellpads.

There will be no routine driving on public roads at night related to oil exportation.

Assessment of Environmental Impacts

Introduction

The following presents a summary of the analysis of impacts for EOPS, considering incorporated measures identified, plus identifying any mitigation required.

Traffic

The standalone TIA focused on the route from Amosing to Eldoret. Baseline traffic counts on the section of the route from Eldoret to Mombasa indicated that changes due to EOPS traffic in this area would be negligible.

Future baseline (2019) traffic counts were predicted and an impact assessment was based upon this. The estimated change in truck movement was predicted to be less than 2% and it was concluded that EOPS will not impact travel on the roads or result in a significant increase in the potential for vehicles to queue.

Soils, Terrain, Geology and Seismicity

Changes to terrain, geology or seismicity have been scoped out of this assessment as there are no potential sources of effects on geology and seismicity resulting from EOPS.

Physical effects on soil due to EOPS will be minor and limited to the existing Project footprint during groundworks and installation. Potential effects on soil characteristics and on the availability of soil as a resource are considered to be negligible.

Only treated water meeting NEMA effluent discharge standards will be discharged to the soil during operations. Therefore, the potential changes to soil as a result of accidental discharges are considered to be negligible. The impacts of dust deposition are also considered to be negligible.

As such, all effects will result in a negligible impact classification.

Air Quality

The effects analysis for air quality was completed using various methods, including spreadsheet models and specialised computer software, in order to predict the dispersion of emissions in the air. Predicted sources of emissions from EOPS include flares, generators, gas engines and vehicle movements. Predicted sources of dust from EOPS include those generated by groundworks and traffic movements. Meteorological data was used in the computer model to describe the prevailing conditions.

The modelling predicted changes in emissions outside of the wellpad fencelines and concluded that there would be negligible impacts outside the Ngamia wellpads and along the road route, however there would be some (moderate) effects to air quality in the vicinity of the Amosing wellpad. Nevertheless, no human receptors will be present directly outside Amosing, and no evidence of residential use was identified during land surveys, therefore the impacts will be negligible.

Impacts on air quality due to EOPS traffic along the route are also predicted to be negligible.

Noise and Vibration

Vibration sources are considered to be negligible and therefore are scoped out of this assessment.

The effects analysis for noise was completed using different methods including specialised computer software to predict noise propagation. Predicted noise sources from EOPS include flares, generators, gas engines, pumps, heaters and vehicle movements. It was assumed that the 2 m earth bund surrounding the wellpads will be maintained at 2 m, and noise generating equipment will be maintained for good performance throughout the life of the Project.

There will be noise effects due to groundworks and installation activities. The 2 m earth bund surrounding the wellpads is expected to provide noise attenuation from the surrounding receptors.

During operations, the daytime international noise standards are exceeded in the vicinity of Amosing wellpad at a distance of no further than 50 m from the fenceline. At night-time, the international standards are exceeded at a distance of no further than 200 m from the fenceline.

During operations, the daytime international noise standards are not exceeded outside the fenceline at the Ngamia wellpads. However, at night-time the international standards are exceeded at a distance of no further than 100 m from the fenceline.

No human receptors will be present in these locations, and no evidence of residential use was identified during land surveys, therefore the impacts are predicted to be minor or negligible. Impacts on noise and vibration due to EOPS traffic along the route are predicted to be negligible.

Nevertheless, TKBV are committed to the following mitigation:

- Groundworks and installation activities should occur during daylight hours and comply with noise legislation; and
- The 2 m bund surrounding each wellpad must be maintained at a height of 2 m prior to any groundworks and installation and throughout operations and decommissioning.

Water Quantity

The effects of EOPS on water quantity have been analysed using spreadsheet models and professional judgement. The potential sources of effects included groundworks intercepting groundwater, changes to drainage, abstraction, discharge and flood risk. It is considered that, as the footprint of the wellpads will not change, only very small volumes of water will be required, and acceptable water management practices will be adhered to throughout the life of the Project; the impacts on water quantity are therefore considered to be negligible.

Water Quality

The effects of EOPS on water quality have also been analysed using spreadsheet models and professional judgement. The sources of effects included discharges from the wellpad and groundwater heating. Groundwater temperatures could increase by 2^{o}C at a distance of 50 m from the wellbore, which is a negligible effect outside of the fenceline. Given that acceptable water management practices will be adhered to throughout the life of the Project, impacts on water quality are considered to be negligible.

Landscape and Visual

Visual effects were assessed using specialised computer software and verified on site. The Project infrastructure and lighting would be the main sources of visual effects. However, provided lighting effects are managed on site, a negligible visual effect would occur as a result of EOPS as trees and scrubland form a natural barrier to any visual effects.

Biodiversity, Ecology and Protected Areas

The biodiversity impact assessment considers the impacts on both habitats and species and considers both direct and indirect effects from a multitude of different sources (e.g. noise, air quality, light).

Increased traffic could present a collision risk to certain ground-foraging bird species. These unmitigated impacts are considered to be minor to moderate reflective of the differing sensitivities of different species.

Similarly, unmitigated impacts to other raptors could result in possible mortality from the gas flares if an appropriate start-up protocol is not in place. That is, individual raptors could be attracted to these flares. Therefore, with suitable flare start-up procedures in place, the predicted impact significance is considered moderate.

Moderate unmitigated impacts may also occur to identified raptor and vulture species as a result of drinking water from evaporation ponds.

There are also moderate impacts anticipated to large mammals and bats as a result of site lighting potentially affecting species movement patterns and foraging habitats.

TKBV are committed to a number of mitigation measures to address the impacts, including:

- No hunting or collection of timber, flora and fauna by staff and/or contractors to be permitted;
- Adoption of a start-up protocol for the flares so start up only occurs during daylight and ensure no perching birds are present at start up;
- A process for frequent checks for evidence of presence of birds across the wellpad, specifically around the flare. Should mortality occur there will be a process in place for the review of operational practices, e.g. flaring times; and
- Effective wildlife exclusionary devices should be installed to prevent wildlife mortality. Netting is likely to be the most effective method of keeping birds from entering produced water evaporation ponds.

Ecosystem Services

The ecosystem services impact assessment considers the impacts on local 'beneficiaries' (e.g. people, businesses) relating to their livelihoods, health, safety, and/or culture, and considers both direct and indirect impacts from a multitude of different sources (e.g. noise, air quality, water, cultural heritage).

The assessment concludes that there will be a moderate unmitigated impact during operation on grazing for livestock, medicinal plants and biomass fuel. This could occur as a result of population influx.

TKBV are committed to mitigation measures to initiate an inventory and monitoring of grazing, biomass fuel, wild food, livestock and medicinal plant use (to be developed prior to the implementation of FFD).

Social

The sources of economic effects relate to taxes and other payments, as well as employment and an increased purchasing of goods and services. Impacts have again been considered across a range of topic areas, including demographics; infrastructure and services; economics, employment and livelihoods; land use and ownership; community health and safety; social maladies; social capital and conflict.

Moderate unmitigated impacts are predicted as a result of road traffic accidents from increased Project related traffic; sexually transmitted diseases (including HIV) from increased salaried employment and an influx of commercial sex workers; social maladies as a result of influx; and declining community cohesion as a result of increased oil development in an area with very limited experience of industry.

TKBV are committed to a number of mitigation measures to address the impacts, including:

- Tullow will commit to an information campaign on local employment opportunities;
- Tullow will commit to a traffic safety campaign; and
- Tullow will commit to an HIV policy and information campaign on Sexually Transmitted Diseases (STDs).

Cultural Heritage

Cultural heritage occurs in both tangible and intangible forms:

- 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.
- Intangible cultural heritage is described as elements of culture such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles (IFC, 2012a).

As no additional land take is proposed, no new ground disturbance is anticipated, and so direct impacts to cultural heritage sites are not predicted. The impact assessment does however consider indirect effects, such as those resulting from visual, air quality and noise effects.

The assessment concludes negligible impacts upon cultural heritage assets as a result of EOPS. Minor impacts are predicted on intangible elements of cultural heritage, reflective of their very high sensitivity.

Environmental Risks and Accidents

The environmental risks and accidents assessment included an evaluation of environmental and industrial hazards and the probability of their occurrence. This was done in order to assess the risk of unplanned natural and industrial events, which could result in environmental or social impacts by adversely affecting the environment or public safety.

Although considered to be low probability unplanned events, vehicle collision causing death or injury (within the wellpad), road traffic accidents causing an oil spill, spill of other hazardous materials or damage to public infrastructure (on public roads), and emergency gas release from degassers, are considered to be a significant risk, and road traffic accidents causing death, injury or damage to biodiversity receptors is considered to be a high risk. Failure in the operation of the flare leading to unplanned emissions, natural seismicity (earthquakes), heavy rainfall, high winds, flooding or extreme weather events are considered to be medium risks. All of these will be managed under an Emergency Response Plan, Traffic Management Plan and Operational Management Plan.

Assessment of Residual Impacts

Through the adoption and implementation of the proposed mitigation measures, all adverse impacts have been reduced to either minor or negligible. For Social, a number of initially negative impacts can, with the proposed mitigation in place, result in positive benefits.

Cumulative Impacts

No other major developments have been identified within the study area that have the potential to generate cumulative impacts with the EOPS Project. However, the improvements being made to the transport route from Amosing-1 to Eldoret may lead to cumulative effects. These other developments include the upgrade works on the C46 road and development of rest stops on the transport route.

These are anticipated to result in improved access, leading to pressure on ecosystem services, influx and migration and potential increases in sexually transmitted diseases, which must be managed using the Traffic Management Plan and Social Management Plans.

ESMP

An Environmental and Social Management Plan (ESMP) compiles a set of management, mitigation and monitoring measures to be taken during groundworks and installation, operation (including maintenance) and decommissioning, in order to manage key potential environmental and social impacts identified in this ESIA.

The ESMP for EOPS includes the following sections, which will be developed into management plans and will be “living documents”, to be updated as appropriate throughout operations:

- Groundworks and Installation Management Plan;
- Environmental Compliance Plan;
- Water Management Plan;
- Biodiversity Management Plan;
- Social Management Plan;
- Traffic and Transport Management Plan;
- Hazardous Materials Management Plan; and
- Emergency Preparedness and Response Plan.

Table of Contents

TABLES

FIGURES

DRAWINGS

1.0 INTRODUCTION

This report presents the environmental and social impact assessment (ESIA) for the proposed Early Oil Pilot Scheme (EOPS) Phase 2. The EOPS project is divided into two stages. EOPS Phase 1 covers the existing trucking of stored crude oil produced during the Extended Well Testing carried out during the exploration and appraisal phase which is covered under the existing Extended Well Test (EWT) Environmental Impact Assessment (EIA) licenses. EOPS Phase 2 will cover the installation of EOPS facilities, the production of limited quantities of crude oil from existing wells at Amosing and Ngamia fields and the operation of the EOPS Early Production Facility (EPF) (the oil production is also known as the Upstream component of the Project).

The EOPS ESIA addresses Phase 2 only. Within this document, where the term EOPS is used, this refers exclusively to Phase 2 (unless explicitly stated).

The Ngamia and Amosing wellpad sites are existing wellpads and Tullow Kenya B.V (TKBV) is currently permitted to undertake exploration activities under exploration permit no. PR 7764/0001253 at these wellpads. The ESIA assesses the groundworks and installation of infrastructure to develop these exploration wells into production wells; the activities and infrastructure associated with operation of these wellpads; the activity of transporting oil to port; and the decommissioning of EOPS. The Project description is presented in Section 4.0 and a summary of the main Project components is given in Table 1-1. The main locations referred to in the report for the Upstream and Midstream components are shown in Figure 1-1 and Figure 1-2.

Table 1-1: Summary of the EOPS Phase 2 Project Scope

Project Component	Activities and Infrastructure
EOPS Upstream	• 2,000 bpd production of crude from existing exploration wells ate Ngamia and Amosing wellpad sites. • Installation and operation of three satellite oil degassing units at the Ngamia 6, Ngamia 8 and Ngamia 3 wellpads including flares. • Installation and operation of one EPF at the Amosing1/2A wellpad, including water/oil separation, stabilised oil storage, produced water storage and a flare; • Installation and operation of a contingency evaporation wellpad at Amosing-5 wellpad (if required). • Power generation from diesel generators (Ngamia wellpads) and power generation from produced gas (Amosing 1/2A wellpad). • Solid waste generation and storage. • Liquid waste generation, treatment and disposal. • In-field transport of crude oil/water mix. • Tanker loading and export of stabilised crude.
EOPS Midstream	• Transport of crude in tanktainers from Amosing to Mombasa (approximately 1,500 km), with 14 tanktainers leaving Amosing each day for an estimated 7-day return journey; transportation fleet will comprise 98 tanktainers. • No physical infrastructure upgrades to existing roads as part of the Project.[1]

[1] In parallel to implementation of the EOPS project by TKBV, the Kenya National Highways Agency (KeNHA) is implementing a national road upgrade programme that will improve much of the roads along the EOPS Midstream export route.

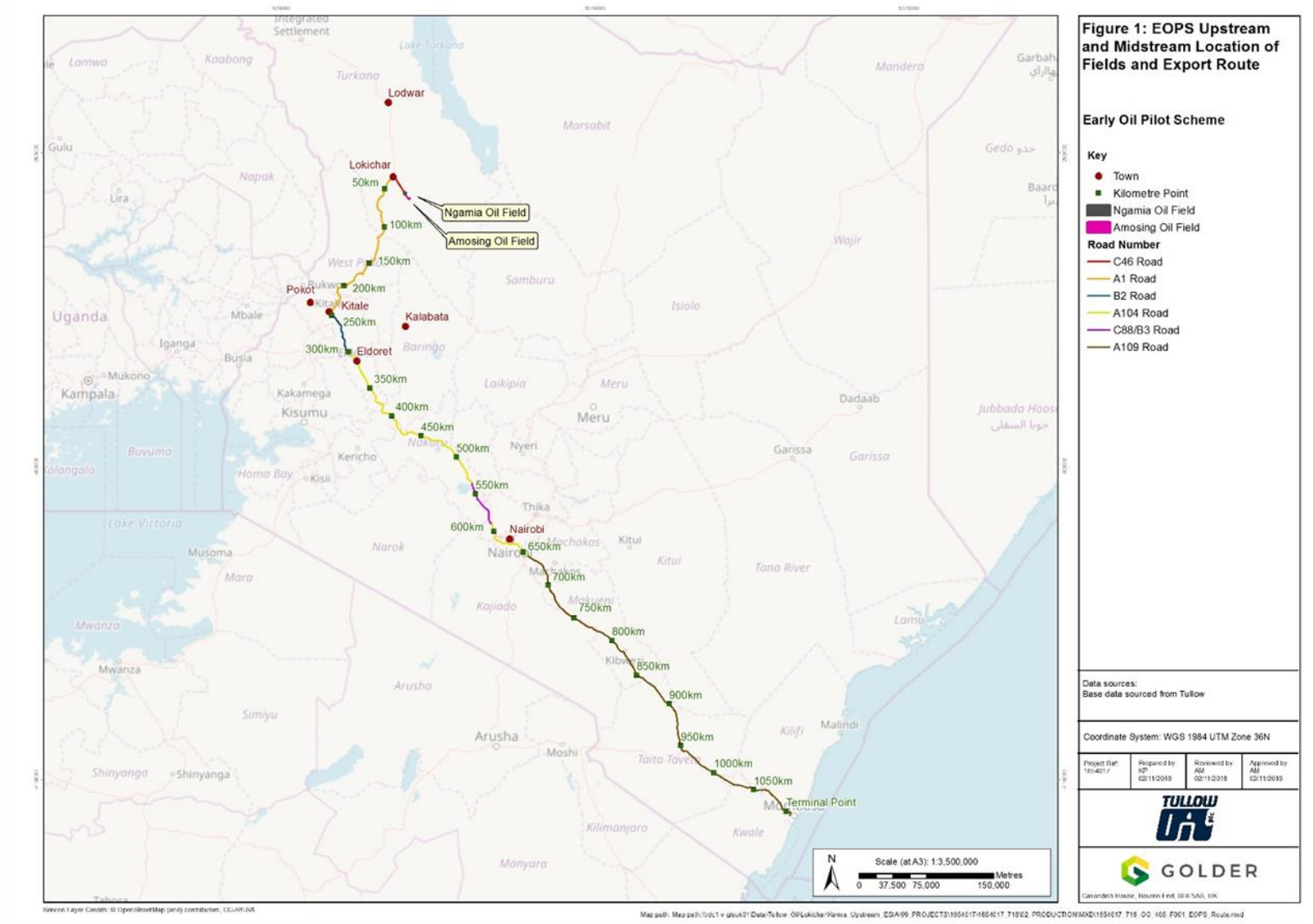


Figure 1-1: EOPS Upstream and Midstream location

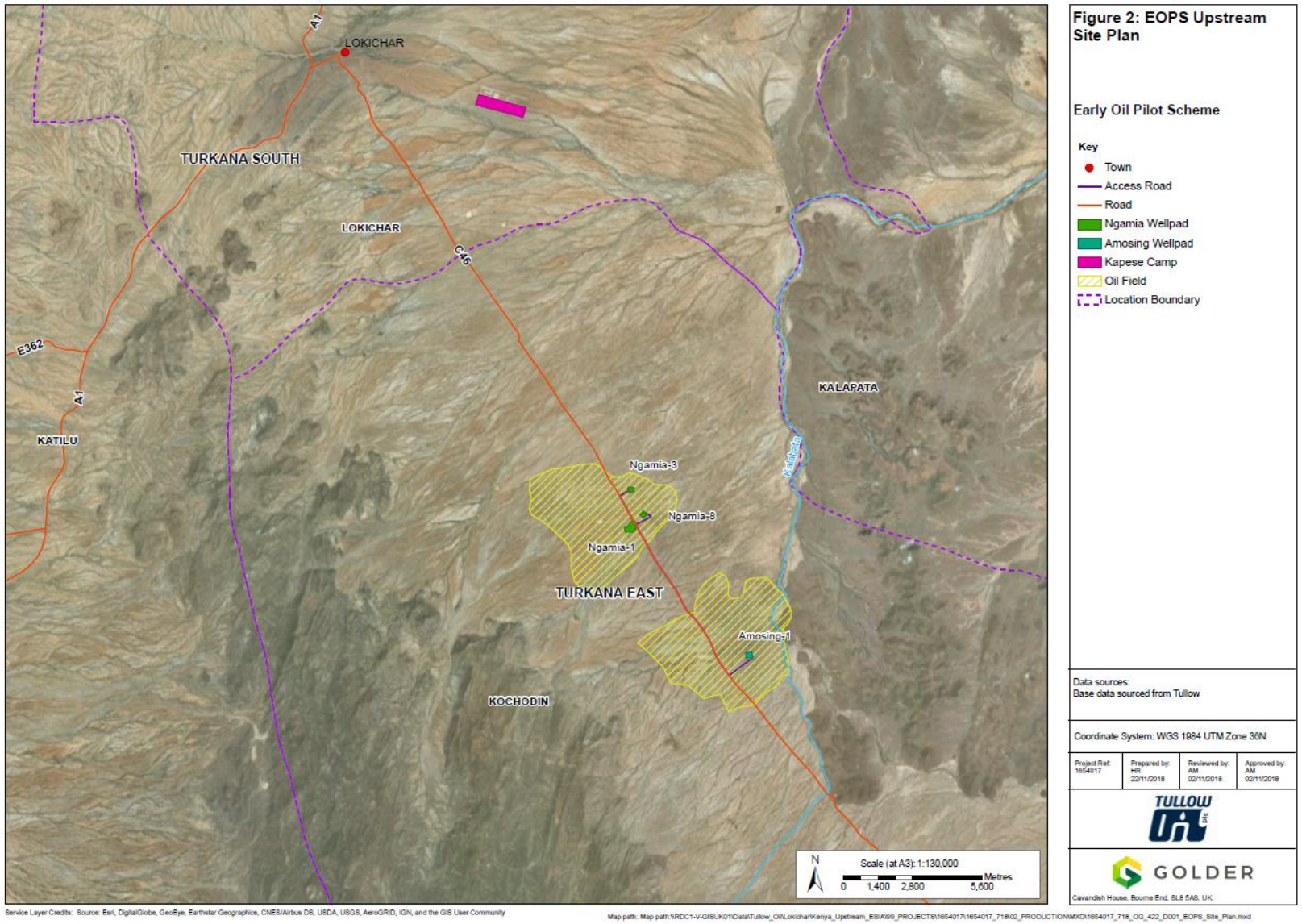


Figure 1-2: EOPS Upstream Site Plan

The objective of the ESIA is to identify and quantify impacts that the Project may have on the biophysical and socio-economic environments through comparison to the ESIA baseline and Project standards. Where identified as necessary, the ESIA will prescribe potential mitigation and management processes to prevent unacceptable deterioration of environmental and social conditions, minimise negative impacts and enhance benefits to Kenya, Turkana, local communities and other stakeholders. Where mitigation or management is required, residual impacts will be determined, where relevant.

The structure of this ESIA is as follows:

- Volume I – ESIA:
  - ESIA (this document); and
  - ESIA drawings.
- Volume II – Supplementary Information:
  - Stakeholder Engagement Plan;
  - EOPS ESIA consultation – summary of key issues and responses
  - Baseline Report;
  - ESIA Terms of Reference;
  - ESIA methods; and
  - Additional Technical information in support of the ESIA.

The ESIA is assessed in different technical areas (or disciplines), which can be split into three component areas, as follows:

- Physical Component, which includes:
  - Traffic;
  - Noise and Vibration;
  - Air Quality;
  - Soils, Terrain, Geology and Seismicity;
  - Water Resources and Quality;
  - Landscape and Visual; and
  - Tangible elements of Cultural Heritage, e.g. Archaeology.
- Biological Component, which includes:
  - Biodiversity and Protected Areas; and
  - Ecosystem Services.
- Social Component, which includes:
  - 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
- Intangible and “Living” Cultural Heritage.

1.1 Background

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 in Turkana, northeast Kenya. TKBV is planning to develop its discoveries to enable production and further exploration to proceed concurrently. The Full Field Development Project (FFD) includes oil discoveries within Blocks 10BB and 13T.

Once commercial volumes of oil have been discovered there are multiple pathways to development. Government of Kenya (GOK) ministries and TKBV were tasked with exploring the feasibility of delivering an Early Oil Pilot Scheme (EOPS, the ‘Project’). The pilot scheme is not an alternative to the FFD, rather it represents an intermediate step on the road to the full commercialisation of discovered resources. The pilot scheme proposes to use existing wellpads and wells at the Amosing and Ngamia fields in South Lokichar, with oil transported by tanktainers, using existing road infrastructure, to Mombasa for export.

In 2007, Turkana Drilling Consortium (Kenya) signed a Production Sharing Contract (PSC) for a 100% working interest in newly designated Block 10BB. In 2011, Africa Oil Kenya B.V and Tullow agreed a farm-in deal whereby Tullow acquired a 50% interest and Operatorship in block 10BB. At the end of 2015, Africa Oil Corporation (AOC) entered into a farm-out agreement with Maersk Oil & Gas A/S, whereby Maersk will acquire 50% of Africa Oil's interests in block 10BB. Subsequent to this, Total acquired the Maersk working interest of 25%. At the time of writing, Africa Oil Kenya B.V and Total each have a 25% working interest and TKBV has a 50% working interest in the block.

TKBV contracted Golder Associates (UK) Ltd (Golder) to undertake the EOPS 2 ESIA, with support from Kenyan-based ESIA consultant EMC Consultants Ltd (EMC).

1.2 Policy, Legal and Institutional Framework

The following section provides the relevant policy, legal and institutional framework governing the ESIA. The ESIA has been prepared to meet Kenyan regulatory requirements in order to obtain necessary national approvals from the National Environment Management Authority (NEMA). For the topics assessed, the ESIA has been developed to be in-line with international standards (i.e. IFC Performance Standards on Environmental and Social Sustainability (2012) and IFC’s General EHS Guidelines (2007a, 2007b)). The ESIA also conforms to Tullow’s corporate HSE standards and policies.

Project standards will comprise the more stringent of the Kenyan or Good International Industry Practice (GIIP). For noise, it was agreed with the National Environment Management Agency (NEMA) that IFC standards would be used as the Project standard. The reasons for this are outlined in the Noise Position Paper (Golder, 2016b).

1.2.1 Context

Kenya has undergone regulatory reforms over the past two decades, culminating in the enactment of a new constitution in 2010, which replaced that of 1969. This has, in turn, driven new policies and strategies relating

to environmental management and conservation (including Environmental Impact Assessments), and more generally to the energy sector, including oil and gas.

The new constitution establishes the structure of the Kenyan government, the Bill of Rights, and provides the basic and comprehensive principles for environmental protection and management in the country. Under Chapter 5 (Part 1) of the constitution (Land and Environment), it requires that land be used and managed in "a manner that is equitable, efficient, productive and sustainable, and in accordance with the following principles: (a) equitable access to land; (b) security of land rights; (c) sustainable and productive management of land resources; (d) transparent and cost effective administration of land; (e) sound conservation and protection of ecologically sensitive areas; (f) elimination of gender discrimination in law, customs and practices related to land and property in land; and (g) encouragement of communities to settle land disputes through recognised local community initiatives consistent with this constitution". Furthermore, Part 2 of Chapter 5 is dedicated to environment and natural resource utilisation, management and conservation, with reference to the establishment of EIA, environmental audit and monitoring of the environment.

The constitution also stipulates that all minerals and mineral oils shall be vested in the national government in trust for the people of Kenya. Devolution of powers from the central government to the newly established 47 Counties is also specified by the constitution. County governments are in charge of planning and development, amongst other services, and can enact legislation with possible implications for planned and current projects. Respective County Governments have the ability to pass laws through their County Assemblies. In addition, County governments also hold all unregistered community lands in trust on behalf of the communities who use it.

Other reforms include the establishment of key administrative and legislative organisations that regulate oil and gas development in Kenya. The roles and responsibilities of these organisations is outlined in Section 1.2.2.

1.2.2 Governance and Administrative Structure

The key administrative agencies that regulate oil and gas development and its environmental implications in Kenya, and which therefore have a key role in the EIA authorisation process, include:

Ministry of Petroleum and Mining

The Ministry of Petroleum and Mining is responsible for facilitating the provision of clean, sustainable, affordable, reliable, and secure energy services for national development while protecting the environment.

Relevant departments include the Ministry of Energy and the Energy Regulatory Commission (ERC), which was established under the 2006 Energy Act. The ERC's objectives and functions include regulating electrical energy, petroleum and related products, renewable energy and other forms of energy, and setting and reviewing tariffs, regulation enforcement and approval of power purchase agreements. The ERC must be notified of accidents or incidents causing significant harm or damage to the environment or property, which has arisen in Kenya.

Ministry of Environment and Forestry

The Ministry of Environment and Forestry's mission statement and key objective is to facilitate good governance in the protection, restoration, conservation, development and management of the environment and natural resources for equitable and sustainable development.

Following the passage of the Environmental Management and Coordination Act (EMCA) 1999, now amended and referred to as EMCA (amendment) 2015 (CAP 387), several administrative structures were established under the Ministry. These include the National Environmental Council (NEC), National Environment Management Authority (NEMA), National Environment Tribunal (NET) the National Complaints Committee (NCC), and the Standard and Enforcement Review Committee (SERC).

Ministry of Water and Sanitation

The Ministry of Water and Sanitation (MWS) mission statement is to contribute to national development by promoting and supporting integrated water resource management to enhance water availability and accessibility. The MWS has the following technical departments: Water Services, Water Resources, Water Storage and Land Reclamation, and Irrigation and Drainage.

National Environment Management Authority

NEMA is the administrative body that is responsible for the coordination of the various environmental management activities in Kenya. NEMA is also the principal government authority for implementing all environmental policies.

NEMA is also responsible for granting EIA approvals and for monitoring and assessing activities, in order, to ensure that the environment is not degraded by such Project activities.

Water Resources Authority (WRA)

WRA is a state corporation, established under the Water Act 2016 and charged with being the lead agency in water resources management. Among other functions, WRMA is responsible for issuing permits for water use. The Authority is the immediate former predecessor of the Water Resource Management Authority (WRMA).

County Environmental Committees (CEC)

The CEC shall be responsible for the proper management of the environment within the county for which it is appointed. The Committee also develops county strategic environmental action plan for five years.

National Environmental Department (NED)

The NED functions are to investigate any allegations or complaints against any person or against the Authority in relation to the condition of the environment in Kenya. NED may also on its own motion investigate any suspected case of environmental degradation and to make a report of its findings together with its recommendations to the Cabinet Secretary.

The National Environment Tribunal

The National Environment Tribunal (NET) has a number of functions, including to hear and determine appeals from NEMA's decisions; to adjudicate over actions relating to the issuance, revocation or denial of Environmental Impact Assessment (EIA) licences; to determine the amount of money to be paid under the Act; to decide upon the imposition of restoration orders; to give direction to NEMA on any matter of complex nature referred to it by the Director General; and in accordance with the Forest Conservation and Management Act, No. 34 of 2016, NET is mandated to make determination on any matter that remains unresolved after reference to the lowest structure of devolved system set out in the County Government Act under section 70.

Ministry of Sports and Heritage

The mission of the Ministry of Sports and Heritage is to develop, promote, preserve and disseminate Kenya's diverse cultural, artistic and sports heritage, through formulation and implementation of policies that enhance national pride and improve the livelihood of the Kenyan people. Of particular relevance to the Project are the Ministry's responsibilities for:

- National Heritage Policy and Management;
- National Archives/Public Records Management;
- Management of National Museums and Monuments; and
- Historical Sites Management.

Following the passage of the National Museum and Heritage Act 2006, the National Museums of Kenya (NMK) was established under the Ministry, which has the following function:

- Heritage promotion, collection and documentation;
- Research;
- Preservation and conservation; and
- Information dissemination.

Ministry of Transport, Infrastructure, Housing and Urban Development

The Ministry of Transport. Infrastructure, Housing and Urban Development has two departments, namely the State Department of Transport and the State Department of Infrastructure. The Ministry is mandated to perform a number of functions, including (amongst others): National Roads Development Policy Management, Transport Policy Management, National Road Safety Management, Development and Maintenance of Airstrips and National Transport and Safety Policy.

Ministry of Interior and Coordination of National Government

The mission of the Ministry of Interior and Coordination of National Government is to create an enabling environment for Kenya's growth and prosperity via the provision of security and safety to people and property, maintain a credible national population registration system, promotion of national cohesion, facilitate administration of justice, provision of correctional services and coordination of national government functions. Of particular relevance to the Project are the Ministry's responsibilities for:

- National government coordination at counties
- Disasters and Emergency Response Coordination;
- Internal Security Affairs; and
- Citizenship and Immigration Policy and Service.

Turkana County Government

This is the County Government responsible for Turkana County, and was formed as part of the devolved government provided for in Kenya's new Constitution. The Turkana County Government consists of the County Assembly and the County Executive, which is made up of several County Ministries. The Turkana County Government functions include agriculture, health and sanitation, control of air and noise pollution, cultural activities, county transport, planning and development, implementation of national government policies on natural resources and environmental conservation.

Other Government Agencies

Other government agencies relevant to the Project at the national level may include:

- Kenya Forest Services;
- Kenyan Wildlife Services;
- National Land Commission;
- Ministry of Lands and Physical Planning;
- Kerio Valley Development Authority;
- Energy Regulatory Commission;
- Kenya Revenue Authority;

- Kenya Bureau of Standards;
- National Construction Authority;
- Kenya Petroleum Refineries Limited (KPRL);
- Lamu Port South Sudan Ethiopia Transport Corridor (LAPSSET);
- National Disaster Operation Centre;
- Kenya Maritime Authority;
- Kenya National Highways Authority (KeNHA);
- Ministry of Health; and
- National Drought Management Authority.

1.2.3 Kenyan Policy and Legislative Requirements

Table 1-2 and Table 1-3 provide a summary of Kenyan policy documents and legislation respectively, which are applicable to the ESIA.

Table 1-2: Key Kenyan Policy Documents

Policy	Description
The National Environment Policy (2013)	The goal of this policy is to provide better a quality of life for present and future generations through the sustainable management and use of the environment. Its objectives include to (i) provide a framework for an integrated approach to planning and sustainable management of the environment; (ii) ensure sustainable management of the environment; and (iii) promote partnerships in the protection, conservation and sustainable management of the environment.
The National Water Policy (2012)	The National Water Policy includes details of the national government's policies and plans for the mobilisation, enhancement and deployment of financial, administrative and technical resources for the management and use of water resources.
The Wetland Policy (2013)	The Wetland Policy aims to provide a framework for mitigating the diverse challenges that affect wetlands conservation and use in Kenya. Adoption of the policy also fulfils Kenya's obligations under the Ramsar Convention.
The Wildlife Policy (2012)	The Wildlife Policy makes provision for an overarching framework for the prudent and sustainable conservation, protection and management of wildlife and wildlife resources in Kenya, with incidental provision on access and the fair and equitable distribution of benefits accruing there-from, and its alignment with other sector-specific laws and the environment policy.
Kenya Vision 2030 (2010)	Kenya Vision 2010 is a national long-term development blue-print to create a globally competitive and prosperous nation with a high quality

Policy	Description
	of life by 2030. The vision is anchored on three key pillars; economic, social and political governance.
National Land Policy (2009)	The Policy was a key component towards addressing questions in the previous regulatory framework and contained the vision to provide Kenyans with "sustainable and equitable" access to and use of land.

Table 1-3: Relevant National Legislation

Name of Legislation	Description
Environmental Management and Coordination Act (EMCA) (1999) as amended in (2015), and the subsidiary Regulations notably:	The EMCA as amended in 2015 and its subsidiary regulations set out requirements and procedures for conducting EIAs, auditing and environmental monitoring in Kenya. Furthermore, they establish environmental standards for water quality, noise, fossil fuel emission, and waste management. It also regulates activities impacting wetlands, river banks, lake/sea shores, and the conservation of biological diversity.
The EMCA (Impact Assessment and Audit) Regulations (EIAAR) (2003) *The EMCA (Impact Assessment and Audit) Regulations (EIAAR) (Amendment) (2016)*	These Regulations contain rules relative to the content and procedures of an EIA, to environmental audit and to monitoring and strategic environmental assessment. These rules regulate other matters such as the appeal for, and registration of, information regarding EIA. The EIA/EA amendment revises and replaces the second schedule of projects required to undergo EIA by categorising projects into low, medium and high risk. Petroleum exploration and production are categorised as high risk. The draft ESIA and EA Guidelines for the Downstream Petroleum Sub-sector (2012) issued by the ERC provide advice on their interpretation to that sector.
The EMCA (Wetlands, River Banks, Lake Shores and Sea Shore Management Plan) Regulations (2009)	These Regulations require the protection of wetlands, river banks, lake shore and sea shore areas which provide ecological habitats.
The EMCA (Fossil Fuel Emission Control) Regulations (2007)	These Regulations set emission standards for internal combustion engines, provide for the licensing of persons responsible for treating fuel, provide for the appointment of environmental inspectors required to inspect emissions, and authorise NEMA to enter into partnerships in order to conduct emission inspections.
The EMCA (Conservation of Biological Diversity and Resources, Access to Genetic	These Regulations ensure that activities do not have an adverse impact on any ecosystem.

Name of Legislation	Description
Resources and Benefit Sharing) Regulations (2006)	
The EMCA (Water Quality) Regulations (2006)	These Regulations outline the water quality standards that should be met for different uses including effluent discharge. The following schedules in the Water Quality Regulation set out the relevant standards and monitoring requirements: ■ First Schedule: Quality Standards for Sources of Domestic Water; ■ Second Schedule: Quality Monitoring for Sources of Domestic Water; ■ Third Schedule: Standards for Effluent Discharge into the Environment; ■ Fourth Schedule: Monitoring Guide for Discharge into the Environment; ■ Fifth Schedule: Standards for Effluent Discharge into Public Sewers; and ■ Sixth Schedule: Monitoring for Discharge of Treated Effluent into the Environment. The Water Resources Management Authority and NEMA are key administering authorities.
The EMCA (Noise and Excessive Vibration Pollution) Control Regulations (2009)	This regulation establishes environmental standards that should be met for noise. NEMA is a key administering authority. The following schedules in the Noise and Excessive Vibration Pollution Control Regulation set out the relevant standards and monitoring requirements: ■ First Schedule – Maximum Permissible Intrusive Noise Levels; ■ Second Schedule – Maximum Permissible Noise Levels for Construction Sites; ■ Third Schedule – Maximum Permissible Noise Levels for Mines and Quarries; ■ Fourth Schedule– Application for a License to Emit Noise/Vibrations in Excess of Permissible Levels; ■ Fifth Schedule–License to Emit Noise/Vibrations in Excess of Permissible Levels; ■ Sixth Schedule – Application for a Permit to Carry out Activities. ■ Seventh Schedule – Permit to Emit Noise in Excess; ■ Eighth Schedule – Minimum Requirements for Strategic Noise and Excessive Vibrations Mapping; ■ Ninth Schedule – Minimum Requirements for Action Plans; and ■ Tenth Schedule – Improvement Notice.
The EMCA (Waste Management) Regulations (2006)	These Regulations set rules for general waste management and for the management of solid waste, industrial waste, hazardous waste, biomedical waste, radioactive waste, pesticides and toxic waste. These Regulations prohibit the pollution of public places, provide for the granting of licences for waste transportation and waste disposal

Name of Legislation	Description
	facilities, and require an EIA to be undertaken on any site disposing of or generating biomedical waste.
Environmental (Prevention of Pollution in Coastal Zone and Other Segments of the Environment) Regulations, 2003	The regulations provide a framework for the protection of coastal zone from the pollutants and effluents by ship activities at the port. The regulations further provide a requirement for certification in accordance with MARPOL, the International Convention for the Prevention of Pollution from Ships 1973 as modified by the Protocol of 1978
Environmental Management and Co-ordination (Controlled Substances) Regulations, 2007	The regulations provide a framework for controlled substances management including classification and controls in disposal, movement, export and import of controlled substances listed in the schedule. The regulations also provide for licensing
National Environmental Tribunal Procedure Rules, 2003	The rules provide for the procedure for appeals and referrals to the tribunal for determination. The Tribunal hears appeals and complaints from the decisions of the National Environmental Management Authority
The Draft Environmental Management and Co-ordination (E-Waste) Regulations 2013	The Regulations provide an appropriate legal and institutional framework and mechanisms for the management of E-waste handling, collection, transportation, recycling and safe disposal of E-waste. It also provides for improved legal and administrative co-ordination of the diverse sectoral initiatives in management of E- waste as a waste stream, in order, to improve the national capacity for the management of the E-waste
Draft EMCA (Conservation and Management of Wetlands) Regulations 2017	The overall objective of the draft Amendment Regulations, 2017 is to align it to the Constitution of Kenya, 2010, Environmental Management and Coordination Act, 1999 and the National Wetlands Conservation and Management Policy, 2015. The Regulations also seek to address emerging issues such as climate change and invasive species.
The Draft Environment Management and Co-ordination (Deposit Bonds) Regulations, 2014	The Regulations are applicable to the activities, industrial plants and undertakings which have or more likely to have adverse effects on the environment. This is to ensure, among other things, good environmental practices, adequate remediation is achieved without adversely affecting economic viability. Any person operating or proposing to operate an industrial plant and undertaking an activity as stipulated in the Deposit Bonds. Register shall be required to prepare a Deposit Bond Assessment Report.
Draft Environmental Management & Coordination (Toxic & Hazardous Industrial Chemicals & Materials Management) Regulations, 2018	The regulations will provide for the sustainable management of chemicals in Kenya, specifically, labelling, classification, registration, manufacture, storage, transport (road, air and sea), distribution, handling, import, export, chemical use in mining, substances in articles / chemicals in products, polluter release and transfer register,

Name of Legislation	Description
	restrictions and banning, incidents, liabilities, waste disposal and offences of toxic and hazardous chemicals and materials.
The Water Act, (2016) and subsidiary legislation	This Act provides for the regulation, management and development of water resources and sewerage. The Rules implement the Act.
The Wildlife Conservation and Management Act (WCMA) (2013)	An Act of Parliament to provide for the protection, conservation, sustainable use and management of wildlife in Kenya and for connected purposes. It also regulates wildlife conservation and management in Kenya, through the protection of endangered and threatened ecosystems. Specifically, it prohibits the disturbance or harm of flora and fauna within public places, community and private land, and Kenyan territorial waters. The Act also establishes Kenya Wildlife Service (KWS) as the implementing agency.
The National Museums and Heritage Act (2006)	An Act of Parliament to consolidate the law relating to national museums and heritage; to provide for the establishment, control, management and development of national museums and the identification, protection, conservation and transmission of the cultural and natural heritage of Kenya. The Act also establishes a notification of discovery requirement and sets restrictions on moving objects of archaeological or palaeontological interest.
Physical Planning Act (1996)	An Act of Parliament to provide for the preparation and implementation of physical development plans and for connected purposes.
Public Health Act (2012)	The Act provides for the prevention of the occurrence of nuisance or conditions dangerous/injurious to humans. It also provides that the relevant local authority shall take all lawful, necessary and reasonably practicable measures for preventing any pollution dangerous to health of any supply of water which the public within its jurisdiction has a right to use and does use for drinking or domestic purposes (whether such supply is derived from sources within or beyond its jurisdiction).
Occupational Health and Safety Act (2007), and subsidiary legislations and rules.	An Act of Parliament to provide for the safety, health and welfare of workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. This Act includes requirements for the control of air pollution, noise and vibration in every workplace where the level of sound energy or vibration emitted can result in hearing impairment, be harmful to health or otherwise dangerous.
Work Injury Benefits Act (2007)	The Act of Parliament seeks to provide framework for compensation to employees for work related injuries and occupational diseases contracted in the course of their employment.

Name of Legislation	Description
	The Act provides for, among other provisions, the right for compensation in case of injury related to work, or in case of death due to an accident at work.
Factories and Other Places of Work (Noise Prevention and Control) Rules, 2005	These rules require that where the noise level is above ninety dB(A), the employer shall put in place a noise conservation program that includes posting conspicuous signs reminding employees that hearing protection must be worn, supply hearing protection and ensure all employees wear hearing protection.
Prevention, Protection and Assistance to Internal Displaced Persons and Affected Community Acts (2012)	An Act of Parliament on internal displacement in Kenya that includes vital provisions to secure the participation of displaced people in decision-making that affects them.
Agriculture, Fisheries and Food Authority Act (2013)	The Agriculture, Fisheries and Food Authority Act consolidate the laws on the regulation and promotion of agriculture and makes provision for the respective roles of the national and county governments in agriculture and related matters.
Traffic Act (Revised 2015)	The Traffic Act relates to traffic on all roads.
Kenya Roads Act (2007)	An Act of Parliament to provide for the establishment of the Kenya National Highways Authority, the Kenya Urban Roads Authority and the Kenya Rural Roads Authority, to provide for the powers and functions of the authorities and for connected purposes.
Petroleum (Exploration and Production) Act (1984) and subsidiary legislation	An Act of Parliament to regulate the negotiation and conclusion by the government on petroleum agreements relating to the exploration, development, production and transportation of petroleum and for connected purposes.
The Energy Act (2006) and subsidiary legislations	An Act of Parliament amend and consolidate the law relating to energy, to provide for the establishment, powers and functions of the Energy Regulatory Commission and the Rural Electrification Authority, and for connected purposes Part IV of the Energy Act deals with petroleum and natural gas.
The Forest Conservation and Management Act (2016)	An Act of Parliament to give effect to Article 69 of the Constitution with regard to forest resources; to provide for the development and sustainable management, including conservation and rational utilization of all forest resources for the socio-economic development of the country and for connected purpose.
The EMCA (Air Quality Standards) Regulations (2014)	This Regulation's objective is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. It provides for the establishment of emission standards for various sources such as mobile sources (e.g. motor vehicles) and stationary

Name of Legislation	Description
	sources (e.g. industries). The Regulations provide the procedure for designating controlled areas, and the objectives of air quality management plans for these areas.
Community Land Act (2016)[2]	The Act provides a legislative framework to give effect to Article 63 of the Constitution and makes provision for the recognition, protection, management and administration of community land. The proposed legislation allows a community to register ownership of an area of community land.
Land Act (2012)	It is the substantive law governing land in Kenya and provides legal regime over administration of public and private lands. It also provides for the acquisition of land for public benefit. The government has the powers under this Act to acquire land for projects, which are intended to benefit the general public. The projects requiring resettlement are under the provision of this Act.
Land Laws (Amendment) Act 2016	The Act gives effect to Article 68(c) (i) and 67 (2) (e) of the constitution, to provide for procedures on evictions from land, and for connected purposes.
Environment and Land Court Act (2011)	The Kenya Constitution establishes the Environment and Land Court[3]. Article 162 of the constitution provides for the creation of specialized courts to handle all matters on land and the environment. Such a court will have the status and powers of a High Court in every respect. Article 159 on the principles of judicial authority, indicates that courts will endeavour to encourage application of alternative dispute resolution mechanisms, including traditional ones, so long as they are consistent with the constitution.
National Land Commission Act (2012)	The Act establishes the National Land Commission with the purpose of managing public land and carrying out compulsory acquisition of land for specified public purposes.
Climate Change Act (2016)	The objective is the development, management, implementation and regulation of mechanisms to enhance climate change resilience and low carbon development for sustainable development.
Access to Information Act (2016)	The Act upholds the right to information and enables citizens to access information from the state and private companies.

Draft legislation and guidelines that are expected to be relevant to this study are provided in Table 1-4.

[2] The Community Land Act (2016), which relates to land ownership, will affect the land acquisition process. TKBV has developed a Land Access Framework (LAF) to guide the land acquisition process in compliance with the requirements of IFC Performance Standard 5, although this is a 'live' document and subject to amendment in response to legislative changes.

Table 1-4: Draft Legislation and Guidelines

Name of Legislation	Description
The Energy Bill, 2015 ■ *Energy (Local Content) Regulations, 2014*	The Energy Bill provides for a National Energy Policy and for the establishment of energy related entities and will provide for the regulation of midstream and downstream activities. The Bill consolidates the laws relating to energy, to provide for the national and county government functions in relation to energy, to provide for the establishment, powers and functions of the energy sector entities; promotion of renewable energy; exploration, recovery and commercial utilization of geothermal energy; regulation of midstream and downstream petroleum and coal activities; regulation, production, supply and use of electricity and other energy forms.
The Petroleum (Exploration, Development and Production) Bill, 2015, and subsidiary regulations: ■ *Petroleum Exploration, Development and Production (Local Content) Regulations*	The Bill once it comes into force is to provide a framework for the contracting, exploration, development and production of petroleum and cessation of upstream petroleum operations. The local content regulation will apply to local content with respect to the upstream petroleum operations.
Local Content Bill, 2018	The Bill seeks to provide for a framework to facilitate the local ownership, control and financing of activities connected with the exploitation of gas, oil and other mineral resources; and further to provide framework to increase the local value capture along the value chain in the exploration of gas, oil and other mineral resources.
The Draft National Energy Policy (2015)	The draft National Energy Policy set the policy for the provisions Clean, Sustainable, Affordable, Competitive, Reliable and Secure Energy Services at Least-Cost while Protecting the Environment.
Natural Resources (Benefit Sharing) Bill, 2018	The Bill seeks to establish a system of benefit sharing in resource exploitation between resource exploiters, the national government, county governments and local communities.
Physical Planning Bill, 2017	The Bill seeks to make provision for the planning use, regulation and development of land.
Land Value Index Laws (Amended) Bill, 2018	The Bill seeks to amend the Land Act, the Land Registration Act and the Prevention, Protection and Assistance to Internally Displaced Persons and Affected Communities Act; to provide for the assessment of land value index in respect of compulsory acquisition of land.

1.2.4 International Guidance and Standards

The ESIA has been completed with regard to Good International Industry Practice (GIIP), including the following:

- IFC (2012). Performance Standards for Environmental and Social Sustainability and accompanying Guidance Notes; and
- IFC (2007a). EHS General Guidelines including key sections on the following:
  - EHS Guidelines: Wastewater and Ambient Water Quality;
  - EHS Guideline: Air Emissions and Ambient Air Quality;
  - EHS Guideline: Occupational Health and Safety
  - EHS Guideline: Noise
  - EHS Guidelines: Water and Sanitation; and
- (IFC, 2007b). EHS Guidelines for Onshore Oil and Gas Development.

Good Practice guidelines which will be referred to throughout the ESIA include, but are not limited to, the following:

- Business and Biodiversity Offsets Programme (2012). BBOP Standard on Biodiversity Offsets Guidance;
- IFC (2013). Good Practice Handbook: Cumulative Impact Assessment and Management – Guidance for the Private Sector in Emerging Markets;
- International Petroleum Industry Environmental Conservation Association (IPIECA) (2005);
- IPIECA (2007). An ecosystem approach to oil and gas industry biodiversity conservation;
- IPIECA (2010). Alien invasive species and the oil and gas industry Guidance for prevention and management;
- IPIECA (2014). Cross Sector Biodiversity Initiative Guidance;
- The Energy and Biodiversity Initiative (2006). Integrating Biodiversity into Environmental and Social Impact Assessment Processes and associated guidance;
- The Energy and Biodiversity Initiative (2006). Negative Secondary Impacts from Oil and Gas Development; www.theebi.org;
- The Energy and Biodiversity Initiative (2006). Biodiversity Indicators for Monitoring Impacts and Conservation Actions; www.theebi.org;
- The Energy and Biodiversity Initiative (2006). Opportunities for Benefiting Biodiversity Conservation; www.theebi.org;
- The Energy and Biodiversity Initiative (2006). Good Practice in the Prevention and Mitigation of Primary and Secondary Biodiversity Impacts; www.theebi.org;
- The Energy and Biodiversity Initiative (2006). Framework for Integrating Biodiversity into the Site Selection Process;
- World Resources Institute (WRI) (Landsberg F, Treweek J, Stickler MM, Henninger N and Venn 0) (2013). Weaving ecosystem services into impact assessment: A Step-By-Step Method;
- WHO (2011). Drinking Water Quality Guidelines – 4th edition;
- WHO (2005). Air Quality Guidelines Global. Guidelines on the standards that should be achieved for air, in the absence of national guidelines;
- WHO (1999). Guidelines for Community Noise; and

- Traffic Impact Assessments, Institute of Transportation Engineers Trip Generation Manual (2001).

1.2.5 International Conventions

Relevant international agreements, treaties and conventions that have a social and/or environmental aspect, to which Kenya is a signatory or has acceded to/ratified, are detailed in Table 1-5.

Table 1-5: International Conventions

Convention	Date Ratified/Acceded to
African Convention for the Conservation of Nature and Natural Resources (2003)	Ratified (12 May 1969)
Convention on Biological Diversity (1992)	Ratified (26 July 1994)
Vienna Convention for the Protection of the Ozone Layer (1985)	Acceded to (9 November 1988)
UNESCO Convention for the Protection of the World Cultural and Natural Heritage (1972)	Accepted to (5 June1991)
UNESCO Convention on Intangible Cultural Heritage (2007)	Ratified (24 October 2007)
Convention on the Conservation of Migratory Species of Wild Animals (1985) ■ The African-Eurasian Water-bird Agreement (AEWA). ■ The Agreement on the Conservation of African-Eurasian Migratory Water birds (AEWA).	Acceded to (26 February 1999)
Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973)	Acceded to (13 December 1978)
Convention on Wetlands of International Importance (the Ramsar Convention 1971)	Only signatory
Convention on Persistent Organic Pollutants (2001)	Ratified (24 September 2004)
Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal (1995)	Acceded to (1 June 2000)
Bamako Convention on the Ban of the Import into Africa and the Control of Trans-boundary Movement and Management of Hazardous Wastes within Africa (1991)	Only signatory
Convention on Biological Diversity (2006)	Ratified (26 July 1994)
Convention on Climatic Change and the Kyoto Protocol (1997)	Ratified (25 February 2005)
Lusaka Agreement on the Cooperative Enforcement Operations Directed against Illegal trade in Fauna (1994)	Ratified (17 January 1997)
International Covenant on Economic, Social and Cultural Rights	Ratified 1972
Convention on the Elimination of All Forms of Discrimination against Women.	Ratified 1984

Convention	Date Ratified/Acceded to
Optional Protocol to the Convention on the Elimination of Discrimination against Women	Adopted 1999
Convention on the Rights of the Child	Ratified 1990
Optional Protocol to the Convention on the Rights of the Child on the involvement of children in armed conflict	Ratified 2002
Optional Protocol to the Convention on the Rights of the Child on the sale of children, child prostitution and child pornography	Signed 2000
Convention on the Rights of Persons with Disabilities	Ratified 2008
Convention Relating to the Status of Refugees	Ratified 1966
The African Charter on Human and Peoples" Rights (African Charter)	Ratified 1981
The African Charter on the Rights and Welfare of the Child	Ratified 1990
The AU Convention on Preventing and Combating Corruption	Ratified 2003
The AU Convention Governing Specific Aspects of Refugee Problems in Africa	Ratified 1974
The Protocol to the African Charter on the Rights of Women in Africa (Maputo Protocol)	Ratified 2003
The African Commission on Human and People's Rights	Ratified 1972
International Covenant on Economic, Social and Cultural Rights	Ratified 1972
Abolition of Forced Labour Convention	Ratified 1964
Equal Remuneration Convention	Ratified 2001
Right to Organise and Collective Bargaining Convention	Ratified 1964
Discrimination (Employment and Occupation) Convention	Ratified 2001
Worst Forms of Child Labour	Ratified 2001
Forced Labour convention	Ratified 1964
United Nations Convention Against Corruption	Ratified 2003
African Union Convention on Preventing and Combating Corruption	Ratified 2007
East African Community's Protocol on Preventing and Combating Corruption.	Signed 2008

1.2.6 TKBV Policies, Procedures and Guidelines

TKBV environmental and social internal policies, procedures and guidelines that inform the ESIA process include, but are not limited to, the following:

- Policy on Safe and Sustainable Operations;
- Community Grievance Management Procedure;
- Contractor Local Procurement Guidelines;
- Contractor Local Recruitment Guidelines;
- Contractor Non-Technical Risk Assessment and Management form (Risk Levels 1 and 2);
- Employee Standard;
- Human Resources – Contractor Standard;
- Human Rights Policy;
- Interim Trucking Project – Supplemental Appraisal;
- Kenya Joint Venture Socio-Economic Investment Strategy in Turkana (2017 – 2021);
- Land Access and Resettlement Framework (LARF);
- Local Content and Capacity Building Framework;
- Non-Technical Risk Standard;
- Tullow Oil Integrated Management System; and
- TKBV Shared Prosperity Commitment.

1.2.7 Consideration of Climate Change

The influence of climate change on the Project will not be considered due to the short life-span of the Project.

1.3 Stakeholder Engagement

The objective of stakeholder engagement is to ensure that legislative requirements are met; sources of information and expertise are identified; stakeholder concerns and expectations are registered and addressed; and affected communities have the opportunity to discuss project risks and impacts, and proposed mitigation and monitoring measures.

The Stakeholder Engagement Plan is presented in Volume II, along with the plan for EOPS disclosure and the consultation materials. However, the following subsections present a summary of stakeholder engagement to date relating to EOPS.

1.3.1 Engagement during exploration and appraisal

TKBV 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 at a national, county and community level has increased.

TKBV has four Community Resource Centres (CRC) in Lodwar, Lokichar, Nakukulas and Lokori. The CRC allow the opportunity for walk-in visitors to receive project information, to ask questions, and to log issues/grievances. The CRC are manned by Community Communications Coordinators. TKBV also has a team of Field Stakeholder Engagement Officers (FSEO) who support day-to-day operations engaging with local stakeholders in Turkana South and East. TKBV also has dedicated Grievance Officers responsible for managing the TKBV Grievance Mechanism.

A key objective of the TKBV field social performance team is to identify and address community grievances raised by stakeholders residing close to the company's area of operations. A total of 98 grievances were received in 2017 (not necessarily related directly to EOPS but related to TKBV activity). As of mid-October 2018, a total of 45 grievances have been received in 2018. As a snapshot and to provide some context for the stakeholder concerns, topics covered in October 2018 grievances include:

- Recruitment process;
- Environmental concerns – dust;
- Environmental concerns – air;
- Contractual terms; and
- Severance pay.

1.3.2 ESIA Scoping Consultation

The EOPS ESIA Scoping Consultations were initiated in May 2016 and included a series of meetings to disclose the Project concept and explain the ESIA process to key stakeholders. Consultations were held with the government, international organisations, the regional media and international, national and regional NGOs. The date, type of meeting and number of attendees are summarised in Table 1-6.

The objectives for each meeting were the same:

- Provide information on the EOPS Project and details of the EOPS ESIA process to key stakeholders;
- Align the ESIA approach with national regulations and international lender requirements;
- Document issues, questions and concerns that need to be considered and addressed during the later stages of the ESIA and reflected in the ToR; and
- Solicit feedback from key national and regional stakeholders on our approach to consultation with a wider group of stakeholders, especially potentially project affected people (PAPs).

The team comprised of TKBV, Golder and EMC staff. TKBV facilitated the meetings, arranged venues and sent out invitation letters. The team held meetings in Nairobi, Lodwar and Eldoret, reaching out to stakeholders in the capital and two County capitals (Turkana and Uasin Gishu respectively[4]).

TKBV agreed with NEMA that community consultation would occur at a later date once a more clearly defined EOPS Project Description is available. The list of stakeholders consulted was drafted in consultation with NEMA. However, all stakeholders were encouraged to share information on the Project with other groups as appropriate. While none of the meetings were advertised to the general public, participants invited to the non-governmental events received a letter of invitation and were welcome to bring other interested stakeholders.

All meetings were started with two brief presentations. The first outlined the development of the EOPS Project Description as well as the ongoing technical and engineering studies underway to further define the Project Design. The second presentation provided information on the EOPS ESIA and stakeholder engagement process. Presentations were provided to all stakeholders on request.

In addition to the presentations, a 4-page printed Topic Sheet was provided to describe the EOPS Project and the EOPS ESIA Process. This was provided to all participants in English and Swahili. All presentations were delivered in English, but participants were invited to ask questions in their preferred language. Turkana-speaking TKBV staff were present at all meetings held in Lodwar for the purpose of translation, if desired, however, no translation was requested.

[4] Engagement in Uasin Gishu did not extend beyond the scoping phase due to the change in project description described in Section 3.2.2.

Each presentation stressed the on-going role of the grievance mechanism. All meeting attendees were encouraged to contact the grievance officer in relation to any outstanding complaints.

Table 1-6: EOPS ESIA scoping Consultation meetings - Total Attendees

Date	Meeting/Type	Total Participants
25 May 2016	Ministerial Forum – Nairobi	19
26 May 2016	UN Forum – Nairobi	3
26 May 2016	International NGO Forum I – Nairobi	9
27 May 2016	International NGO Forum II – Nairobi	20
30 May 2016	Turkana County – Ministry of Energy – Lodwar	5
30 May 2016	Turkana Deputy Governor – Lodwar	1
30 May 2016	Water Resources Management Authority (WRMA) – Lodwar	1
2 June 2016	Chairperson, National Assembly Committee on Environment – Nairobi	1
06 June 2016	Turkana NGO Forum - Lodwar	14
06 June 2016	Turkana County Commissioner and County Commandant - Lodwar	2
07 June 2016	Turkana Media Briefing – Lodwar	6
07 June 2016	Members of the County Assembly (MCA) and National Environment Management Authority (NEMA) – Lodwar	16
9 June 2016	Uasin Gishu NGO Forum – Eldoret	26
10 June 2016	Uasin Gishu Deputy Governor and NEMA – Eldoret	6
10 June 2016	Uasin Gishu Deputy County Commissioner – Eldoret	3
	Total Attendees	132

No scheduled meetings were cancelled, however due to a number of scheduling conflicts under other circumstances (Oil & Gas conference in Lodwar 26/27 May) a number of prominent stakeholders were unable to attend the planned meetings in May. For instance, the representation from the United Nations was less well attended than anticipated. The Chair of the main Oil and Gas civil society platform was unable to attend. The NGOs meeting in Lodwar was less well attended than it had been for the FFD in November 2015. Nevertheless, it is believed that a wide enough cross section of stakeholders was reached to enable an objective assessment of stakeholder concerns.

It is worth noting that during the period of the scoping consultations the team did not meet one major group of stakeholders, namely elected national political representatives from Turkana (MPs, Senator, and Women's Representative). Golder understands that these stakeholder relationships were managed by the TKBV Social

Performance and Government and Public Affairs teams that provide disclosure materials to all key government officials and conducted follow-on meetings.

During the meetings listed above, a total of 212 issues, questions and concerns were documented. The most frequently raised issues are presented below, with the first listed topic being the most commonly raised:

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

The most commonly raised topic was in relation to 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 the FFD. Among environmental issues, the most commonly raised questions were in relation to water, air quality and the potential impacts of gases on nearby communities and traffic, which was 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 largely the responsibility of the government, but that TKBV would seek to make sure that the process around revenues was transparent.

ESIA inquiries 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. As far as possible, 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 following completion of the impact analysis in 2018, (Section 1.3.5).

Compared to the FFD, 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. 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. 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. Nevertheless, for EOPS there would be no land take.

Security inquiries 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 with 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 Turkana County 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 in Lokichar.

1.3.3 ESIA Consultation Stakeholders

The EOPS ESIA Consultations were started in June 2018. They were partly delayed due to a protest that temporarily closed the Kapese Camp and forced the majority of the meetings to be postponed until late September 2018. ESIA Consultations sought to summarise ESIA results for stakeholders, including those in government and civil society at the international, national and regional level. The date, type of meeting and number of attendees are summarised in Table 1-7.

It should be noted that the public barazas in the meeting list included at least a hundred people. Specific participant totals are not included given the nature of the public barazas, in which people come and leave, making it difficult to quantify the exact number of people who attended such open-air events. The issues raised in public barazas are captured in the Consultation Results below.

Table 1-7: EOPS ESIA Consultation meetings - Total Attendees

Date	Meeting/Type	Total Participants
29 June 2018	Nairobi Stakeholder Consultation Meeting	49
21 June 2018	TCG Environmental Sub-committee	28
24 Sept 2018	Lodwar Based NGO, CSO and FBO meeting, and Lodwar Media	86
26 Sept 2016	Turkana South County and National Government County officials	4
26 Sept 2016	Lokichar based NGO, CSO and FBO meeting	9
27 Sept 2016	Chiefs and Elders – Lokichar Location	31

Date	Meeting/Type	Total Participants
27 Sept 2016	Lokichar Traditional Leaders	19
28 Sept 2018	Turkana East County and National Government County officials	15
28 Sept 2018	Lokori based NGO, CSO and FBO meeting	27
30 Sept 2018	General public baraza in Lokichar Location	--
06 June 2016	Nakukulas Based NGOs, CSO and Small Business	28
07 June 2016	Lodwar-based County and National Government officials	9
07 June 2016	Wasafiri-convened Traditional Leaders	56
9 June 2016	General public baraza in Kochodin Location	--
	Total Attendees	361

1.3.4 ESIA Consultation Approach

The objectives for each meeting were the same, however, consultation materials were adapted for events held without facilities to display a presentation. In these events, presenters used printed presentations to summarise information. In each meeting, the consultation team sought to:

- Provide information on the EOPS Project and review the EOPS ESIA process to key stakeholders;
- Explain how the ESIA approach addressed both national regulations and international lender requirements;
- Document issues, questions and concerns; and
- Solicit feedback from key national and regional stakeholders for future consultation.

The team comprised of TKBV, Golder and EMC[5] staff. TKBV facilitated the meetings, arranged venues and sent out invitation letters.

All meetings were initiated via a brief presentation of the ESIA and its results, including the most relevant impact topics and planned mitigation measures. In addition to the presentations, a 4-page printed Background Information Document (presented in Volume II) was provided to describe the EOPS Project and the EOPS ESIA Process. This was made available to all participants in English and Swahili. All presentations, with the exception of public barazas, were delivered in English, but participants were invited to ask questions in their preferred language. Turkana-speaking TKBV staff were present at all meetings for the purpose of translation if desired. However, no translation was requested. During public barazas, presentations were provided in English with translation into Turkana.

Each presentation stressed the on-going role of the grievance mechanism. All meeting attendees were encouraged to contact the grievance officer in relation to any outstanding complaints.

All meetings were held as planned with the exception of the ESIA Consultation for Members of the County Assembly. These and other stakeholders who would like to receive ESIA results will be encouraged to visit

[5] Although due to sickness not all meetings could not be attended by EMC

Community Resource Centres, where full copies of the ESIA and Non-technical Summary will be available for at least 30 days.

1.3.5 ESIA Consultation Results

During the meetings listed above, a total of 327 issues, questions and concerns were documented. The most frequently raised issues are presented below in order, with the first topic being the most commonly raised:

- Community Aspects – 21%:
  - Health, Safety & Security – 11%;
  - Benefits – 6%;
  - Cultural Heritage – 2%; and
  - Social Maladies – 2%.
- Environment – 20%:
  - Water – 6%;
  - Air Quality and Climate – 4%;
  - Biology – 4%;
  - Pollution / Waste – 3%;
  - Traffic – 1%;
  - Visual – < 1%; and
  - Soil – < 1%.
- Engagement – 18%;
- General Project Updates/Inquiries – 14%;
- ESIA General Inquiries – 7%;
- National Content – 6%;
- Land Access & Acquisition – 6%; and
- Security[6] – 4%.

The most commonly raised topic was related to social or community aspects of the Project. Comments on this topic represented 22% of the total comments made. Within this category, the primary concern with 11% of all issues received were related to health, safety and security aspects of the Project.

Environmental issues were the second most commonly raised topic. Engagement and general project enquiries represented 19% and 13% of the total comments, respectively.

ESIA enquiries constituted 7% of the comments, many of which related to the scope of the impact assessment and queries regarding the details of the associated management plans and commitments, all of which will be completed and submitted to the public. As far as possible, the TKBV and Golder team used the responses to

[6] In contrast to the topic of health, safety and security, these issues dealt with aspects of conflict unrelated to Tullow such as banditry and conflict with other ethnic groups.

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.

National content questions were raised in many meetings and represented 7% of the total comments. Stakeholder expectations are high for employment. As with the Scoping Consultation, Golder observed a continued tension between the national content and "local" content, indicating that employment given to people outside Turkana County needs to be clearly justified.

Land issues represented 6% of the total comments. This remains a sensitive issue for many stakeholders, even though all presentations stressed that no new land would be required for the EOPS Project.

Security enquiries related to tensions between Turkana and Pokot, as well as general security along the A1 highway, totalled 4% of total comments. Questions were related to the on-going issue of banditry and conflict with the neighbouring Pokot pastoralists.

1.3.5.1 Issues and Responses

An ESIA Stakeholder Engagement Consultation Issues and Responses document is provided in Volume II and presents issues / questions relating to EOPS, which were raised during EOPS ESIA consultation meetings. It presents 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.

1.4 Impact Assessment Methodology

The following provides a summary of the methodology, which is expanded upon in Volume II.

1.4.1 Overview

The ESIA is a process and management technique that allows for the consideration of the likely environmental and social impacts of a development prior to it proceeding. This provides an opportunity to ensure that the design is optimised in an integrated manner, minimising negative environmental and social impacts and maximising positive impacts.

The ESIA will be undertaken in accordance with the applicable requirements of:

- Kenyan EIA legislation and policy;
- TKBV internal policies and standards; and
- Good International Industry Practice (GIIP).

The ESIA process in Kenya is shown schematically in Figure 1-3.

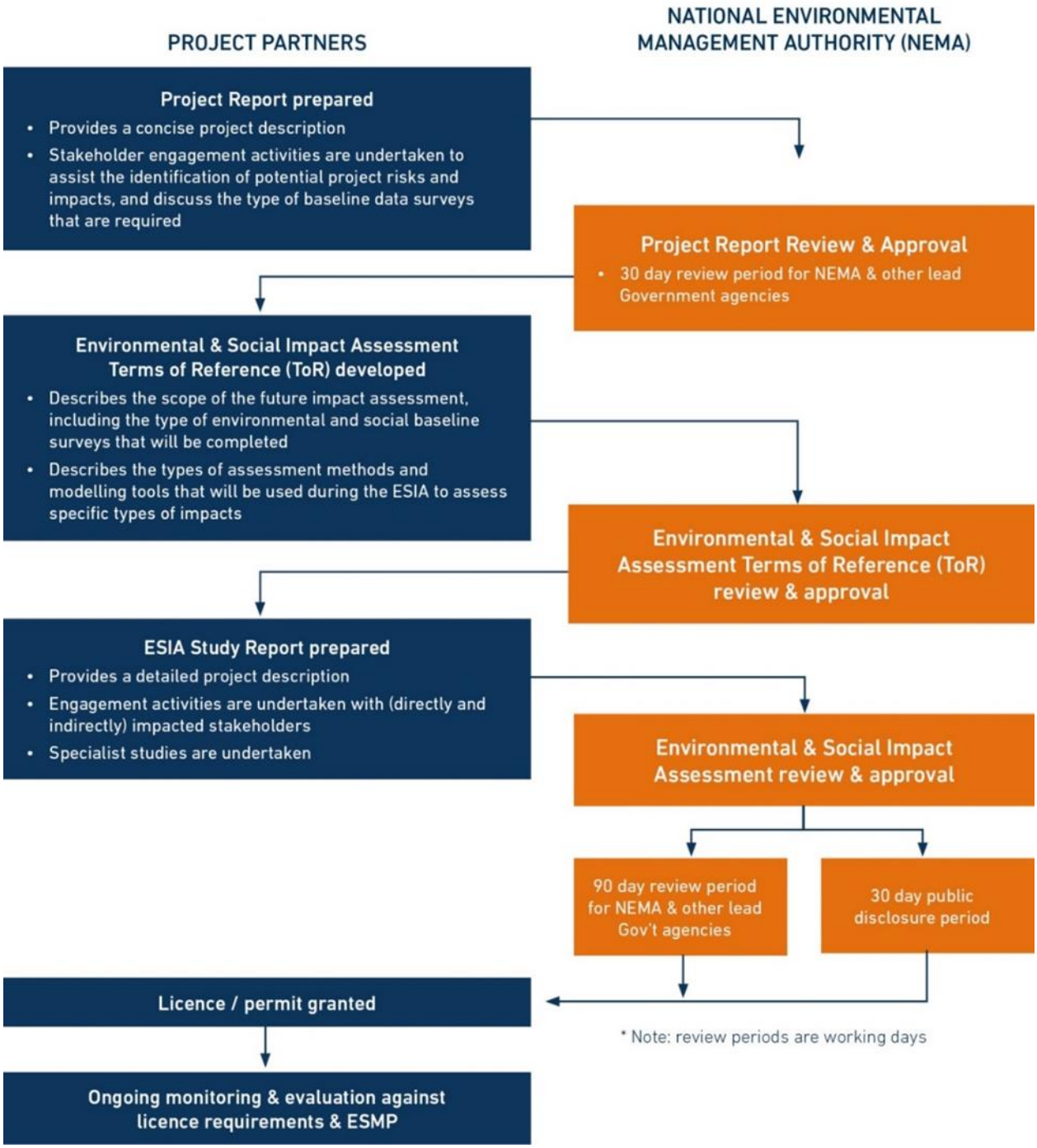


Figure 1-3: Overview of the ESIA Process in Kenya

1.4.2 Scoping Stage

The aim of scoping is to identify at a high level the potential impacts on environmental and social receptors likely to arise from Project activities that will need to be further considered in baseline data collection and the impact assessment. Scoping is also used to determine how the ESIA will be undertaken.

The primary output of the EOPS ESIA scoping stage was the preparation of a ToR (Volume II) and supporting Project Report. For those impacts scoped in, the proposed method and approach for predicting and evaluating their consequence or significance is presented in this ESIA report, and further described in Volume II.

1.4.3 Establishment of Baseline Conditions

Baseline data collection is undertaken to characterise the existing environmental and social receptors and conditions in a defined Baseline Study Area, and to identify trends in such conditions, including the situation that would prevail in the absence of the Project. Baseline data determination largely comprises:

- Review of existing published sources and other available secondary information, including those held by government agencies, Non-governmental Organisations (NGOs) and research agencies; and
- Site reconnaissance visits and field surveys, and the subsequent analysis and interpretation of data.

1.4.4 Impact Assessment

The term “effect” will be used when describing a change arising from the Project. The term “impact” will be used to describe an effect that results in a change to a receptor. This may or may not require mitigation or management to be considered. 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 and that may not be within the control of the developer (e.g. changes to water availability due to increased influx of people). Where there is an effect on a receptor from a certain discipline that is outside the scope of that specific discipline (e.g. emissions to air affecting cultural heritage assets) this is also considered an indirect effect; and
- Combined – the combination of multiple direct or indirect effects of the Project on any one or group of receptors (e.g. combined effect of air and noise emissions on cultural heritage receptors).

The impact assessment process will comprise the following main steps:

- Identification of the effects of the Project on receptors taking into account incorporated environmental and social measures (see Section 1.4-5);
- Evaluation of the magnitude of the effect;
- Impact determination and classification;
- Development of mitigation measures; and
- Where necessary, prediction of the consequence of residual effects.

An overarching framework for the impact assessment of environmental and social topics, based on these steps, is provided in Volume II. The details of the methodology for each topic will, however, be developed based on: professional judgement; comparison with topic-specific regulations or standards; comparison with experience on other similar projects; and consultation with stakeholders.

In addition to the standard ESIA methodology, the impact analysis for each environmental and social topic will be accompanied with a hazard analysis of environmental risks and accidents, which will be reported in a separate chapter.

1.4.5 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).

1.4.6 Environmental Impact Classification

The environmental impact classification (also applied to cultural heritage) will be determined by taking into account several factors. This will vary per topic but may include one or several of the following:

- Magnitude of effect;
- Geographic extent of effect;
- Duration of effect; and
- Frequency.

It is proposed that probability is not considered as part of the criteria for the prediction of effects. Probability will be considered only when assessing environmental risks/accidents, which will be addressed separately in the ESIA.

Impacts will be considered to be either Major, Moderate, Minor or Negligible; and Beneficial, Adverse or Neutral. Impact assessment criteria will be specific to each environmental topic and will be defined in the impact assessment using a combination of environmental standards, guidance and professional judgement.

1.4.7 Evaluating the Consequence of Environmental Impacts

Impact consequence will be determined for some technical areas by consideration of the importance/sensitivity of the receptor in combination with the impact classification.

Impact consequence will be considered to be either Major, Moderate, Minor or Negligible; and Beneficial, Adverse or Neutral.

1.4.8 Evaluating the Consequence of Social Impacts

The evaluation of social impacts will differ from the evaluation of environmental impacts. The consequence 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 four criteria to reach a conclusion for the overall social impact:

- Direction:
  - Positive direction;
  - Negative direction; and
  - Mixed direction.
- Consequence:
  - 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, however, an overall conclusion on consequence is also given.

1.4.9 Mitigation of Impacts

Additional measures will be committed to if, as a result of the ESIA, mitigation is required. Mitigation will be identified in accordance with a hierarchy of options, in compliance with GIIP. This hierarchy is:

- Avoid - making changes to the Project's design or location to avoid adverse effects on an environmental feature or adverse social impacts;
- Minimise - reduction of adverse effects through sensitive environmental treatments/design, or different project design to reduce adverse social impacts;
- Restore - measures taken during or after construction to repair/reinstate and return a site to the situation prior to occurrence of 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; and
- 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.

1.4.10 Identification of Residual Impacts

Residual impacts are those that remain following the implementation of the proposed mitigation. Residual impacts will be defined based on the same process applied to the evaluation of impacts.

1.5 Study Areas / Areas of Interest

The Project is located in Turkana County (Figure 1-4) with proposed infrastructure located in the two sub-county administrative units, or Constituencies, of Turkana East and Turkana South, within land where TKBV is currently permitted to undertake exploration activities under exploration permit no. PR 7764/0001253.

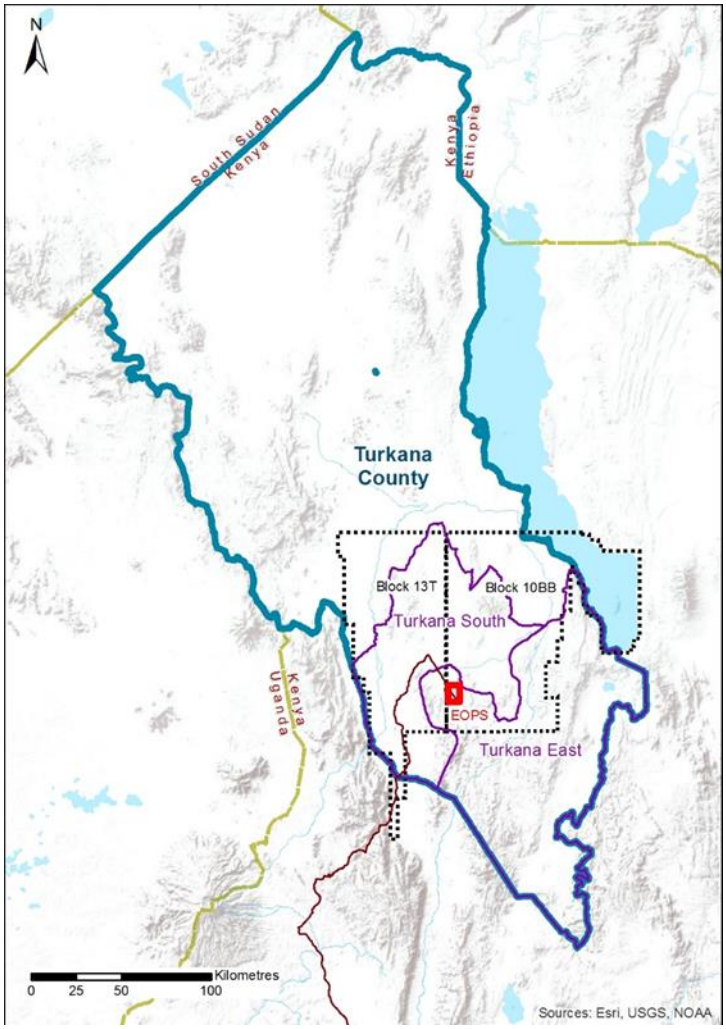


Figure 1-4: EOPS Location

Baseline study areas (local study areas and, where relevant to the baseline, the regional study areas also) for each of the technical discipline areas are presented 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.

In order that the results of effects analyses and impact assessments could be shared between disciplines and common receptors could be identified within those study areas, common impact assessment areas were defined. The outcome is the following study areas (or Areas of Interest), which are used throughout the EOPS ESIA:

- **Upstream Biophysical Impact Assessment Local Study Area** (Drawing 1.5-2) - used by biophysical disciplines including Noise and Vibration; Air Quality; Soils, Terrain, Geology and Seismicity; Water Quality and Quantity; Biodiversity and Protected Areas; Ecosystem Services; and Cultural Heritage;
- **Upstream Physical Impact Assessment Regional Study Area** (Drawing 1.5-3) - used by physical disciplines, including Landscape and Visual; and Water Quality and Quantity;
- **Upstream Biological Impact Assessment Regional Study Area** (Drawing 1.5-4) - used by biological disciplines, including Biodiversity and Protected Areas; Ecosystem Services;
- **Upstream Social Impact Assessment Study Area** (Drawing 1.5-5) - used by social disciplines; and

- **Midstream Impact Assessment Study Area** (Drawing 1.5-6) - used by all disciplines where effects analyses are relevant to Midstream activities[7], including Social (particularly related to accidents and spread of STDs). Noise and Vibration; Air Quality; Biodiversity and Protected Areas; and Cultural Heritage. This study area is defined as a 200 m wide corridor, 100 m either side of the road network used to transport oil between the EPF at Amosing-1 and Mombasa, plus any protected areas which fall in part within that corridor.

[7] Where not considered relevant this is stated within Section 5 of this document.

2.0 SUMMARY OF EXISTING ENVIRONMENTAL AND SOCIO-ECONOMIC CONDITIONS

The Environmental and Social baseline report is presented in Volume II of this ESIA. In order, to provide context for the impact analyses presented in herein; this Section presents a summary of the key findings of the baseline studies as they relate to the scope of the impact assessment i.e. not all baseline conditions are described in full if not directly of relevance to the impact assessment – the comprehensive baseline conditions are described in Volume II. As impacts for the Midstream component of EOPS are more limited than those predicted for the Upstream component, the baseline focusses mainly on the Upstream baseline conditions.

2.1 Traffic

Existing background traffic data was obtained from KeNHA. The Kenya Institute of Safety and Health (KIOSH) completed preliminary traffic surveys during Q4 2016 at nine locations along the EOPS designated route (clustered at four strategic positions including Kitale and Eldoret). Data was also gathered in Lokichar by EMC (12-hour daytime count was undertaken at two locations). Summarised data is presented in the Traffic Impact Analysis (TIA) in Volume II.

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. The total volume of traffic, including articulated vehicles, identified in the KIOSH survey is presented in Table 2-1.

Table 2-1: Total Daily Traffic Count - Midstream 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

Location	Direction	
	Nairobi-Eldoret	Eldoret-Nairobi
	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.

2.2 Climate

A detailed discussion of the climate and meteorology is included in the climate baseline study, which is presented in Volume II. The EOPS Upstream area is located in the Turkana region of northeastern Kenya. Meteorological stations established at Kapese Camp and the Ngamia oil field are located approximately 80 to 100 km south of Lodwar, which is the primary reference station. The area has a warm desert climate with high average temperatures. The equatorial location means that there is limited annual variation in temperature, which is reflected in the high (>20°C), stable monthly average temperature and the maximum and minimum temperatures recorded by the meteorological stations in Kapese Camp and Ngamia oil field. These measurements are in concordance with those recorded at the Lodwar meteorological station. The warm desert climate of the EOPS Upstream area is also reflected in low relative humidity encountered at Kapese Camp and Ngamia during the majority of the year.

Most areas of equatorial eastern Africa have a double rain season, with one between March and May and a second between October and 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 April to June rain season are reflected by a peak in total precipitation and relative humidity recorded during this time at Kapese Camp and Ngamia, as well as at

Lodwar. The 'long rains' season coincides with the recorded maximum daily precipitation events at Kapese Camp, Ngamia and Lodwar and the 1-hour intensity precipitation events at Kapese Camp and Ngamia. There is also a secondary peak in precipitation in November during the "short rains". Monthly maximum total precipitation and the monthly average precipitation received at Lodwar over a period of 34 years indicates significant annual variation in the area.

Average and maximum monthly wind speeds at Kapese Camp and Ngamia are low (<3.5 m/s and <9 m/s, respectively) and do not exhibit any distinct seasonal variation. Average and maximum wind speeds at Lodwar are very similar to Kapese Camp 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 from 2008 to 2013, wind speed is less than 4m/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 northeast monsoons dominate between December and February, whilst the southeast monsoons are observed between June and August. Wind roses for Kapese Camp, Ngamia and Lodwar all indicate a prevalence of easterly winds. A slight shift in prevailing wind direction to northeast at Ngamia may be related to local topography and the high grounds located approximately 10 km to the east of Ngamia. The Lodwar wind rose 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 dataset provided by the on-site meteorological stations reflects the local warm desert climate and is in general agreement with the secondary data from the Turkana region recorded at Lodwar. The prevalence of easterly winds is associated with the distinct monsoon pattern observed over equatorial eastern Africa and shared with the wider region. The measurements from the on-site meteorological stations, as well as the Lodwar dataset, are reflective of the meteorological conditions within the Upstream area.

2.3 Soils, Geology and Seismicity

2.3.1 Soils

The soils baseline study identified that soils in the Project area are generally nutrient-poor, with high pH, low organic matter and clay content. At the Ngamia and Amosing wellfields specifically, the soils are moderately well drained, moderately saline, strongly sodic and prone to rapid erosion by wind and water. Key observations included:

- Soils are locally saline and contain few rocks or stones. They are susceptible to moderate sheet erosions from flood events and locally moderate wind erosion;
- Sand is the dominant particle size at all test pits across Amosing and Ngamia wellpads and access roads, which coincides with the dominantly sandy characteristics of the soils that are typical of the region;
- Chemical analyses show that total carbon, organic carbon and inorganic carbon values are low across both the Amosing and Ngamia oil fields, which reflects the typical low soils organic matter of the region; and
- Results from the infiltration tests undertaken near to the Ngamia oil field are indicative of a fine to medium sand material, whilst results from the infiltration test undertaken near to the Amosing oil field are indicative of loamy soils.

2.3.2 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.

2.3.3 Geology of the Study Area

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.

2.3.4 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. The intensity of earthquakes in the region of the study area is degree VI (strong) or degree VII (very strong) on a scale 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. 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.

2.4 Air Quality

Background ambient air concentrations and dust deposition, for the effects analysis, were derived from the air quality baseline study (Volume II). Baseline monitoring was undertaken from November 2015 to September 2016 at Amosing, Ngamia, Kapese Camp and Lokichar, with PM10 and PM2.5 monitored at Kapese Camp only.

Baseline average air quality concentrations for the monitored pollutants are provided for the Ngamia and Amosing wellpads in Table 2-2. These are deemed to be representative of the Upstream area. The table also includes is the Air Quality Standard (AQS) for each pollutant.

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

	Averaging Period	Concentration (µg/m^3, unless stated)	AQS (µg/m^3, 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)/	Annual	34.5	140	25
	24-hour	40.7	200	20

	Averaging Period	Concentration (µg/m^3, unless stated)	AQS (µg/m^3, unless stated)	Concentration as % of AQS
Total Particulate Matter (TPM) (b)				
PM^{10} (b)	Annual	21.7	20	109
	24-hour	25.6	50	51
PM$^{2.5}$ (b)	Annual	5.0	10	50
	24-hour	5.9	25	24
Deposited Dust	Annual	69.5 mg/m^2/day	200/m^2/day	35

(a) No relevant AQS

(b) Data from Kapese Camp - The maximum concentration recorded was 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 baseline for the annual average concentration of PM_{10} exceeds the AQS, indicating that levels of PM_{10} in the area are naturally high or are already the subject of effects at Kapese Camp. The AQS of 20 µg/m^3 is the IFC Guideline value. However, the IFC also has interim targets (Interim Targets 1, 2 and 3), which are 70, 50 and 30 µg/m^3 respectively. These interim targets are seen as incremental steps in a progressive reduction of air pollution and are intended for use in areas where baseline is already above guideline values. The Kenyan standard for annual PM_{10} is 50 µg/m^3 at both the boundary and off-site, which corresponds with the IFC interim target 2. Due to the high baseline concentrations that have been recorded, it is considered that these interim targets could be applicable as a management tool for EOPS, with the AQS of 20 µg/m^3 the ultimate target.

2.5 Noise and Vibration

2.5.1 Noise Baseline

Noise baseline data gathering was completed as part of the FFD ESIA activities during three separate field visits (October 2015, January 2016, and October 2016) and included nine monitoring locations. Four of these monitoring locations are directly relevant to EOPS, the measurements from which are presented in the EOPS ESIA Baseline (Volume II). Data from these four locations, Lokichar, Amosing-5, Ngamia-5/6, and Kapese Camp, characterise the baseline noise environment within the EOPS Upstream area.

The relevant noise parameter for the baseline noise survey is LAeq (i.e., equivalent noise level). This is a unit commonly used to describe outdoor noise such as construction noise and noise from industrial installations and is the parameter adopted both by international and Kenyan guidance. Detailed definitions of noise terms and units are presented in the Noise Position Paper (Golder, 2016b).

The sound level meters (SLMs) were deployed once at each measurement location for approximately 24-hours. The gathered noise data were aggregated to give daytime (07:00 to 22:00) and night-time (22:00 to 07:00) period averages. A summary of the minimum hourly and period average measured baseline noise levels is provided in Table 2-3.

Table 2-3: Measured baseline noise levels

Monitoring Location	Coordinates (UTM 36N)	Monitoring Period	Daytime (07:00 – 22:00)		Nighttime (22:00 – 0700)	
			Minimum Hourly $L_{Aeq,1hr}$ (dBA)	Daytime Average $L_{Aeq,day}$ (dBA)	Minimum Hourly $L_{Aeq,1hr}$ (dBA)	Nighttime Average $L_{Aeq,night}$ (dBA)
Lokichar	**E:** 794168 **N:** 263794	October 2015	51.3	65.7	42.2	62.3
Amosing-5 [(a)]	**E:** 809673 **N:** 241418	January 2016	34.3	46.2	34.1	34.4
Ngamia-5/6	**E:** 807014 **N:** 244742	October 2016	39.3	59.9	34.1	43.4
Kapese Camp	**E:** 800931 **N:** 261631	October 2015	24.2	55.0	21.6	30.0

(a) Although measurements were made during each of the three data gathering periods at Amosing- 5; the January 2016 field program at Amosing-5 resulted in the lowest noise measurements and therefore was carried forward for the effects analysis to provide a more conservative 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 activity related noise.

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 the baseline noise levels.

Ngamia-5/6 is located within 200 m of the Lokichar Lokwamosing Road; traffic from this road contributed to the elevated average baseline noise levels.

2.5.2 Vibration Baseline

No existing sources of blast vibration were identified within the EOPS Upstream area. Intermittent vibration (produced by road traffic, construction activities and industrial sources) propagates over comparatively small distances, in the order of tens of metres. Other than at locations immediately adjacent to the roadside, baseline vibration levels in the EOPS Upstream area were therefore assumed to be similar to levels that occur in the natural environment, and as such, no baseline vibration survey was completed.

2.6 Water Resources

The water resources baseline was prepared using a combination of primary and secondary data sources, including existing reports on rainfall, water use, aquifer testing, water level monitoring, TKBV production well abstraction volumes, infiltration tests, groundwater level monitoring and surface water flow monitoring. The full baseline is provided in Volume II. Key points include the following:

- The Kalabata catchment in the vicinity of the EOPS Upstream area is located in an arid environment with drainage provided by an extensive dendritic network of wide shallow streams, known as luggas;
- Rain predominantly falls during the long-wet season (April – June) and the short-wet season (October – December);

- The main watercourse that flows through the study area is the Kalabata, which is located in a valley to the east of the Ngamia and Amosing oil fields. This is an ephemeral watercourse that is fed by direct precipitation, run-off and ephemeral flow from luggas, which provide a drainage network from the southwest;
- Flow in the luggas is ephemeral and driven by short duration, intense seasonal rainfall. Given the lack of vegetation, this likely leads to extensive erosion, high suspended solids content and rapid channel migration;
- 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 EOPS 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, occurs quickly;
- 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;
- The primary data, gathered from the wells located in the east of the catchment in which EOPS is located, indicates that groundwater is typically encountered at depth of 5 m to 20 m below ground level (bgl);
- Infiltration rates to the ground from tests provide an estimated saturated vertical hydraulic conductivity between 8.3 x 10^{-6} m/s and 2.6 x 10^{-5} m/s;
- The groundwater flow direction, indicated by both secondary and primary data sources, is towards the northeast, which corresponds with drainage towards the Kalabata;
- The depth to groundwater is greatest where the topographic elevation is highest (~30 m bgl at Kapese village) and in the area just to the north of the EOPS Upstream area (35-40 m bgl in Nabolei and Kengomo 1);
- 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;
- Groundwater is abstracted from wells as a source of exploration water by TKBV. In November 2016, the main local exploration water supply abstraction was occurring from East Lokichar, Nakukulas 9, Nakukulas 10 and Kengomo 1; and
- TKBV 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 TKBV'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.

2.7 Water Quality

The water quality baseline was prepared using a combination of primary and secondary data sources, including groundwater and surface water quality sampling by TKBV and Golder; field parameter measurements (pH, electrical conductivity, total dissolved solids, dissolved oxygen, temperature and oxidation reduction potential) made by Golder; and the findings presented in previous studies (Price 2014a and Price 2014b). The baseline data is presented in Volume II. A summary of the baseline is presented in this section. Key findings were as follows:

- Samples taken of groundwater and surface water have a typical temperature of around 30°C to 35°C;
- The pH of both groundwater and surface water is close to neutral. The pH of surface water ranges from 7.37 to 7.85 and the pH of groundwater ranges from 7.34 to 8.92. These are mainly within the range of the Project quality standard (>6.5 and <8.5). As the pH of rainwater is typically slightly acidic, the pH is likely to be a reflection of contact with soils/sediments;

- Electrical conductivity values, taken from both field and laboratory measurements, range between 0.274 mS/cm and 0.575 mS/cm in surface water and between 0.6 mS/cm and 3.5 mS/cm in groundwater. Values are variable over time with no apparent temporal/seasonal trends. Groundwater will typically have a higher electrical conductivity as it has been in contact with soils/sediments that can increase the presence of dissolved material that conducts electrical current. The highest of the electrical conductivity measurements in groundwater are mainly, but not exclusively, from deeper boreholes;
- Total Dissolved Solids (TDS) results from groundwater field measurements range from 263 mg/l to 625 mg/l and are within the range expected for fresh water. TDS in groundwater samples measured in the laboratory ranges from 255 mg/l to 4,150 mg/l. TDS concentrations are higher than the quality standard in samples taken from Nakukulas 9, Kengomo 1, Kengomo 2, Ewoi, Ekunyuk and Nabolei;
- Dissolved oxygen in the surface water samples ranges from 2.02 mg/l to 5.02 mg/l. The dissolved oxygen concentrations measured in groundwater range from 0.7 mg/l to 5.51 mg/l. The values indicate that the water is not completely saturated, but that the water is also not depleted in oxygen. The dissolved oxygen concentrations are higher during the wet season;
- Oxygen Redox Potential (ORP) calculated around the time of the short-wet season (November) was negative, indicating a reducing environment. All of the measurements made in May/June (towards the end of the longer wet season) were positive, indicating an oxidising environment;
- Water quality across the study area can be described as good with no inexplicable exceedances of water quality standards;
- The concentrations of major ions are generally below the Project water quality standards. Sodium concentrations are commonly elevated compared to the 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 samples from most locations. Elevated concentrations of fluoride 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 noted in samples taken from Nakukulas 9, GW5, Kengomo 1, Ekunyuk and Nabolei. It is considered likely that these fluoride and chloride levels are indicative of the prevailing conditions within the Ngamia and Amosing oil fields, although no sampling was undertaken in these exact locations;
- Metal concentrations in most surface water samples were below the laboratory limit of detection (LOD). Barium, boron and zinc were all detected in surface water samples, but at concentrations below the defined Project water quality standard;
- In groundwater, most of the metal concentrations are below the laboratory LOD. 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 smaller proportion of samples taken;
- Poly-aromatic hydrocarbons (PAHs) and total petroleum hydrocarbon (TPH) concentrations were occasionally detected in groundwater at concentrations equal to or just above the LOD of 0.01 mg/l. Naphthalene and pyrene were detected in surface water. Other hydrocarbon concentrations are also mainly below the LOD; and
- There is some evidence of human or animal waste in both surface water and groundwater. Nitrate (as NO3) is commonly measured in groundwater samples at concentrations above the standard of 10 mg/l. Total coliform counts in groundwater samples were frequently greater than the LOD. The coliform count (total and faecal) for surface water is higher than that for groundwater.

2.8 Landscape and Visual

A baseline study was undertaken to determine the aesthetic quality of the landscape and to identify the location and sensitivity of potential receptors within the EOPS Upstream area. The landscape character baseline established the key characteristics and classification of the landscape within a 10 km radius of EOPS and, based

upon these characteristics, classified the landscape into a number of Landscape Character Areas (LCAs). The visual baseline identified potential visual receptors, from which the Project could possibly be visible.

The landscape in the Upstream area is predominantly semi-desert plains, which transitions into dense bushland and rock habitat/stunted bushland on higher ground. The dense bushland landscape is intersected by alluvial woodland along the Kalabata. The landscape baseline ascertained that the majority of the Project footprint was located within LCA 1 (semi-desert).

The baseline visual assessment used Zone of Theoretical Visibility (ZTV) mapping and analysis to identify potential visual receptors. This desktop analysis identified 14 homesteads that had the potential to be visually impacted by EOPS. A photographic field assessment was subsequently carried out in May 2017 to record the views from these homesteads. It was found that no homesteads are in the visibility range of the Project due to the landscape vegetation of scrub and trees.

2.9 Biodiversity, Ecology and Protected Areas

The biodiversity baseline was prepared using a combination of primary and secondary data sources, including GBIF, IBAT and ILRI datasets; NMK museum and herbarium records, published dataset in Van Breugel *et. al.,* (2015); White (1983); IUCN (2016); published scientific studies, historical and recent reports related to the Project and wider area. In addition to published and unpublished data, consultation was held with regional experts to gather their input and knowledge of the study area, identify additional data sources, and to gain expert opinions and advice.

Primary data sources included land cover mapping and classification for the Upstream area, and a seasonal field programme. The field sampling programme (largely as part of the FFD ESIA baseline) ran from October 2015 to August 2016, and covered vegetation and flora, invertebrates, herpetofauna, birds and mammals. The full baseline information is presented in the Annex 3. A summary of the key points of that baseline is presented below.

Upstream Study Area

- The Upstream Study Area straddles two of the eco-climatic zones (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. Three broad vegetation communities occur within the RSA: *Acacia/Commiphora* bushland/thicket; riparian forest; wooded ephemeral streams (Drawing 5.8-1). Identified populations of four flora species of conservation concern occur in the 'Katamanak' hill region.
- Wooded ephemeral streams and riparian forest habitat supported the greatest invertebrate diversity; with the most abundant and diverse group represented by the insects. A single invertebrate species of conservation concern (an unnamed ground beetle in the genus *Omophron* (Family: Carabidae, Sub-family: Omophrininae) was collected near Loperot, but is likely to occur more widely. A recently discovered bee species, *Samba turkana*, although not recorded during the baseline surveys, has the potential to occur in the Upstream Local Study Area (LSA).
- Fourteen reptile species, and one amphibian species, were recorded. Two species of conservation concern were recorded: IUCN-listed data deficient Lake Turkana Toad (*Sclerophrys turkanae*), and the nationally protected and CITES Appendix II-listed Kenya Sand Boa (*Eryx colubrinus*). Two other reptile species of conservation concern have a potential to occur within the Upstream LSA.
- Most of the 109-bird species recorded are common and typical of the region. Species community composition was generally comprised of resident woodland and grassland species. No seasonal variation in communities was observed. Nineteen raptor species were recorded, including several Palearctic

migrants, reflecting the areas location within the East Asia/East Africa Flyway. Sixteen bird species of conservation concern were recorded. These included six globally-threatened species, four nationally protected species, and thirteen migratory species. An additional 15 bird species have potential to occur.

- Historically, low densities of a diverse assemblage of grazing herbivores occurred in the area (Coe, 1972; Watson, 1969). Recent studies suggest that the presence of high numbers of livestock throughout the Turkana region have resulted in the suppression of most of those herbivore species (Riginos *et al.,* 2012), presumably with concomitant effects on the assemblage of predatory species. Consequently, the historical wildlife community is now virtually absent from the region (de Leeuw *et al.,* 2001). Twenty-nine mammal species were recorded, with a potential for at least another six to occur. Eight species of conservation concern have a potential to occur.
- Three vegetation communities of conservation concern are mapped within the Upstream RSA (Drawing 5.8-2). One of these, riverine wooded vegetation, aligns with the riparian forest mapped during baseline field studies in the Upstream Study Area.
- Two protected areas (Lake Turkana National Park, a Ramsar site and Important Bird Area (IBA); South Turkana National Reserve) lie adjacent to the Upstream Study Area; however, they are distant from the proposed activities, and are, therefore, not considered a potential receptor.

Midstream Study Area

- Three internationally and/or nationally designated or protected areas will be traversed by the Midstream Study Area: Kinangop Grasslands IBA, Kikuyu Escarpment IBA, and Tsavo West National Park and IBA. These areas are either adjacent to or passed through by the existing road network that will be used by EOPS.

2.10 Ecosystem Services

The ecosystem services baseline was prepared using a combination of primary and secondary data sources, obtained from the baseline biophysical and social surveys and assessments completed for the Baseline Upstream Study Areas (Volume II), focus group meetings held in June 2017, and relevant available literature. The full baseline information is presented in the baseline report (Volume II). A summary of the key points of that baseline is presented below.

- Three broad vegetation communities occur within the Upstream Study Area: *Acacia/Commiphora* bushland/thicket; riparian forest; wooded ephemeral streams (Drawing 5.9-1). The condition of the various ecosystems of the Upstream Study Area, and hence their capacity to supply ecosystem services, has been affected to a greater or lesser extent by human factors, including persistent overgrazing from livestock, and the presence of naturally bare, hydrophobic soils.
- Pastoralism, and the keeping of livestock, is the dominant livelihood in the Upstream Study Area (refer to Volume II). Consequently, provisioning services are the dominant ecosystem service category in the area; priority provisioning services identified include grazing/browsing resources for livestock, wild foods, medicinal plants, biomass fuel (firewood and charcoal), wood and fibre (used for construction materials, utensils, ceremonial articles), and freshwater supply.
- Trees, and especially wild food plants, are an integral part of the Turkana people's culture. 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. These are considered priority ecosystem services.
- Priority regulating and supporting services for beneficiaries in the Upstream Study Area include pollination and primary production, which are necessary for the provision of grazing/browsing resources for livestock, and wild fruits for people. The Project is reliant on the ongoing regulation of water flows and timing, soil

stability and erosion control, and ecosystem support of the natural hydrological regime through unimpeded surface water flow; groundwater recharge; and evaporation rates.

- 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[8] is spatially and temporally high.
- Although many of the settlements from which demand for Type I priority services arises are outside the Upstream Study Area, their inhabitants rely, to a greater or lesser extent, on ecosystem services provided by ecosystems within the Upstream Study Area, particularly fodder for stock, medicinal plants, firewood.
- 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 there.

2.11 Social

2.11.1 Administrative Divisions and Governance Structure

Turkana County is one of 47 county governments in Kenya and with a size of 77,000 km2, 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. The national government began a devolution process after the 2007 elections. The 2010 Constitution substantially remodelled the Kenyan state by creating two layers of government at the national and county level. The process of devolution is still in 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.

Turkana County is divided into seven Sub-counties. Each Sub-county is further divided into Divisions, Locations and Sub-locations. 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.

The primary focus of socio-economic studies for the EOPS Upstream SA concentrate on the two main Sub-counties that contain the footprint of the Project, Turkana South and Turkana East Sub-counties. At Sub-county level, Turkana South has five Wards and Turkana East has three.

Further decentralisation has led to the development of administrative units under the County Government into "villages" with traditional pastoral social groups (Adakar) treated as special units within the new system. The vast majority of land within the South Lokichar area is technically unregistered, community land. Though land is effectively held in-trust by the Turkana County government, there are local geographic affiliations with land divided into ere or larger territorial Sections including ekitela.

Furthermore, the reorganisation associated with devolution has led to 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. Mixed views are apparent among the local population. Devolution is said to have brought decision-making closer to the people and some improvement in services overall, yet these improvements are believed

[8] Type I Priority ecosystem services are those services on which project impacts affect the livelihoods, health, safety, or culture of the ecosystem service beneficiaries (after IFC, 2012; Landsberg *et al.*, 2013)

to be largely biased towards urban areas. The relationship between the national, county and traditional land ownership and leadership is therefore, clearly complex and evolving.

2.11.2 Demographics

The most recent census (2009) counted a total population of 855,399 in Turkana (2.2% of the total population of Kenya). The census also indicated that 86% of people identifying as of Turkana ethnicity reside within Turkana County. Recent official statistics are unavailable but, based on a predicted and steady growth rate of 6.4% per year, the current population is believed to be approximately 1,427,797. It is also estimated that the two Constituencies within the Upstream area include approximately 225,000 people. The County is characterised by clustered settlements, with rural areas settled with the nomadic, pastoral communities, on a temporary basis and consequently these figures on population are presented with a note of caution to account for the movement of pastoralists.

Traditional, pastoralist migration, linked to the raising of livestock, is at the heart of the way most residents of Turkana County live, adapting to exploit the harsh environment and erratic rainfall by moving homes and animals. Migration is also driven by external factors, including a search for security from conflict and economic opportunities. 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 where wealth may be linked to herd ownership as opposed to monetary income (as discussed further in Volume II and Section 1.4).

2.11.3 Infrastructure and Services

By nature of its location, climate and relatively neglected history since independence the infrastructure and services of Turkana County are generally poor. However, there are recent signs of improvement. Health facilities are improving and the distance to health facilities has been reduced. There are more Early Childhood Development (ECD) facilities that have 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.

Waste disposal is a major environmental issue in Turkana where the authorities only collect 0.2%, and few households use latrines. Access to quality water is a critical problem and the County has inadequate water for the concurrent demands of domestic use, livestock watering and crop irrigation.

Power access and supply is also an issue across the County, compounded challenges including weak transmission and available distribution infrastructure, the high cost of power, and low per capita power consumption. Only 1% of Turkana households have access to electricity in the home.

The County road network is poorly developed. Many roads are corrugated, badly weathered with potholes and often impassable after prolonged wet periods. The poor infrastructure network has negative implications for regional economic activities and local security (i.e. for road users).

2.11.4 Economics and Livelihoods

The majority of Turkana County depends on nomadic pastoralism. Crop farming, fishing and weaving are also common sources of income, and to a lesser extent, agro-forestry, mining and tourism. Efforts are being made to encourage diversification, primarily through activities complementary to pastoralism such as livestock trading. There is very limited data on salaries and the contribution of cash salaries to household incomes and Turkana and unemployment levels are estimated at 70% (in contrast to national figures of 42%).

The Turkana County has three urban centres namely Lodwar, Kakuma and Lokichoggio. Lodwar is the most developed with more infrastructural and social amenities. Patterns of livelihood clearly vary from one area to

another across the County and local factors such as climate, soil, access to markets all influence livelihood patterns.

Turkana County has 2.5 million hectares of arable land and the Upstream area falls mainly in a “central livelihood pastoral zone” (as defined by Oxfam Save the Children (2012) and further described in Volume II). Within this zone, 80% of the population rely on livestock to provide the main source of food and cash income (there is no agriculture or cash crops). 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 bordering zone but is generally more secure, with increased access to County markets and services.

Turkana has some of the highest levels of poverty in the country. Kenya National Bureau of Statistics reports poverty at 94%. However, such figures need to be considered in the local context whereby many consider wealth through the context of herd size and a household’s ability to maintain their animals.

2.11.5 Land Use and Ownership

Existing infrastructure from the exploration and appraisal stage will be re-used. There is no additional land take or earth moving required by EOPS, only compaction of existing land to prepare for construction. However, baseline data has been collected in the Ngamia and Amosing study areas for the purpose of assessing areas around the wellpads that may be affected by some environmental aspects of the Project.

People potentially affected by EOPS include families living in long term homesteads (as discussed in Volume II, seasonal homesteads did not indicate a pattern of repeat seasonal use for any specific area). Baseline data has been collected in the Upstream area for the purpose of assessing areas around the wellpads that may be indirectly affected by EOPS:

Ngamia (3, 6 and 8) wellpads

Two long term homesteads were occupied in May 2017, comprising a total of 25 family members. There were 11 other occupied homesteads in addition – five of these are classified as short term/seasonal homesteads and likely to be occupied for two to three months during the wet season grazing period (April to June).

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 in the future. Although all absent in May 2017, these five homesteads have an estimated total of 57 residents.

2.11.6 Community Health and Safety

Demographic and health indicators for Turkana County are generally worse than the regional or national average. Many of health indicators reflect the poor access to, or utilisation of, public healthcare institutions at the County level. Children were a particularly vulnerable group in the County, and 64% of women in Turkana are without access to education (Volume II).

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 and health seeking behaviours. County documents show that access to health is low compared to the size of the territory and population, with one doctor for every 70,000 people and one nurse for every 5,200 people.

Road traffic accidents (RTAs) and domestic or other forms of violence are of particular relevance in this setting. Gender based violence and sexual violence was reported as an increasing concern in the County. Inter-ethnic conflict has been a concern, related to land, grazing areas, boundary disputes, and cattle rustling.

The health infrastructure consists 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. Health system issues emerged a key concern. In a meeting with Lodwar hospital health team, it was reported that demand for healthcare services had increased tremendously in recent years. Outbreak and epidemic response is limited in the County, exacerbated by the vast area covered, the migrant population, and the movement of people across borders.

2.11.7 Education

In total, there are only 315 primary schools and 32 secondary schools in all of Turkana County. Polytechnic institutes are also found in Kakuma and Lodwar. The only campus university sites are in Lodwar and Lokichoggio and a Technical Training Institute is being built in Lodwar.

The low literacy levels (22.2 percent) across the County can be attributed to many causes, including poverty, understaffing in schools and cultural practices such as early marriages. Factors are also environmental and security related, with drought and inter-boundary conflicts inhibiting the provision of proper education and compounding low literacy and education standards. The Ministry of Sports and Heritage believes that pastoralist lifestyles have also contributed to past low enrolment figures.

2.11.8 Social Maladies

Limited data has been received from local administrative units on social maladies which have therefore, been investigated through key informant interviews and focus groups (regarding alcohol/drug use, crime, commercial sex work, child and forced labour etc.). It is generally considered that drug abuse has risen in the last three years, with alcoholism in particular on the increase, and there is also an increasingly visible display of prostitution locally. The specific results of relevant focus group discussions are summarised in Volume II.

Population influx was cited as a source of new social maladies in the Kochodin Location where the Project is located, compounded by pressures to acquire goods, the availability of amenities and limited economic opportunities. The rise in HIV/AIDS has been attributed to recent infrastructure development with accommodation facilities and transport stops for truckers (in Lodwar specifically) believed to have attracted commercial sex workers. With salaried employment being relatively limited among the predominantly pastoralist communities of Turkana, discrimination in employment, whether real or perceived, is also a commonly cited problem.

2.11.9 Social Capital, Security and Conflict

Turkana, and neighbouring counties, have well-known histories of conflict and violence, often associated with cattle raiding. The current aspects of conflict relate to 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 a relative calm and decrease in violence has shifted again. There has been an increasing incidence of inter-communal clashes and banditry from January 2016 to 31 May 2017 (a full breakdown of monthly occurrences is provided in Volume II).

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. 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 leading to increased fatalities. 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.

During Golder's research in July 2016, the majority of key informants and focus group participants describe an improved situation between Turkana and neighbouring herders overall, principally after the culmination of a particularly chilling period in 2015 that saw people killed during the violence. Researchers noticed improved security in local settlements with many people confirming that the "peace caravan" (initiated by political leaders to end killings among the region's pastoralist communities) marked the turning point in raiding-related violence. Numerous interviewees explain that Turkana and Pokot (southwest of Turkana) are even grazing animals with each other and that trade and business happens regularly between the two groups, with Pokot adakar often residing in Turkana County.

However, exceptions are noted, and some tensions remain even if the active violence has greatly decreased. A shortage of police officers was highlighted as an issue and believed to have led to reduced law and order overall. In Turkana South, competition for natural resources was noted and disagreements (some violent) among both stationary and migratory pastoralists occur (as discussed further in Volume II). Security along the A1 highway is also a key area of concern, with violence and robbery, particularly between Kalemngorok to Kakongu, a persistent problem. Such occurrences are anecdotally attributed both a mix of common criminals, and people left destitute after losing their animals in periods of previous violence and raiding. With no animals, but still having access to their weapons, poverty induces them to crime. Local elders have observed increasingly little difference between these two groups. Concern over criminal accusations linked to ethnicity and perceived police corruption have been noted also.

2.12 Cultural Heritage

Cultural heritage, in both tangible and intangible forms, is considered in the baseline. 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 in this assessment comprises 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[9] that are not archaeological are described in this assessment 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).

Baseline cultural heritage conditions, for both the Upstream and Midstream areas, were established through a combination of desk-based study, key informant interviews (KIIs) and field survey. A detailed description of the

[9] 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.

baseline study methodology and results, including a gazetteer of all identified assets, is provided in the baseline document (presented in Volume II), although a summary of the existing conditions is given here. The results are summarised in Tables 2-4 and 2-5.

Table 2-4: Baseline Cultural Heritage Conditions - Upstream

Asset Type	Summary
Archaeology	53 archaeological assets were identified in the Upstream area, wholly comprising findspots[10] of undecorated pottery and a variety of lithic finds. A total of 26 findspots were recorded at Amosing, with 27 findspots at Ngamia. The volume of individual finds was higher at Ngamia (352 at Ngamia as opposed to 99 at Amosing), as was find density (approximately 1 find per 5.7m² surveyed at Ngamia as opposed to 1 find per 8.1 m² at Amosing).
Tangible Living Cultural Heritage	No tangible living cultural heritage assets were identified in the Upstream area.
Intangible Cultural Heritage	Some elements of intangible cultural heritage, such the practice of religious beliefs, are limited to settlements, which are located outside of the study area. Some elements, such as general Turkana culture, a nomadic pastoralist way of life and the use of the local environment for subsistence, are experienced over large geographical ranges, including the Upstream area.

Table 2-5: Baseline Cultural Heritage Conditions - Midstream[11]

Asset Type	Summary
Archaeology	11 archaeological assets were identified in the midstream study area, including 7 undated burials located adjacent to the road between Lokichar and Amosing-1. The other four archaeological assets are monuments recorded in the National Museums of Kenya (NMK) archives.
Tangible Living Cultural Heritage	Five tangible living cultural heritage assets were identified in the midstream study area, comprising three churches, one mosque and a former colonial-era prison. Two of the churches and the mosque were recorded in Lokichar.

Each asset identified was assigned a unique Golder ID, comprising a two-letter prefix, defining its general location, followed by a sequential numbering system. The two letter prefixes used comprise:

- AM – Amosing;
- NG – Ngamia; and
- TR – Transport Route (Amosing-1 to Mombasa).

[10] A findspot indicates a location where archaeological remains were discovered during walkover survey. A findspot may consist of a single artefact (e.g. one pottery sherd) or may include numerous artefacts (e.g. multiple pottery sherds, pottery sherds and lithic remains).

[11] Baseline data collection along the majority of the Midstream was limited to third party, secondary data (i.e. no walkover survey or KIIs were completed). As such, the presence of unrecorded archaeological or living cultural heritage (tangible and intangible) assets along the route has not been ground truthed.

3.0 PROJECT ALTERNATIVES CONSIDERED BY THE PROJECT DEVELOPER

3.1 Need for the Project

As a demonstration of the ability of Kenya to successfully deliver an oil-exporting project, EOPS will act to improve international investor sentiment for key future components of Kenya's Oil & Gas industry. For example, export options and further testing of logistical options for FFD. It will additionally provide substantial reservoir understanding, which will contribute to the design process of the planned Upstream FFD.

3.2 Main Alternatives

3.2.1 Upstream component

The Upstream Infrastructure was defined using data from seismic surveys, exploration and appraisal drilling and EWT activities at Amosing-1 and Ngamia-5/6 wells. The proposed plan to develop resources is based on the results of these activities however TKBV did consider a number of alternative options for various key elements. These alternatives, and the reasons they were ultimately disregarded, are described in this section.

3.2.1.1 The location of the proposed production wells

All wells drilled to date during exploration and appraisal in the Amosing, Ngamia, Ekales, Twiga and Agete fields were considered for EOPS.

Extended Well Test (EWT) activities were undertaken in 2015 at Amosing and Ngamia only, which provided TKBV with a good understanding of the reservoir in those fields. The rest of the fields were discounted for EOPS as no EWT activities has been undertaken there (to date), and so insufficient information was available to inform the development of a pilot scheme.

Based on the current understanding of the reservoir within the Amosing and Ngamia fields, five existing wells have been selected for use in EOPS, comprising Ngamia-3, Ngamia-6, Ngamia-8, Amosing-1 and Amosing-2A. These are the five optimum wells (i.e. most productive with the lowest intervention cost required to convert them to production) and they are located at four existing wellpads – Ngamia-3, Ngamia-6, Ngamia-8 and Amosing-1, respectively (both Amosing-1 and Amosing-2A wells are at Amosing-1 wellpad). As such, no additional land will be required.

3.2.1.2 Location of the proposed Early Production Facility (EPF)

The four optimum wellpads were considered as potential locations for the EPF. Amosing-1 was ultimately selected for the proposed EPF because 75% of production is expected to come from the two wells located there (Amosing-1 and Amosing-2A).

3.2.1.3 No additional land required

The overall concept behind EOPS is to make use of existing facilities to the maximum extent possible. For example, the proposed production wells are located at existing wellpads that are already levelled and fenced. All wellpads have a flare stack which will be located on existing flare pits, which will be filled in prior to flare stack siting. In addition, the Amosing-1 wellpad has wastewater treatment facilities and the crude oil storage tanks from the 2015 EWT programme. Design options discounted to avoid acquisition of additional land, include:

- Flowlines for transport of well fluids between the wellpads – the de-gassed production liquids from the Ngamia pads will instead be pumped into tanktainers for transportation by truck to the EPF, located at the Amosing-1 wellpad; and

- Temporary camps and facilities at wellpads for preparation activities and operations – the existing Kapese Integrated Support Base (ISB) will provide accommodation facilities for all staff associated with groundworks and installation, as well as operations.

3.2.1.4 Power generation alternatives

A link to grid power was discounted for EOPS as it is not considered a realistic option. It would be both financially infeasible and the lead time required to establish a connection would be too great for a project with a proposed two-year lifespan. Using diesel power generators for 100% of power generation throughout the operational life at all wellpads was also considered and disregarded by TKBV on the basis that utilising as much of the associated gas as possible was the most resource-efficient option.

Hydrocarbon gas that is associated with the oil production will be used as fuel gas to provide power, at Amosing-1. Using the associated hydrocarbon gas for power generation, as opposed to just using diesel, will reduce the diesel emissions associated with EOPS. It is also a more cost-efficient and resource-efficient option.

At the Ngamia wellpads, it is anticipated that the volume of associated gas produced as a result of EOPS will be insufficient to provide a significant enough proportion of the power required for operation. As such, the establishment, and associated financial investment, of a gas engine is not justified or feasible. Consequently, diesel generators will be required for power generation, with the minimal amounts of produced gas to be flared.

At Amosing-1 wellpad, diesel will be used for power generation for the first three months to allow for the lead time required by the gas engine. Once this is functioning, power generation will be powered entirely by hydrocarbon gas and any excess gas will be flared as no other uses have been identified in the Amosing or Ngamia fields and this is the safest disposal option.

3.2.1.5 Storage alternatives

The existing storage tanks at Amosing-1 wellpad were designed to accommodate the processed fluids produced in the EPF, which have a temperature of approximately 80°C. As such, they are fit for purpose for EOPS. They can also safely store fluids of a lower temperature, such as the degassed fluids transported from Ngamia, which have a temperature of approximately 55 - 60°C.

The alternative for safe storage of oil, water and other liquids for EOPS would be to import new infrastructure. This was disregarded as TKBV wish to take advantage of existing infrastructure rather than import new infrastructure, both for financial and environmental reasons.

3.2.1.6 Production water treatment/disposal alternatives

The evaporation pond at Amosing-1 wellpad is the primary recipient for water treatment, due to its proximity to the Amosing-1 and Amosing-2A production wells. It is expected that 75% of production will come from these two wells and, consequently, the highest volume of waste water will also be produced from these wells.

Any alternative to the use of the evaporation pond at Amosing-1 wellpad would involve increased transport or pumping of waste water beyond the fenceline of Amosing-1 wellpad. These alternative options have greater potential environmental and financial implications than the selected option.

The Amosing-5 wellpad has been selected to accommodate a contingency evaporation pond due its proximity to the primary evaporation pond at Amosing-1 wellpad. Alternative locations at Ngamia or other existing wellpads have been disregarded as Amosing-5 is the closest wellpad to the Amosing-1 and Amosing-2A wells and will therefore minimise transport and the associated potential environmental and financial implications.

3.2.1.7 Waste management alternatives

The expected volume of waste that will be generated during EOPS is comparable to the relatively low volumes generated to date by exploration and appraisal activities. All exploration and appraisal wastes have been

managed by transferral to the main camp (Kapese ISB), where it is subsequently managed and disposed of by a NEMA licenced waste company. It is considered that the same waste management strategy can be used for EOPS.

As with a power grid connection, a dedicated waste facility is not considered a realistic alternative for EOPS, as it would be financially infeasible and the lead time for installation would be too great for a project with a two-year lifespan.

3.2.1.8 Alternative Water supply

The existing permitted and sustainable water boreholes for exploration and appraisal activities will provide sufficient water supply to meet demand for EOPS without degrading existing water resources locally and regionally. Therefore, an alternative water supply has not been considered for EOPS.

3.2.1.9 Alternative accommodation

The Kapese ISB has sufficient capacity to accommodate the labour required during groundworks and installation and operations. An alternative would be to seek accommodation in local settlements or dedicated accommodation for EOPS either on the wellpads or elsewhere. However, given the short life of EOPS and the presence of existing permitted accommodation, these alternatives have not considered for permitting, financial, security, worker health and safety and environmental reasons.

3.2.2 Oil Trucking Component (Midstream)

The only possible alternative to the movement of crude oil by road would be to use the existing rail infrastructure between Eldoret and Mombasa as there is no existing pipeline or alternative conveyance infrastructure. This, however, would still require transport by road as far as Eldoret.

Rail transport was evaluated as part of the planning for the overall EOPS programme. In September 2016, TKBV Oil commissioned Worley Parsons to undertake a risk assessment of the potential use of Rift Valley Railways to move the crude oil from Eldoret to Mombasa. The key findings were that it would take a minimum of 6 months, with significant capital expenditure and modifications of rail infrastructure at Eldoret Inland Container Depot (ICD) and Changamwe Refinery required. In addition, buildings at Eldoret ICD are currently being used by Moi University students, creating additional encroachment and separation issues, which would require to be managed. As a result, it was concluded that the existing railway infrastructure was not currently in adequate condition for the reliable and safe transport of tanktainers and was removed from the reference case with a road-only export solution selected.

3.2.2.1 Road route between Amosing and Eldoret

Regarding the route taken by EOPS, there are two main options associated with the road route from Amosing-1 to Eldoret:

- Use of the C46, A1, B2 and A104 to Eldoret; and
- Use of the C46 (south), C113, B4 and C51.

Each road route was driven by TKBV as part of early feasibility studies to investigate existing road conditions. Discussions were also held with KeNHA in relation to undertaking road improvement works along specific sections of the road route. The outcome of the discussions with KeNHA and the findings of road condition assessments indicated that the optimum route was the C46, A1 and B2 to Eldoret on the basis that:

- The overall road route is shorter (by approximately 30%) which reduces travel time, community H&S risks associated with the presence of tanktainers on the road network (in terms of the hours spent for each journey) and economic cost of transport from fuel consumption and driver hours required;

- The existing condition of the C46 can be improved by KeNHA by undertaking emergency repair works under a planned project to rehabilitate the C46 road; and
- Using the A1 road network is preferable to relying on C-type roads which are narrower compared to the A-class (national) road network. Whilst the condition of the A1 from Lokichar to Kitale is currently in poor condition, KeNHA are willing to undertake emergency maintenance works as part of a wider planned project to fully rehabilitate the A1.

On this basis, the C46, A1, B2 and A104 to Eldoret was identified as the optimum road route.

3.2.2.2 Road route between Eldoret and Mombasa

Two routes around Nairobi were considered, using the Southern Bypass or the A104. The Southern Bypass is considered to be the route with less congestion and therefore will be adopted from the perspective of travel time and driver health and safety.

3.2.2.3 Road route in Mombasa

The refinery is located at Changamwe, on the outskirts of Mombasa. There is only one road to access the refinery, which does not pass through Mombasa City. Alternative routes through Mombasa were considered but as a result of the likely traffic congestion and related security and safety issues this option was deemed infeasible.

3.3 "No Project" Alternative

It is considered that if the Project were not developed (the "No Project" Alternative), TKBV would be responsible for decommissioning the existing wellpads and, following revegetation and rehabilitation of the ground at the Amosing and Ngamia wellpads, the biophysical environment would prevail as prior to the exploration and appraisal activities.

The "No Project" Alternative would mean that the potential changes to biodiversity, ecosystem services, security, vector related diseases, sexually transmitted diseases, road traffic accidents and influx of job opportunity seekers identified within this ESIA would not occur (as a result of EOPS).

However, the "No Project" Alternative would also result in the absence of any economic and employment benefits associated with EOPS and the positive residual benefits identified in Section 5.10.9 would not be realised. Benefits would potentially include:

- Employment;
- Local procurement for services and supplies;
- Improvement of local content employment;
- Improvement of contractor employment practices; and
- Improved screening for sexually transmitted infections.

It must be noted that EOPS has been identified by TKBV as a necessary engineering step to develop FFD. Therefore, if EOPS did not occur, this could have a significant impact on the feasibility of FFD and in turn any positive benefits FFD could have locally, regionally and nationally.

4.0 PROJECT DESCRIPTION

The Project description for the EOPS focuses on the Upstream infrastructure and activities, namely the EPF, oil extraction wells, satellite degassing wellpads, supporting infrastructure, and infield transportation. For the Midstream there is no new infrastructure and the only activities will be the transport of the oil from Amosing-1 wellpad to Mombasa.

The Upstream Infrastructure for EOPS (Figures 1-1 and 1-2) spans two fields, Amosing and Ngamia, both located in Block 10BB. All production wells and wellpads already exist. The EPF will be co-located with the Amosing-1 and Amosing-2A production wells at the Amosing-1 wellpad. The degassed, partially stabilised produced liquids at the Ngamia satellite wellpads (Ngamia-3, Ngamia-6 and Ngamia-8) will be pumped to tanktainers for transportation by truck to the EPF for further processing.

In order to sustain production levels up to a maximum of 2,000 barrels/day, it is anticipated that the Midstream component of EOPS will comprise the movement of, on average, 14 tanktainers per day from the EPF to the KPRL facilities in Mombasa.

The Project description draws upon information generated by various technical studies undertaken by TKBV, which provide information on the location of key facilities, the basis of design and functional specifications for production facilities. Supporting Project description information has not been included in this ESIA but can be provided on request.

4.1 Design Parameters

The key design parameters for the Project include the following:

- The estimated groundworks and commisioning period will be approximately 3 months (including ground compaction and installation of new equipment and loading pads);
- An EOPS production period of up to two years;
- Existing infrastructure from the exploration and appraisal stage will be re-used. There is no additional land take or earth moving required by EOPS, only compaction of existing land to prepare for installation. There is no requirement for additional areas of land to be cleared or fenced. The existing earth bund remains and will be maintained at a height of 2 metres above ground level;
- Any concrete or aggregates required for construction by EOPS will be produced and imported from off-site;
- The presence of associated gas within reservoir fluids will be optimised and used for power generation to the maximum extent possible at Amosing-1 where any excess gas or asssociated gas will be sent to flare systems. At Ngamia sites the low volume of produced gas will be sent to flare systems;
- Within the wellpads, storage vessels and loading bays are bunded, or a drainage system is installed to direct the liquids to an interceptor to prevent release to the environment;
- All hazardous material storages feature a secondary containment or bund, to contain no less than 110% of the stored volume, and prevent the release of pollutants to the environment following failure of primary containment;
- Materials to be used for the Project have been selected to take into consideration specific reservoir fluids and operating conditions whilst trying to use materials with a low environmental toxicity to reduce the volume and type of waste generated;
- Where possible the Project is designed so that all emissions, noise and discharges meet applicable environmental standards; and
- The Project will be designed in line with the commitments to environmental mitigation measures defined in the ESIA.

4.2 Groundworks and Maintenance

Existing wellpad site preparation activities will require minor earthworks of grading, compaction, installation of foundations for the equipment and drainage.

Some groundworks and maintenance are permitted under the existing exploration permits (permit reference: PR 7764/0001253) and will be undertaken in advance of EOPS. The following ongoing maintenance activities are, therefore, outside the scope of the EOPS ESIA:

- Site preparation & maintenance of wellpads and roads;
- Rework on bunds & wellpad pits;
- Drainage;
- Repair of storage tanks; and
- Laydown and storage of equipment.

Traffic movements and weathering at the existing wellpads and on the access roads may result in the road surface becoming loose and rutted. Infield roads will be graded and then recompacted.

The approximately 1 km infield road from the C46 to the EPF at Amosing-1 wellpad will be sealed by KeNHA (of behalf of TKBV) by laying a bitumen seal, this process is therefore within the scope of the ESIA.

4.3 Operational Infrastructure

The EOPS Upstream Infrastructure will comprise four wellpad locations (one EPF plus three satellite degassers). There is also potential to, in the future to convert one wellpad (Amosing-5) for use as an evaporation pond.

The Upstream component of the EOPS is illustrated in Figure 4-1.

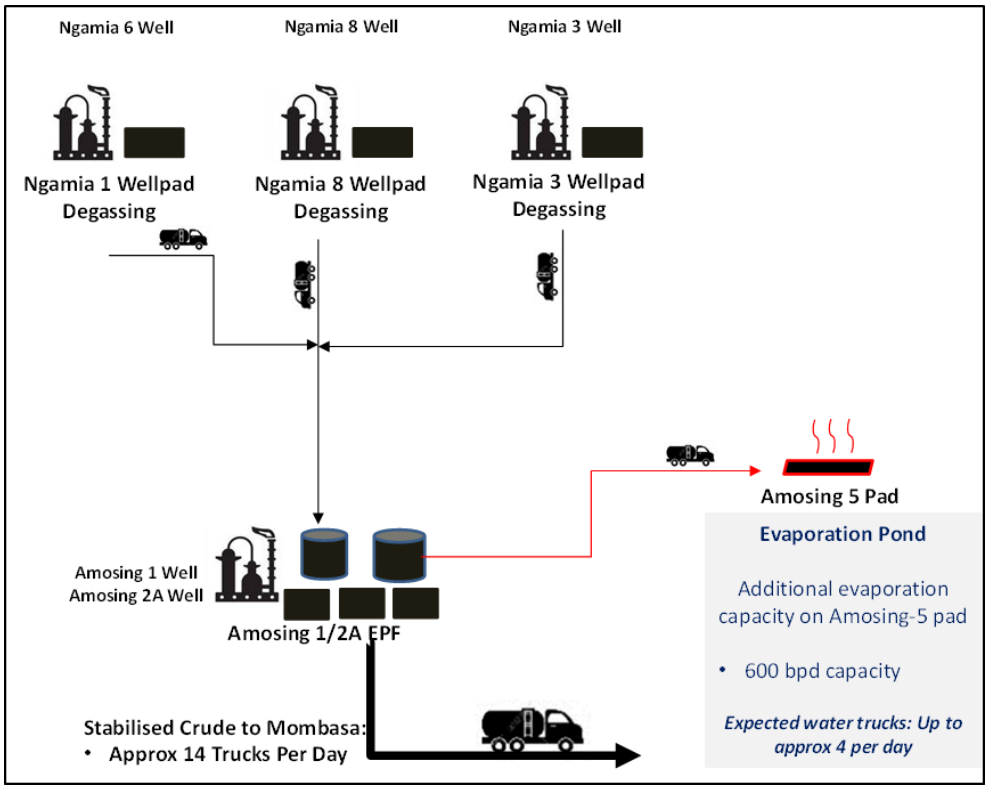


Figure 4-1: Schematic of EOPS Field architecture (Contingency measures noted in orange)

4.3.1 Wellpads and EPF

The product specification, the emissions inventory and noise profiles for specified infrastructure at each wellpad can be made available upon request.

4.3.1.1 Satellite degassing wellpads (Ngamia wellpads)

All production wells at the Ngamia wellpads (Ngamia-3, Ngamia-6 and Ngamia-8) will require artificial lift via progressive cavity pumps (PCPs). Downhole separation will occur upstream of the PCPs causing gas to flow up the annulus. Well fluids will flow into a Degassing Vessel and the associated gas will be sent to a flare system (Section 4.3.6). There will be a flare system at each wellpad.

A well heater will be used at each of the satellite wellpads and will operate at temperatures up to 70°C.

Degassed oil/water will flow under gravity into two bitutainers, which are stored at each wellpad. The bitutainers are vented to atmosphere and have a storage capacity of 400 barrels per bitutainer.

The crude oil/water mixture in the bitutainers will be exported from the wellpad facilities via infield tankers (Section 4.4) to Amosing-1 where it will undergo further processing in the EPF. Each infield tanker will have a capacity of approximately 150 barrels.

4.3.1.2 Amosing 5 contingency evaporation wellpad

The evaporation capacity at the Amosing-1 evaporation pond is expected to be sufficient at the commencement of the operations, however later in the life of the Project, if the water cut increases, it might be necessary to pump the excess produced water into infield tankers for transport to an evaporation pond located at Amosing-5 wellpad. The frequency of trucking produced water will depend on reservoir performance.

4.3.1.3 Amosing 1: Early Production Facility (EPF) and wellpad

A single EPF located at the Amosing-1 wellpad will perform the required processing for the produced fluids from the Amosing production wells (Amosing-1 and Amosing-2A), plus the degassed fluids from the Ngamia satellite degassers.

The incoming infield tankers from the degassing wellpads at Ngamia will offload the partially stabilised crude/water into a storage tank at Amosing-1 wellpad, before being pumped into the EPF. The crude/water mixture from the inlet storage tank will be pumped before mixing with the incoming well fluids from the Amosing wells upstream of the inlet heater.

The EPF separates the water and stabilises the oil at elevated temperature, in the inlet heater, which is the entry point to the EPF. The produced water will be stored in a settling tank before being pumped to an onsite evaporation pond at Amosing-1 or trucked to a contingency evaporation pond at Amosing-5. The oil will be stabilised in order to meet a True Vapour Pressure (TVP) specification suitable for local storage, as well as for being exported to Mombasa via tanktainer.

There are demands for both heat and electrical power, notably for PCPs and wellbore heating, as well as within the processing facility. The design is expected to utilise the available produced gas for all power generation (also see Section 4.3.5) and process heating requirements. Any excess gas will be sent to a flare at the Amosing-1 wellpad (Section 4.3.6).

4.3.2 Estimated Production – EOPS

Profiles for oil production throughout EOPS have been estimated using two scenarios; one of high flow rate and one of low flow rate. The ranges of the resultant oil, gas and water production from all EOPS facilities can be summarised as follows:

- Monthly oil production estimates range from 2000 barrels per day (bpd) to 1289 bpd;

- Monthly gas production estimates range from 250 MSCF/d to 401 MSCF/d; and
- Monthly water production estimates range from 37 bpd to 587 bpd.

4.3.3 Storage Tanks

There are nine existing crude storage tanks at the Amosing-1 wellpad each of nominal 5,000-barrel capacity. Of these, only three will be used for EOPS (six will not be used):

- 2 x 5000-barrel tanks used for contingency storage and receipt storage from the Ngamia pads; and
- 1 x 5000-barrel tank will be used for produced water storage/settling.

In addition, seven 400-barrel bitutainers will be installed at Amosing-1 wellpad. All the bitutainers will be the primary storage for the processed crude, except one tank, which will also be used for temporary storage of crude oil which does not meet the correct specification.

At the Ngamia wellpads, none of the existing crude storage tanks will be used. Instead, at each Ngamia wellpad, there will be two bitutainers to which the degassed oil/water will flow under gravity.

4.3.4 Water

The water demand during site preparation will not exceed the existing permitted abstraction rates from TKBV existing water boreholes (Nakukulas 9 and Ngamia East). The existing permit to abstract was approved by the Water Resource Management Authority (WRMA) via a WRMA Form 010 as per Environmental Management and Coordination (Water Quality) Regulations (2006). During site preparation water will be used for soil compaction and dust suppression.

Water demand for offices/cabins, at wellpads, associated to EOPS, will be of a minimal quantity of 10-20 m3/day. The water required for operations will not exceed the existing permitted abstraction rates from TKBV's existing water boreholes (Nakukulas 9 and Ngamia East), which will be valid for the duration of the EOPS Project.

4.3.5 Power Generation and Supply

Each wellpad is required to provide power on a standalone basis for the production wells, PCPs, for well heating and other power requirements associated to the wellpad.

At Amosing-1, gas produced through degassing from the wells will be used for power generation and process heating. Supplementary power and heating may be required, depending on the volume of gas available. At Amosing-1 wellpad, the first three months of operation will be powered by a diesel generator, to allow TKBV to assess the volume and composition of the produced gas. In addition, during the remaining months of operation, a back-up diesel generator will be used to provide uninterruptable emergency power supplies to allow for Emergency Shut Down (ESD) and controlled shutdown. The following diesel generators will be used at Amosing-1 wellpad:

- Gas engine (GE-VGF-L36GSI)
  - After 3 months approximately 80,000 scfd of produced gas will be used by the gas engine to satisfy the power demand and the remaining gas will be sent to the flare (500,000 – 80,000 = 420,000 scfd).
- Diesel back-up generator (FG WILSON P-550-1)
  - 455 to 750 Enclosure - CAE (100%) – Prime.
- Downhole heating – Pentair generator P450-1
  - 62% loading.

- 350 -750K VA enclosure - CAE Prime.

There will be no gas engines at the Ngamia wellpads. The following diesel generators will be used at the Ngamia wellpads:

- Diesel generator (FG WILSON P-165-5) for power generation
  - 24-220 enclosure - P 165 -3 Prime (100% load).
- Diesel generator (Pentair P450-1) for downhole heating
  - 62% loading; and
  - 350 -750K VA enclosure - CAE Prime.

4.3.6 Management of Produced Gas

Any excess gas at Amosing-1 that is unable to be used for power generation will be sent to a Micoda vertical flare. At each of the Ngamia wellpads all the associated gas will be sent to a Micoda vertical flare. There will therefore be 4 Micoda vertical flares in total.

The flare system is designed to safely dispose of hydrocarbon gases released from both the degassing wellpads and the EPF, during both normal operation and under emergency situations.

The manufacturer's equipment specification for the flares, plus the emissions inventory for specified infrastructure is available upon request.

Given the absence of blanketing and seals and short length of pipelines, expected fugitive emissions are negligible.

4.3.7 Fuel Storage

All fuel requirements for Project operations, including refuelling facilities, will be stored and managed from Kapese Integrated Support Base (ISB). All fuel required on site will be stored in a designated bunded area. All refuelling will take place within designated areas, for which TKBV has an existing permit which will be valid for the duration of the EOPS Project.

4.3.8 Hazardous and Non-hazardous Materials

All hazardous and non-hazardous materials to be used at each wellpad are presented in Table 4-1 along with an estimate of the volume of materials to be stored.

Table 4-1: Estimated Hazardous material storage requirements

Material	Hazmat throughput at Amosing-1	Hazmat throughput at Ngamia pads (3, 6 and 8)	Total (estimated)
Anti-foam	4 barrels per month [a]	1 barrel per month [a]	7 barrels per month [a]
Demulsifier	4 barrels per month [a]	1 barrel per month [a]	7 barrels per month [a]
Scale inhibitor	4 barrels per month [a]	1 barrel per month [a]	7 barrels per month [a]
Paint thinner	10 USG in total [b]	n/a	10 USG in total [b]
Paint	20 USG in total [b]	n/a	20 USG in total [b]
Engine Oil Lubricant	4 barrels per month [a]	1 barrel per month [a]	7 barrels per month [a]

Material	Hazmat throughput at Amosing-1	Hazmat throughput at Ngamia pads (3, 6 and 8)	Total (estimated)
Hydraulic ATF Oil	2 barrels per month [a]	0.5 barrel per month [a]	3.5 barrels per month [a]
H_2S scavenger	25 barrels in total	n/a	25 barrels in total

n/a = not applicable

[a] 1 barrel = 159 litres

[b] USG = United States Gallon (1 USG = 3.78 litres)

A total of 2 trucks will be required per month to transport hazardous materials (such as chemicals) and other equipment to Amosing and Ngamia wellpads.

4.3.9 Waste Management

Solids generated from preparatory ground works will be segregated on site and will be collected by a NEMA Accredited Contractor and disposed in a NEMA accredited facility. No hazardous waste is anticipated for the civil works. During groundworks and installation, it is envisaged that portable toilets will be used, and all waste water will be treated at the site, and treated water that meets NEMA effluent discharge standards will be released periodically.

All waste generated from the EOPS activities will be collected in sealed vehicles by a NEMA approved waste transporter for disposal in accordance with the Kenyan waste management regulations of 2006. It is estimated that the combined volume of non-hazardous waste produced during groundworks and commissioning will be 5 tonnes per month.

Table 4-2 presents an estimate of waste generated during operations.

Table 4-2: Estimated waste generation during EOPS operations

Waste type	Estimated waste throughput at Amosing-1	Estimated waste throughput Ngamia pads (3, 6, and 8)	Total estimated waste for EOPS
Oily bitutainer sludges	1 barrel per bitutainer every 3 months [a]	1 barrel per bitutainer every 3 months [a]	13 barrels every 3 months [a]
Oily filters	16 Oil Filters	8 Oil Filters	40 Oil Filters
Fuel gas filters	16 gas Filters	n/a	16 gas Filters
Skimmed oil from evaporation pits	0.4 barrels per day [a]	n/a	0.4 barrels/day [ab]
Number of used chemical barrels	12 barrels per month [a]	3 barrels per month [a]	21 barrels per month [a]
Oily waste generated from the drainage system	4 barrels per month [a]	2 barrels per month [a]	10 barrels per month [a]

Waste type	Estimated waste throughput at Amosing-1	Estimated waste throughput Ngamia pads (3, 6, and 8)	Total estimated waste for EOPS
Liquid hazardous waste (e.g. chemicals, lubrication oils, paints).	4 barrels per month [a]	n/a	4 barrels per month [a]
Types and quantities of non-hazardous waste (e.g. plastics, metal, wood, packaging).	150kg per month	50kg per month	300 kg per month

n/a = not applicable

[a] 1 barrel = 159 litres

[b] Estimated that there would be 200 mg of hydrocarbon waste per litre of waste water from oil production, which will go to evaporation ponds. There will be limited quantities of other solid deposits (e.g. salts, sediment)

TKBV has a framework agreement with a NEMA licensed transporter, to collect, transport and dispose of non-hazardous and hazardous wastes generated by TKBV operations. Trucks will be used to transport solid non-hazardous and hazardous wastes generated by EOPS to a NEMA approved Waste Management facility.

The bitutainers will be cleaned every three months and oily sludge removed and disposed of by a NEMA licensed waste handler. The existing crude storage tanks used in EOPS at Amosing-1, will be cleaned and oily sludge and other waste will be removed at the end of operations and manged by the waste handler.

No liquid waste products will be discharged to the environment which do not meet NEMA standards. Contact water (any rainfall runoff that could come into contact with potentially contaminated areas on site) during operations will be managed on site separately from non-contact water and will be conveyed through oil traps prior to any discharge to the environment or infiltration from sumps.

The produced water from operations at Ngamia and Amosing will be stored at Amosing in one of the existing crude storage tanks until the settlement residence time of oil and other materials has been completed. At which time the waste water will be pumped to the evaporation pond. The residue solid waste in the evaporation pond, post evaporation, will be disposed of by a NEMA approved waste transporter. The predicted quality of produced water that will go to the evaporation ponds is as follows:

- Solids content (mg/l) – 200; and
- Oil in water content (ppm) - ≤30.

There will be a sanitation waste water treatment package installed at Amosing-1. Sanitation waste from toilets at Ngamia-8 will be treated on site and treated water released to the environment on meeting NEMA effluent quality standards. For both options, monitoring will be undertaken to ensure effluent guidelines are met in line with the Project standards.

4.3.10 Transportation

4.3.10.1 Tanktainers

UN T11 ISO Tank Containers (Tanktainers) will be used to transport reservoir fluids from Ngamia-6, -3 and -8 to Amosing-1 wellpad for loading into the EPF.

Tanktainers will also be used to transport crude oil from the EPF to KPRL facilities in Mombasa.

A photo of a typical tanktainer is provided in Figure 4-2. Tanktainers will have the minimum specification listed below:

- Designed to hold fluids up to 130ºC and insulated to prevent heat loss whilst on route;
- Minimum of 25,000 litres capacity (approximately 150 barrels of oil);
- Designed for a Maximum Allowable Working Pressure (MAWP) of 4 bar and fitted with a pressure relief valve;
- Fitted with temperature gauges;
- Fitted with heating coils;
- Designed for periodic tank cleaning;
- Fitted with cable seals;
- Designed with ISO lifting points and a roll-over cage; and
- Fitted with an electrical earthing point.

Tanktainers will be loaded using a bottom flange point connection as shown in Figure 4.-2. Articulated road trucks will be used to transport tanktainers. A photo of a commonly used articulated truck mounted with a tanktainer is provided in Figure 4.-3.

Figure 4-2: Typical ISO tanktainer

Figure 4-3: Articulated road truck with a mounted tanktainer

4.3.10.2 Infield transportation of crude oil and workers

Following degassing at the Ngamia wellpads, reservoir fluids (crude oil mixed with produced water) will be loaded into a tanktainer for transportation to the EPF at Amosing-1 wellpad. Based upon the current understanding of the hydrocarbon reservoir and projected production profiles, it is estimated that a minimum of

one tanktainer each day per wellpad will be required to transport reservoir fluids from the Ngamia wellpads to the EPF. This equates to a minimum of three road movements each day using the infield access roads and the existing section of the C46 road between the Ngamia wellpads and Amosing-1 wellpad.

Infield road movements to an evaporation pond located at Amosing-5 wellpad, may be required if the produced water volumes generated are higher than that currently anticipated.

In addition, a total of 2 trucks will be required per month to transport hazardous materials (such as chemicals) and other equipment to Amosing and Ngamia wellpads.

All workers accommodated at Kapese ISB will be transported every day from Kapese ISB to the wellpads (totalling 30 – 60 people for construction and 20 – 25 people during operations).

4.3.10.3 Oil trucking to Mombasa

Loading for transportation is planned to be undertaken between 4pm and 6am, however, where operationally necessary, loading may also take place during the day. All trucks will be parked at Amosing-1 or the Ngamia wellpads, with drivers transported to Kapese ISB via shuttle bus. A dedicated shut truck driver will be used to load the trucks.

In order to sustain production levels up to a maximum of 2,000 barrels/day, it is anticipated that an average of 14 tanktainers per day will be used, 7 days a week, for a one-way journey. This equates to an average of 28 road movements each day along the defined route. However, due to the potential for operational delays to occur, greater numbers of road movements may occasionally be required. For example, it is possible that up to 20 tanktainers (or more) may be used in order to catch up with the transport of crude from the EPF to the Mombasa KPRL refinery, and a similar number used for the return journey.

The route to be used from Lokichar to Eldoret takes into consideration a planned/ongoing road maintenance programme by KeNHA. The proposed route is summarised below:

- Infield road from the Amosing-1 wellpad entry gate to the junction with the C46;
- C46 to the junction of the A1, which requires passage through Lokichar;
- A1 south to Kitale until reaching the junction with the B2;
- B2 from Kitale to the junction with the A104 (signposted towards Eldoret);
- A104 towards to Navisha;
- C88/B3 road to Nairobi; and
- A109 road to Mombasa.

The route described above is approximately 1,100 km in length and illustrated in Figure 4-4.

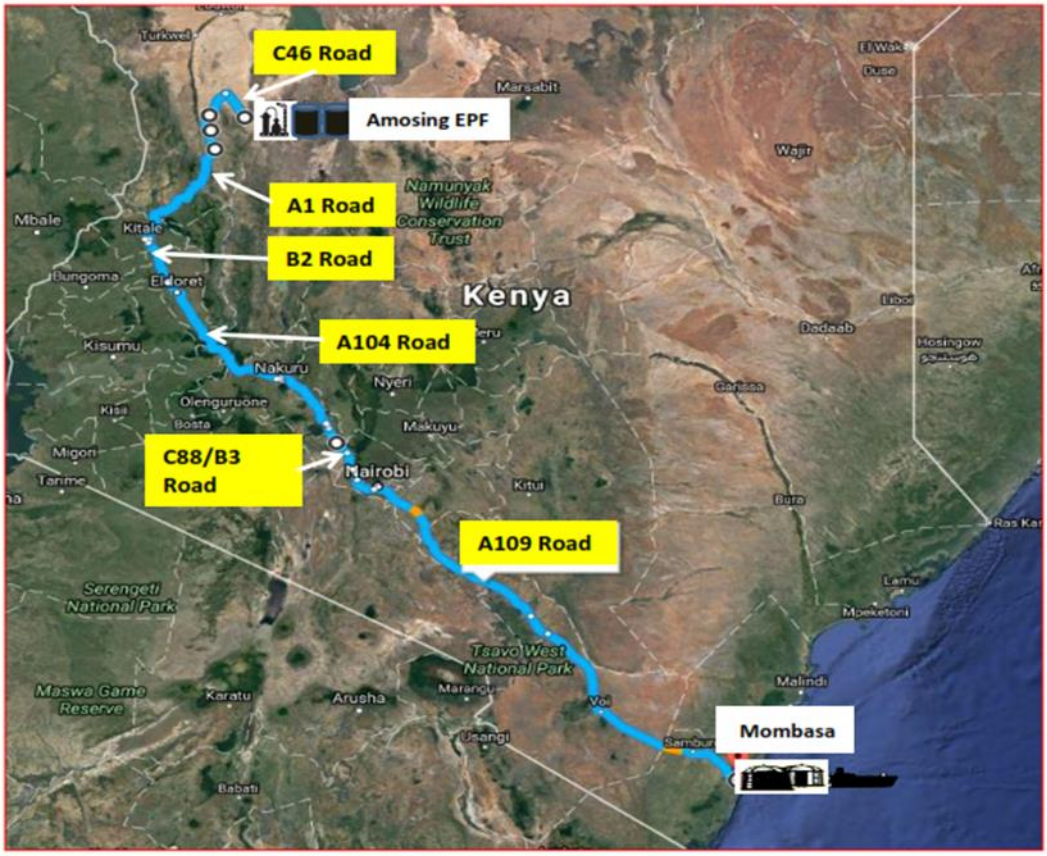


Figure 4-4: Road transportation route

Two logistics contractors will be used to transport tanktainers by road and maintain a suite of drivers and road trucks. The required number of trucks is 92, plus contingency trucks and drivers. The logistics contractors will employ sufficient drivers to drive the trucks and to cover days off and sickness. Transportation will be conducted during daylight hours only, unless unforeseen conditions require otherwise (e.g. traffic congestion or delay due to vehicle accident).

TKBV logistics contractors responsible for transportation will use already established rest stops. TKBV have audited these rest stops as well as overnight rest stops with suitable accommodation for drivers. Routine maintenance of the fleet of trucks will be performed at the logistics contractor's main bases in Nairobi and Mombasa, to keep them in working order. Truck marshalling yards will be used to provide secure parking overnight. Accommodation and welfare arrangements throughout the route will be provided to drivers by the logistics contractor.

The logistics contractor will develop an operational plan, as well as a detailed emergency response plan, to respond to any road incident. This plan will be developed in conjunction with TKBV and relevant authorities along the route and will contain a description of the locations of spill response resources.

4.3.10.4 Speed Limits

Vehicles will adhere to the designated speed limit for the roads being used by Project traffic. These are:

- 80 kmph on sealed national roads;
- 50 kmph on infield roads;
- 40 kmph on the Kapese ISB access road; and
- 10 kmph within wellpads.

Variable speed limits within certain areas (e.g. in residential areas) will also be adhered to.

4.4 Workforce

It is expected that a total skilled workforce of 30 to 60 people required for commissioning. Additional man power estimates will be developed as part of the Operations Management Plan. Shuttle buses will transport people every day to and from the wellpad areas. It is estimated that, during commissioning and groundworks, in addition to the skilled workforce, there will also be Turkana employment opportunities during the three-month commissioning period.

The required skilled workforce for operations is expected to be 20 to 25 people working in a two-shift system. During operations, there is predicted to be 61 Turkana employment opportunities. These include:

- HGV drivers;
- LGV/escort drivers;
- Bus drivers;
- Field office administration;
- Assistant field marshals;
- Recovery and Spill Crew drivers; and
- Mechanics and tyre-men.

During operations, there will be 92 tanktainers travelling between Amosing-1 and Mombasa. Tanktainer drivers will be employed by the logistics contractor.

The following training will be provided:

- Petroleum Overview (one day);
- Basic well testing level one (two days);
- Basic well testing level two (two days);
- Basic oilfield calculations (one day); and
- Oil Spill Response training.

4.5 Accommodation

The existing, permitted Kapese ISB will provide accommodation facilities for staff associated with EOPS commissioning and operations at the Amosing and Ngamia fields. Accommodation and welfare arrangements (including food) will be provided at Kapese ISB to drivers providing transport between the fields and from the EPF to Mombasa. Personnel will be transported using one to two buses.

The expected total skilled workforce of 30 to 60 people required for commissioning will be accommodated at Kapese ISB.

The required skilled workforce of 20 to 25 people required for operations, will all be accommodated at Kapese ISB.

Worker welfare facilities on site will comprise between five and eight cabins (offices, break out areas) at Amosing-1. However, all overnight accommodation will be provided at Kapese ISB.

4.6 Project Revenue Sharing

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.

This proposed formula currently provides for 75% share to the national government, 20% to the local county government, and 5% to local communities.

EOPS 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 FFD Project is completed. In addition, revenue sharing will be subject to the provisions of the draft Petroleum Bill, 2017; which is currently under consideration in the Senate.

4.7 Decommissioning

It is the intention that EOPS wellpads will be used for the FFD. Decommissioning and closure of the FFD will comply with GIIP, IFC Standards, NEMA requirements, TKBV's environmental and social policies and also Kenyan legislative and regulation requirements. As part of the FFD ESIA, a Site Closure and Restoration Plan will be developed.

TKBV will also adopt appropriate measures during the operational life of the FFD to minimise and mitigate any impacts upon decommissioning.

5.0 ASSESSMENT OF ENVIRONMENTAL AND SOCIAL IMPACTS

Section 5 presents the analysis of impacts of EOPS considering the measures that are incorporated into the design to minimise impacts, as well as policies and initiatives which Tullow are already committed to (incorporated environmental measures). In addition to these incorporates measures and following the classification of impacts, mitigation measures are identified, which will manage or reduce the impacts. Residual impacts are those that remain following the implementation of the proposed mitigation and will be defined based on the same process applied to the evaluation of impacts.

5.1 Soils, Geology and Seismicity

5.1.1 Sources of Effects

The potential impacts of the Project to geology and seismicity were scoped out of the assessment due to the nature and scale of EOPS.

The elements of the Project that have been identified as potential sources of effect for soils include:

- The movement of soil, soil compaction and laying concrete during groundworks/installation;
- Contamination from the deposition of airborne contaminants during operation;
- Discharges of untreated sewage or dirty water from latrines, accommodation facilities or septic tanks; and
- Discharge of untreated contact water from within the wellpad footprints.

Spills and leaks caused by accidents involving tanktainers or wellpad operations that could result in soil contamination during groundworks/installation and operations will be addressed in the Environmental Risks and Accidents section (Section 5.12).

5.1.2 Incorporated Environmental Measures

The following measures are incorporated into the design of EOPS:

- Soil compaction from groundworks/installation will be minimized as EOPS will use existing facilities (including wellpads, accommodation, fuelling areas, maintenance yards, workshops and roads) permissibly constructed during the exploration and appraisal stage;
- Project materials will be selected which take into consideration specific reservoir fluids and operating conditions and materials with a low environmental toxicity will be selected to reduce the volume and type of waste generated; and
- Designated waste storage areas with low permeability high density polyethylene (HDPE) linings will be incorporated in the design. All waste will be stored within the wellpads. All waste generated from EOPS activities will be collected in sealed vehicles by a NEMA approved waste transporter for disposal in accordance with the Kenyan waste management regulations of 2006.

5.1.3 Study Area and Receptors

The soils baseline considered the Upstream component of EOPS, comprising the Ngamia and Amosing wellpads and a 500 m buffer around each wellpad. This has been incorporated into the Upstream Biophysical Impact Assessment Local Study Area, as presented in Section 1.

It also considered the midstream component, with a 100 m buffer either side of the proposed road route. This has been incorporated into the Midstream Biophysical Impact Assessment Study Area.

Within these study areas, the receptor identified and considered in this assessment is the quality of existing soil.

5.1.4 Considerations from Stakeholder Engagement

Key issues / questions relating to soils, geology and seismicity raised during EOPS ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018 as well as responses are included in Volume II.

5.1.5 Key Guidelines and Standards

The following are the key laws, guidelines and standards that have been considered during the completion of the soils, terrain, geology and seismicity impact assessment:

- Kenyan policy and legislation, including:
  - The EMCA (Waste Management) Regulations (2006); and
  - Environmental Management and Coordination Act (EMCA) (1999) and Amendments (2015).

There are no specific Kenyan guidelines that should be followed to conduct evaluations of soil properties. Soils have been identified using the Food and Agriculture Organization (FAO) of the United Nation's soil classification system, which is a common classification system for describing natural soils in Africa, and the United States Department of Agriculture Soil Taxonomy Classification System.

5.1.6 Effects Analysis

5.1.6.1 Methods

The soils impact assessment utilises the source-pathway-receptor concept. The 'source' is the potential source of effect to the quality or quantity of the soil. The 'receptor' is the existing soil in the study area that has the potential to be affected. The 'pathway' is the viable route(s) by which the receptor could be affected by the source.

Changes to geology or seismicity have been scoped out of this assessment as there are no potential sources of effects on geology and seismicity resulting from EOPS. The design of the Project takes into account the potential effects of regional seismicity on the Project (e.g. the integrity of infrastructure).

5.1.6.2 Results

5.1.6.2.1 Assessments of Effects Associated with Groundworks/Installation

The EOPS wellpads are already constructed and are present as part of the baseline. Existing facilities at the wellpads will be used, which limits the need for new groundworks.

The 2 m bund is existing and therefore soil will not need to be won from elsewhere. Maintenance of the 2 m bund on the perimeter and dust suppression will reduce the potential for increased erosion.

Soil management methods will be utilised, which will reduce the potential for increased erosion. Therefore, the potential for a decline in soil quality will be reduced and the potential effects on soil quality are considered to be negligible.

As effects on soil will be minor and limited to the existing Project footprint, potential effects on soil characteristics and on the availability of soil as a resource are considered to be negligible.

5.1.6.2.2 Assessment of Effects Associated with Operation

Incorporated environmental measures, such as designated waste storage areas within the wellpads with low permeability HDPE linings, mean that direct discharges of liquids from within the wellpad areas to soil will be controlled to meet NEMA effluent discharge standards. Therefore, the potential changes to soil as a result of discharges are considered to be negligible.

Deposited dust will potentially be generated during operations by traffic travelling on the roads between the wellpads and the highway. The source will be created by a limited number of vehicles moving on unpaved

roads between the wellpads and Kapese Camp. Dust that can be deposited from the air is, by virtue of its size, limited in terms of the distance it can be transported. The spatial extent of any deposition related impacts from the operational sources will, therefore be limited to those areas adjacent to the activities (i.e. <50 m from roads). Further details are provided in Section 5.3. Deposition may result in dust soiling onto surfaces and vegetation. However, there is limited vegetation and habitats adjacent to the roads. This combination of limited source and limited impact area results in a negligible impact on soils from deposited dust.

5.1.7 Impact Classification

Table 5-1 presents the impact assessment criteria used for the qualitative assessment of potential impacts on soil.

Table 5-1: Impact Assessment Criteria for Soils and Terrain

Magnitude	Geographic Extent	Duration	Frequency
Negligible Very minor (immeasurable) change or no change to soil quality or availability **Low** Measurable change to soil quality or availability used by Project affected people for agriculture or livestock, but no change in land use **Medium** Partial change to soil quality or availability used by Project affected people for agriculture or livestock, leading to change in land use **High** Complete change to soil quality or availability used by Project affected people for agriculture or livestock, leading to loss of land use	**Local** Within Upstream Biophysical Impact Assessment Local Study Area and Midstream Impact Assessment Study Area **Regional** Beyond Upstream Biophysical Impact Assessment Local Study Area and Midstream Impact Assessment Study Area	**Short-term** Effect is reversible at end of construction **Medium-term** Effect is reversible at end of operations **Long-term** Effect is reversible within a defined length of time or beyond closure **Permanent** Effect not reversible	**Infrequent** Effect occurs intermittently but not continuously over the assessment period **Frequent** Effect occurs repeatedly or continuously over the assessment period

5.1.7.1 Determination of Impact

The effects analysis (taking into account incorporated environmental measures) indicates that all potential changes to soil quality and availability are predicted to result in effects with negligible magnitude. As such, the geographical extent, duration and frequency of the effects will not change the outcome of the impact classification and all effects will result in a negligible impact classification.

5.1.8 Mitigation

Beyond the incorporated environmental measures, no further mitigation is required to manage the impacts the Project may have on soil quality and availability. TKBV will commit to the following management and monitoring measures to ensure impacts remain negligible:

- All construction work will follow the measures presented in the Environment Management Plan (EMP) to ensure the use of soil management practises which reduce the potential for increased soil erosion and contamination of soil;
- The wellpad contact water drainage systems and waste storage facilities will be inspected and maintained to prevent discharges/releases to the environment;
- All pipe work and sumps will be inspected regularly and maintained to a standard that reduces the potential for unplanned discharges to the environment;
- All waste material will be segregated, handled, stored and disposed of in accordance with the Waste Management Plan, which will include control measures used to prevent releases of waste or residue to the environment (such as HDPE linings); and
- All hazardous materials will be identified, segregated, handled and stored as outlined in the Hazardous Materials Risk Management Plan (such as HDPE linings).

5.1.9 Assessment of Residual Impacts

No residual impacts are considered as mitigation is not required.

5.2 Traffic

The Traffic Impact Analysis (TIA) was undertaken to identify potential traffic impacts associated with the delivery of crude oil from Amosing to the port/refinery in Mombasa during the EOPS. Existing vehicle traffic generation between Amosing 1 and Kapese camp in association with current exploration and appraisal activities is limited to TKBV employees and contractors. The volume of traffic generated by these activities is considered to be minimal and to have a negligible effect on the Level of Service (LOS) on these roads, and therefore was not included in this TIA.

The TIA does not follow the same format as other impact assessment chapters, it informs the other impact assessment chapters.

5.2.1 Considerations from Stakeholder Engagement

Key issues / questions relating to traffic raised during EOPS ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018 as well as responses are included in Volume II.

5.2.2 Effects Analyses

According to Kenyan definition, Level of Service (LOS) is a qualitative classification of quality of service, with LOS A (free flow of traffic) being the best and LOS F (stop and go, congestion) being the worst. Baseline data were analysed and interpreted and background traffic, projected traffic volume and project-related traffic was determined. The calculated figures were then compared to the estimated capacity of the type of roads traversed by project traffic and to generalised peak hour directional LOS classes.

Kenya has not adopted a TIA methodology for use in conducting TIA's. Based on Golder experience and TIA methodologies adopted in similar environments, the magnitude criteria for undertaking comprehensive TIA focuses on geographic areas where project traffic is expected to contribute 5% or more of a road's design capacity. The predicted traffic levels for EOPS do not trigger this criterion as only 14 trips per day are predicted.

5.2.3 Determination of Effects

Table 1 presents the projected Tanktainer truck volume-to-roadway's design capacity ratio for 2019 and 2019 LOS with and without project traffic. As indicated in this table, the estimated truck volume-to-capacity ratio is very low (less than 2.0%).

LOS is very good throughout most of the study area, with LOS of A to C in Mau Summit, Eldoret, Kitale south of A1/B2 Junction and Marich Pass. Portions of Kitale operate at LOS D, representing congestion during the

peak hour. This situation is also reflected when comparing future traffic volume against the design capacity. However, the Project traffic represents only one percent of the background traffic, even when considering all 13 one-way vehicles traversing the location within the peak hour. The Project does not degrade existing LOS or result in a significant increase in the potential for vehicles to queue.

The TIA found that the existing roadway network has sufficient capacity in many areas to accommodate Tanktainer traffic during the EOPS phase of the project. Moreover, it is considered that the Project will not cause additional congestion in Kitale.

5.3 Air Quality

5.3.1 Sources of Effects

Potential atmospheric emissions, considered in this impact assessment, from activities during groundworks, installation, and operations can be categorised into two groups:

- The following combustion emissions:
  - Emissions from flares;
  - Emissions from well heater generators;
  - Emissions from diesel generators;
  - Emissions from the gas engine; and
  - Emissions from tanktainer movements (midstream).
- The following fugitive emissions[12]:
  - Dust generated during groundworks and installation at the wellpads;
  - Dust from traffic on roads between wellpads;
  - Dust from traffic on the highway between Amosing-1 and Mombasa (midstream); and
  - Odour from water storage areas.

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 not significant and do not require further assessment. Fugitive emissions from sources such as tanks and valves are also deemed to be negligible.

5.3.2 Incorporated Environmental Measures

In relation to air quality, the following environmental measures have been incorporated into the Project design and assumed present in this impact assessment:

- Regular schedule of vehicle and generator maintenance to ensure optimal emissions performance;
- Water spray and dust suppressant on unsealed access roads; and
- All equipment and infrastructure will be operated and maintained in line with manufacturer's recommendations.

In addition to the incorporated environmental measures, some groundworks and maintenance within the wellpads are permitted under the existing exploration permits, described in Section 4.

[12] Fugitive air emissions are those that are 'distributed spatially over a wide area and not confined to a specific discharge point' (IFC EHS Guidelines: Air Emissions and Ambient Air Quality).

5.3.3 Study Area and Receptors

The air quality baseline study area comprised the areas surrounding the EOPS wellpads. This has been incorporated into the Upstream Biophysical Impact Assessment Local Study Area, defined in Section 1. Air quality has also been considered within the Midstream Impact Assessment Study Area, as defined in Section 1.

Air quality receptors within the Upstream Biophysical Impact Assessment Local Study Area have been defined as 'sensitive' (high sensitivity) or 'non-sensitive' (low sensitivity). Sensitive receptors are considered to be any specific locations where people live or spend long periods of time, whilst non-sensitive receptors are areas where people have access (e.g. for the purposes of grazing) but do not spend long periods of time.

Due to the prevalence of nomadic pastoralism in Turkana and the associated transience of settlement, sensitive receptors cannot be easily defined. In which case sensitive receptors identified during baseline data gathering, have been considered indicative of where sensitive receptors may be located, even though it is recognised that their presence is unlikely to be permanent.

Therefore, indicative sensitive receptors that have been included in the assessment are based on homesteads identified in the Land baseline (presented in Volume II). The remaining Upstream Biophysical Impact Assessment Local Study Area that lies outside the wellpad fence lines, is considered to be a non-sensitive receptor.

Only receptors located outside the wellpad boundaries were considered in the air quality impact assessment. Results for air quality within the wellpads, whilst informed by this assessment, will be considered separately in the context of occupational health and managed through the occupational health management plan (worker health and safety plan).

5.3.4 Considerations from Stakeholder Engagement

Key issues / questions relating to air quality raised during EOPS ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018 as well as appropriate responses is included in Volume II of the ESIA.

Prominent air quality issues / questions raised during the stakeholder engagement process included concerns on the impacts of gas flaring and increased dust production on local community health.

5.3.5 Key Guidelines and Standards

The AQS adopted for the Project are based on standards and guidelines from both Kenyan and International Finance Corporation (IFC) guidance and legislation. The AQS relevant to the assessment are summarised in Table 5-2. 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 5-2: Summary of AQS adopted for human health

Emission	Time weighted average	Concentration ($\mu g/m^3$, unless stated)
SO2	Annual	50
	24 hours	20
	10 minute	500
NO_2	Annual	40

Emission	Time weighted average	Concentration ($\mu g/m^3$, unless stated)
	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

(a)Abbreviations: CO = carbon monoxide; $\mu g/m^3$ = micrograms per cubic metre; $mg/m^2/day$ = milligrams per square metre per day; 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.

5.3.6 Effects Analysis

5.3.6.1 Methods

The effects analysis was undertaken using both quantitative and qualitative analysis. The quantitative air quality assessment includes air dispersion modelling (ADM), which is briefly described in Section 5.3.6.2. The qualitative air quality assessment is briefly described in Section 5.3.6.3. Both methods are described in greater detail in the Noise Position Paper (Golder, 2016b), which is available upon request.

Table 5-3: Assessment methods for effects analysis

Phase	Activity/Process	Emission	Assessment methodology
Construction	Minor earthworks (compaction, foundations)	Dust	Qualitative
	Concreting	Dust	Qualitative
Operation	Air emissions from wellpad activities	Combustion emissions	Quantitative
	Traffic on roads between wellpads	Dust	Qualitative

Phase	Activity/Process	Emission	Assessment methodology
	Storage of used water	Odour	Qualitative
	Traffic on highway between Amosing-1 and Mombasa (midstream)	Dust and combustion emissions	Qualitative[13]
Decommissioning [14]	Minor earthworks	Dust	Qualitative

Combustion emissions emit most of the gaseous emissions, including NOx, NO_2, SO_2, CO, VOC, PM_{10} and $PM_{2.5}$. Emissions from activities during operations were estimated using a combination of data supplied by TKBV, information available from manufacturer's specification sheets and IFC emission limits data. All emissions sources are conservatively modelled as being operational for 100% of the time.

5.3.6.2 Quantitative Assessment

Emissions concentration and deposition predictions are based on an ADM using AERMOD (ADM software, version 7.12.1.0). Modelled emissions from the Project include gases (NO_x, NO_2, SO_2 and CO), total VOC, PM_{10} and $PM_{2.5}$.

Two scenarios were modelled. The first scenario, the "normal operating scenario" simulated operations during which all infrastructure or equipment producing combustion emissions are operating continuously. The second scenario, "the power generator scenario" included a power generator in place of the Amosing gas engine to simulate the likely scenario prior to the gas engine coming online. Although a diesel generator would only be required for three months in the second scenario (to allow the gas engine to be installed and commissioned), the model calculated emissions on the assumption it would operate for a full year. This is due to a limitation of the modelling software; it cannot model emissions for under 1 year.

The pathway by which emissions to air may impact upon sensitive receptor locations is through atmospheric dispersal. Emissions to air from the sources will be transported by the wind to potential downwind receptors. The distance and dilution of emissions dispersed, and potentially deposited, will be dependent on the prevailing meteorological conditions, as detailed in Volume II.

At the time the ADM model was set up, 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) from Eldoret. Prior to the modelling, the Eldoret data was compared against the monitored Site data from Kapese and Ngamia and all three stations showed a prevalence of easterly winds associated with the distinct monsoon pattern observed over equatorial eastern Africa, therefore Eldoret data, with its longer historic record,

[13] The assessment was qualitative as the increased traffic volumes were not significant enough to trigger the requirement of a full quantitative assessment.

[14] Decommissioning scenario assumes that the wellpads are not used in the full field development and need to be restored and revegetated in a manner consistent with the surrounding areas

was appropriate for use in the model. Wind roses for Kapese, Ngamia, Eldoret and Lodwar are presented in the Meteorology baseline (Volume II) and all indicate a prevalence of easterly winds.

The ADM predicts the potential effect of emissions on air quality across the model domain (represented by a grid of points), which extends beyond the potentially sensitive human receptors, but within the EOPS biophysical impact assessment study area).

The ADM predicts the process contribution (PC) concentration from the source. The resulting ambient air PC concentration across the model domain is added to the baseline concentration, to calculate the predicted environmental concentration (PEC). The PEC is then compared to the AQS and an evaluation of the magnitude of the effect can be made using the criteria defined in Section 5.3.7.

5.3.6.3 Qualitative Assessment

The qualitative assessment addresses fugitive emission sources of dust and odour.

A source-pathway-receptor assessment approach has been used to identify possible effects. This assessment method involves the following stages:

- Source characterisation: to identify the potential emission sources associated with the Project;
- Pathway: to show the manner in which potential emissions from the Project are transported to the receptor; and
- Receptor evaluation: to review the receptors which could be affected by the potential emissions from the Project.

Potential effects on air quality are likely to occur during the construction groundworks/installation, operations, and decommissioning phases (as presented in Table 5-3). Effects were determined by establishing the source emission potential (magnitude, frequency and duration) and pathway effectiveness for each source (wind speed and direction) and comparing them to establish the magnitude of effect.

There is no prescribed international assessment method for odour. Therefore, the method for assessing the effects of odour emissions from the Project is broadly based on the United Kingdom (UK) Environment Agency and Department for Environment, Food & Rural Affairs guidance on 'Risk assessments for specific activities: environmental permits'[15] and Horizontal Technical Guidance Note H4 Odour Management (Environment Agency, 2011).

Similarly, for deposited dust the baseline standard of 200 mg/m^2/day has been adopted (based on the UK Institute of Air Quality Management (IAQM) 'Guidance on Air Quality Monitoring in the Vicinity of Demolition and Construction Sites' (IAQM, 2012). Deposited dust does not travel far due to the size of the particles. The spatial extent of the qualitative assessment is based on the distance between any potential emissions source and receptors. Potential effects were considered up to a maximum of 250 m from the wellpads and 50 m from the roads.

5.3.6.3.1 Traffic Assessment

The effect of road traffic emissions associated with the construction and operation phases of the proposed development, including both dust and combustion emissions, are assessed in accordance with United Kingdom Design Manual for Roads and Bridges (DMRB) guidance on assessing air quality impacts (DMRB, 2007).

[15] https://www.gov.uk/government/collections/risk-assessments-for-specific-activities-environmental-permits, accessed 16/05/2017

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. The DMRB assessment method provides screening and scoping criteria to assess the likely impact of changes to traffic flows on local air quality.

The TIA showed that the maximum percentage change in traffic is predicted to be less than 1%, 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. Truck movements have therefore been scoped out of this air quality assessment, due to their negligible impact on traffic-related air quality impacts.

5.3.6.3.2 Fugitive Dust and Odour Assessment

Fugitive dust and odour emissions from the Project, as presented in Table 5-3, are assessed using a source-pathway-receptor approach.

The assessment establishes the source emission potential of each fugitive dust or odour emitting activity, as well as the pathway effectiveness from sources to receptors, in determining the magnitude of potential impacts.

5.3.6.4 Results

5.3.6.4.1 Quantitative Assessment – normal operating scenario

The results of the ADM for the normal operating scenario (see Section 5.3.6.2), are shown in Table 5-4. Contour plots for all emissions are presented in Drawings 5.3-1 to 5.3-15.

Predicted exceedances are mainly within the fenceline of the Amosing-1 wellpad. As an occupational health issue, this will be managed through the occupational health management plan (worker health and safety plan) and will not be considered further in this impact assessment. The predicted area of exceedance of the AQS pertinent to this assessment is a small area outside of the Amosing-1 wellpad, located between the wellpad and the access road. There are no AQS exceedances beyond the fenceline at the Ngamia wellpads.

The ADM predicts exceedances beyond the Amosing-1 wellpad fenceline of the AQS for NO2 annual and 1-hour averaging periods and NOx annual and 24-hour averaging periods. The locations of these predicted exceedances are shown in Drawings 5.3-1, 5.3-3, 5.3-4 and 5.3-5.

There is a predicted exceedance of the annual AQS for PM10 (Drawings 5.3-14 and 5.3-15) at all wellpads but this is due to the high background levels of PM10 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 (PM10 and PM2.5) 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 baseline conditions at the Kapese Camps. The camp is well established and permitted 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.

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 PM10 is 22 µg/m3, which is only marginally above the background concentration presented in Table 2-2.

Table 5-4: ADM results - maximum concentrations in the modelled domain outside of the Amosing-1 wellpad perimeter

Emission	Time weighted average	PC (µg/m^3)	Estimated background concentration (µg/m^3)	PEC (µg/m^3)	AQS (µg/m^3)	PC % AQS	PEC % AQS	Predicted exceedance of AQS outside wellpad fenceline
NO_2	Annual	62	0.8	62	40	154	156	See drawing 5.3-3
	24-hour	87	0.9	88	188	46	47	See drawing 5.3-2
	1-hour	287	1.5	288	200	143	144	See drawing 5.3-1
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 5.3-5
	24-hour	599	-	599	80	749	749	See drawing 5.3-4
PM_{10}	Annual	3	21.7	25	20	17	125	See drawing 5.3-15
	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/m^3 = microgram per cubic metre; AQS = air quality standard; CO = carbon monoxide; NOx = nitrogen oxidesNO_2 = 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.

5.3.6.4.2 Quantitative Assessment – power generator scenario

The results of the ADM for the power generator scenario (see Section 5.3.6.2), which considers the operation of the flare and the temporary generator at Amosing-1, predicts no exceedances of the AQS outside of any of the wellpads, therefore drawings have not been generated to present these results.

5.3.6.4.3 Qualitative Assessment

All resultant effects are negligible except for dust from the access roads between the wellpads, which is predicted to be a low magnitude effect.

5.3.7 Impact Classification

The assessment of impacts takes the results of the effects analysis and applies the impact assessment methodology.

5.3.7.1 Magnitude of the Effect

Table 5-5 presents the magnitude of effect criteria and other criteria which will be used for the impact assessment for air quality.

Table 5-5: Impact assessment criteria for air quality

Magnitude	Geographic Extent	Duration	Frequency
Negligible No expected detectable change in measurable air emission concentrations or deposited dust to ground at sensitive or non-sensitive receptors. **Low** Change in air emission concentrations or deposited dust predicted to exceed baseline, but not exceed AQS at indicative sensitive receptors. OR Change in air emission concentrations or deposited dust predicted to exceed AQS at non-sensitive receptors, with process contribution less than 25%* of AQS. **Moderate** Change in air emission concentrations or deposited dust predicted to exceed AQS at indicative sensitive receptors with process contribution less than 25% of AQS OR Change in air emission concentrations or deposited dust predicted to exceed AQS at non-sensitive receptors, with process contribution greater than 25% of AQS. **High** Change in air emission concentrations or deposited dust predicted to exceed AQS at indicative sensitive receptors with process contribution greater than 25% of AQS	**Local** Within Upstream Biophysical Impact Assessment Local Study Area and Midstream Impact Assessment Study Area **Regional** Exceeds Upstream Biophysical Impact Assessment Local Study Area and Midstream Impact Assessment Study Area	**Short-term** Effect is reversible at end of groundworks/ 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 not reversible	**Infrequent** Effect occurs intermittently but not continuously over the assessment period **Frequent** Effect occurs repeatedly or continuously over the assessment period

* In alignment with IFC EHS Guideline: Air Emissions and Ambient Air Quality

5.3.7.2 Determination of Impact

The detailed determination of all impacts is presented in Volume II. Table 5-6 summarises the impacts with a consequence of moderate or major.

Potential effects occurring during the groundworks/installation and decommissioning phases are considered to be short-term. Potential effects occurring during the operations phase are considered to be medium-term. Minimal air quality effects are anticipated in the post-closure phases. Air quality effects for all phases are considered to be reversible.

Table 5-6: Determination of impacts for air quality

Receptor	Project phase	Key source of impact	Impact classification	Receptor sensitivity	Impact consequence
Indicative sensitive receptors (homesteads identified from May 2017 Land survey)	Operation	Emissions of PM_{10}	Moderate	High	Moderate

During the operational period, moderate classification impacts are expected from emissions of NOx, NO_2 and PM_{10}. However, due to receptor sensitivity, only indicative sensitive receptors are expected to experience moderate impact consequences. This impact is limited to a small area only, adjacent to the Amosing-1 wellpad, between the wellpad fenceline and the access road, and is shown in Drawings 5.3-1, 5.3-2, 5.3-3, 5.3-4 and 5.3-5.

It is likely that the exceedance of the NO_2 1-hour AQS, and the resultant moderate impact classification, is a direct consequence of the conservative modelling approach used in the ADM. All equipment was modelled as running constantly at the maximum possible emission limit, with no correction for moisture or oxygen (which would reduce the emission rate). Corrections were made for temperature, but it is considered that the model results provided present the worst-case scenario.

The qualitative assessment indicates all impacts will be negligible.

5.3.8 Mitigation

Beyond the incorporated environmental measures, no further mitigation is possible to manage the impacts the Project may have on air quality.

The inclusion or exclusion of the 2 m bund around the Amosing-1 wellpad did not induce any change in the predicted model outputs, so the moderate impact on air quality in the vicinity of the Amosing-1 wellpad cannot be mitigated through further protection at the Amosing-1 wellpad perimeter.

The construction management plan and environmental compliance plan will include commitments to best practice, including incorporated environmental measures and monitoring of emissions through operations.

In the worker health and safety plan there will be a commitment to adequate protection within the wellpad perimeter to meet appropriate occupational health guidelines.

5.3.9 Assessment of Residual Impacts

No residual impacts are considered as mitigation is not required.

5.4 Noise and Vibration

This assessment considers the potential effects on identified receptors arising from noise sources associated with the Project. Based on the information provided, the Project does not include any major sources of vibration, and so vibration effects have not been considered in the impact assessment.

5.4.1 Sources of Effect

The elements of the Project that have been identified as potential sources of noise include:

- Groundworks;
- Installation and commissioning of equipment; and
- Operation of the following equipment or infrastructure;
  - Well heater generators;
  - Flares;
  - Gas engines;
  - Fuelling station pumps and compressors;
  - Oil transfer pumps;
  - Crude oil export pumps;
  - Water booster pumps;
  - Water transfer pumps; and
  - Transport of bulk materials (i.e. tanktainer movements).

5.4.2 Incorporated Environmental Measures

Engineered environmental measures incorporated into the site design include:

- Following best noise management practices during groundworks, installation, operations and decommissioning;
- Noise abatement equipment on machinery (e.g. acoustic enclosures) will be properly maintained and kept in good working order;
- Equipment noise levels will be no greater than the sound power levels shown in Table 5-9;
- Equipment quantity and utilization will be no greater than those presented in Table 5-9;
- Site infrastructure will be installed in line with designs provided for the ESIA project description;
- Maintenance of a 2 m tall earth bund along the fenceline of each wellpad; and
- Operation of gas engines and diesel generators within acoustic enclosures.

5.4.3 Study Area and Receptors

The noise baseline study area comprised the areas surrounding the EOPS wellpads. This has been combined with other discipline baseline study areas to produce a common impact assessment study area in which common receptors can be assessed across disciplines.

The Upstream Biophysical Impact Assessment Local Study Area, as defined in Section 1, incorporates the areas where it is considered that noise from project sources could be detectable. It is considered that measurable noise effects of EOPS are unlikely to reach beyond 1.5 km from their source, due to attenuation with distance. Noise effects have also been considered within the Midstream Impact Assessment Study Area (as defined in Section 1).

Noise receptors within the Upstream Biophysical Impact Assessment Local Study Area have been defined as ‘sensitive’ (high sensitivity) or ‘non-sensitive’ (low sensitivity). Sensitive receptors are considered to be any

specific locations where people live or spend long periods of time, whilst non-sensitive receptors are areas where people have access (e.g. for the purposes of grazing) but do not spend long periods of time.

Non-sensitive receptors have not been considered in the noise impact assessment, as the Project standards apply only to sensitive receptors.

In order to allow a quantitative assessment at indicative receptors, Golder used the data from the May 2017 land baseline survey to identify indicative sensitive receptors, even though it is recognised that pastoralist homesteads are in many cases temporary, short term or unoccupied. Indicative receptors nearest to each wellpad in each cardinal direction (north, east, south, and west) were identified. These are listed in Table 5-7 and their locations are shown on Drawing 5.4-1.

Table 5-7: Noise Assessment Indicative Receptors

Wellpad	Receptor Identification (May 2017 land survey)	Direction from Wellpad[1]	Approximate Distance to Wellpad (m)	UTM Coordinates (NAD 83; Zone 36)	
				Easting (m)	Northing (m)
Amosing-1 (1)	M64H-1	North	240	812018	239471
	M74H-1	West	320	811550	238939
	M63H-1	Northwest	310	811683	239461
Ngamia-3 (2)	M97H-1	North	570	806859	246499
	M16H-1	East	660	807965	246006
	M41H-1	South	520	807524	245318
Ngamia-6	M53H-1	North	190	807379	244758
	M54H-1 (3)	East	490	807842	244539
	M72H-1	South	440	806664	243840
	M63H-1	West	320	806655	244119
Ngamia-8	M41H-4	North	60	807654	245051
	M55H-3	East	430	808212	244652
	M54H-1 (3)	South	220	807842	244539
	M53H-4	West	140	807471	244947

(1) Note there is no appropriate receptor identified south or east of Amosing-1

(2) Note there is no appropriate receptor identified west of Ngamia-3

(3) M54H-1 is a potential receptor both to the east of Ngamia-6 and to the south of Ngamia-8

Noise levels within the wellpads, whilst informed by this assessment, will be considered separately in the context of occupational health and managed through the occupational health management plan (worker health and safety plan.

5.4.4 Considerations from Stakeholder Engagement

Key issues / questions relating to noise and vibration raised during EOPS ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018 as well as appropriate responses is included in Volume II of the ESIA.

Prominent noise and vibration issues / questions included concerns with the impact of truck movements on vibration as well as what mitigation measures will be put in place to address noise pollution.

5.4.5 Key Guidelines and Structures

The International Finance Corporation Environmental, Health and Safety (EHS) Guidelines - Noise Management dated April 30, 2007 (IFC Noise Guidelines) and *Kenya Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations* dated 2009 (Kenya Noise Regulations) are relevant documents to the Project that provide guidance in managing sound levels at specific locations. Golder carried out a review of the IFC Noise Guidelines and Kenya Noise Regulations, recommending the use of the IFC Noise Guidelines for the Project (Golder tech memo 1654017.511). TKBV subsequently confirmed with NEMA in a minuted meeting that the IFC Noise Guidelines could be used as Project standards in the EOPS ESIA.

The receptors identified for the noise impact assessment are best categorized as “residential” under the IFC Noise Guidelines, with sound level limits as presented in Table 5-8.

Table 5-8: IFC Noise Guideline Noise Limits

Receptor Type	Noise Limit (dBA; $L_{Aeq,1r}$) (1)	Reference Period
Residential	55	Daytime (07:00 – 22:00)
	45	Nighttime (22:00 – 07:00)

(1) IFC Noise Guideline allows for either the sound level limits presented here or a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

The Project standards adopt the noise limits presented in Table 5-8, at the nearest off-site indicative receptor location. The magnitude criteria for the impact assessment presented in Section 5.4.7 consider these noise limits for the impact analysis.

5.4.6 Effects Analysis

For the purposes of this noise assessment, a qualitative analysis was conducted for the Upstream groundworks and installation phase and for the transportation (midstream). A quantitative analysis was carried out for the Upstream operational phase of EOPS.

5.4.6.1 Methods – Upstream Operations

The quantitative analysis was completed through analytical numerical modelling to predict the potential noise levels in the acoustic environment as a result of Project noise emissions. The noise prediction modelling was carried out with the aid of Computer Aided Noise Attenuation (CadnaA[16]).

Noise sources are characterized by entering the sound power and/or sound pressure octave band spectrum associated with each source. Other inputs to the model include building dimensions, ground cover, physical barriers - either natural (terrain based) or constructed, atmospheric absorption, source utilisation, and enclosure

[16] Noise modelling software (version 4.6.155, developed by DataKustik GmbH), with modelling algorithms based on *ISO 9613 Acoustics: Attenuation of Sound during Propagation Outdoors (International Organization for Standardization 1993 and 1996)* [ISO 1993 and 1996].

attenuation ratings also define the nature of sound emissions. The ISO 9613 prediction method is conservative as it assumes that all receptors are downwind from the noise source or that a moderate ground-based temperature inversion exists.

Due to variations in the equipment utilisation, noise prediction modelling was undertaken for the predictable worst-case hour, as well as daytime (07:00 to 22:00) and nighttime (22:00 to 07:00) periods. The predictable worst-case hour assumes all equipment is operating at the highest utilisation.

The list of equipment, quantity, utilisation (predictable worst-case hour, daytime period, and nighttime period) and noise emissions summarised in Table 5-9 was provided by TKBV and was used to characterise sources in the noise model. When required, source noise data were supplemented from published manufacturer sources and measured levels of similar equipment. The list of equipment is considered to be representative of the types of equipment and associated activities that are proposed for EOPS. The location of equipment within the model space was determined based on indicative layouts provided by TKBV (Section 1).

It was assumed that the gas engine will be used at Amosing-1 from the commencement of operations because the gas engine has a higher sound power level than the temporary back-up diesel generator.

Table 5-9: Operation Phase Noise Emissions

Wellpad	Source Description	Quantity[1] and Utilisation			Sound Power Level (dBA)[2]
		Predictable Worst Case Hour	Daytime Period (07:00 to 22:00)	Nighttime Period (22:00 to 7:00)	
Amosing-1	Well Heater Generator	100%	40%	67%	100
Amosing-1	Flare	100%	100%	100%	90
Amosing-1	Gas Engine	100%	100%	100%	103
Amosing-1	Fuelling Station Pumps	2 @ 100%	2 @ 40%	2 @ 89%	92
Amosing-1	Fuelling Station Compressor	100%	40%	22%	92
Amosing-1	Tanker Truck Movements	2 trucks/hour	0.8 trucks/hour	1.8 trucks/hour	99
Amosing-1	H/T Oil Transfer Pumps	2 @ 100%	2 @ 100%	2 @ 100%	92
Amosing-1	Crude Oil Export Pumps	2 @ 100%	2 @ 40%	2 @ 22%	92
Amosing-1	Water Booster Pumps	2 @ 100%	2 @ 100%	2 @ 100%	92
Amosing-1	H/T Water Transfer Pumps	2 @ 100%	2 @ 100%	2 @ 100%	92
Amosing-1	Water Transfer Pumps	2 @ 100%	2 @ 100%	2 @ 100%	92
Amosing-1	Inlet Heater	100%	100%	100%	89

Wellpad	Source Description	Quantity[1] and Utilisation			Sound Power Level (dBA)[2]
		Predictable Worst Case Hour	Daytime Period (07:00 to 22:00)	Nighttime Period (22:00 to 7:00)	
Ngamia-3	Diesel Generator	100%	100%	100%	98
Ngamia-3	Well Heater Generator	100%	40%	67%	100
Ngamia-3	Flare	100%	100%	100%	84
Ngamia-6	Diesel Generator	100%	100%	100%	98
Ngamia-6	Well Heater Generator	100%	40%	67%	100
Ngamia-6	Flare	100%	100%	100%	84
Ngamia-8	Diesel Generator	100%	100%	100%	98
Ngamia-8	Well Heater Generator	100%	40%	67%	100
Ngamia-8	Flare	100%	100%	100%	87

(1) Assume quantity is one, unless specified

(2) Sound Power Level does not include time weighting, where appropriate

5.4.6.2 Results

Upstream groundworks and installation

There will be noise effects due to groundworks and installation activities, but they will be temporary, intermittent and limited to the vicinity of the wellpad boundaries. The range in increased noise levels associated with Upstream groundworks and installation activities will depend primarily on the number and type of noise sources and their proximity to the receptors (i.e., the Project noise levels in the environment generally decreases as the distance between the receptor and emission sources increase). The 2 m earth bund surrounding the wellpads, which will be maintained at 2 m throughout all groundworks and installation, is expected to provide noise reduction to the surrounding receptors.

The Project Upstream operational phase is expected to have a higher impact over the entire life of the Project due to its duration and frequency. Therefore, given the results presented below for the operational scenario and the Incorporated Environmental Measures presented in Section 5.4.2, impacts during groundworks and installation will not be considered in the effects analysis.

Upstream operational

Using the source information identified in Table 5-9, the CadnaA software was used to assess sound pressure levels at the indicative receptor locations presented in Table 5-7. The Upstream operational phase overall noise levels predicted during the predictable worst-case hour, daytime period, and nighttime period are presented in detail in Golder, 2016b. Contours are presented in Drawings 5.4-2, 5.4-3 and 5.4-4.

The following presents a summary of the results:

- For the indicative sensitive receptors surrounding the Amosing-1 wellpad that were identified during the May 2017 land survey there will be negligible noise effects at all but one receptor. There is a low effect at

one of the indicative sensitive receptors due to a predicted increase of 3.3 dB above the baseline nighttime noise level, even though the result remains below the noise Project standard.

- The contours in Drawing 5.4-3 and Figure 5-1 show that the daytime Project standard is exceeded outside of the Amosing-1 wellpad fenceline between the fenceline and the access road only; this exceedance is predicted to extend no further than 50 m from the fenceline. The nighttime Project standard is exceeded outside of the Amosing-1 wellpad fenceline (Drawing 5.4-4 and Figure 5-1) but extends for no more than 200 m from the southern boundary of the fenceline. No potential receptors have been identified in that area during either the September 2016 or May 2017 land surveys.

Figure 5-1: Amosing-1 wellpad outline in green, showing day time (purple) and nighttime (red) Project standard exceedance contours

- For the indicative sensitive receptors surrounding the Ngamia wellpads that were identified during the May 2017 land survey there will be negligible noise effects.

  The contours in Drawing 5.4-3 and Figure 5-2 show that the daytime Project standard is not exceeded outside any of the Ngamia wellpad fencelines. The nighttime project standard is exceeded outside of the Ngamia-3 and Ngamia-8 wellpad fencelines (Drawing 5.4-4 and Figure 5-2) but extends for no more than 100 m in very discrete locations to the west of the wellpads, where lower natural ground occurs. No indicative sensitive receptors have been identified in that area during with the September 2016 or May 2017 land surveys.

Figure 5-2: Ngamia-3 (left) and Ngamia-8 (right), with outlines in green, showing day time (purple) and nighttime (red) Project standard exceedance contours

Table 5-10 presents a summary of the change in baseline noise levels predicted at indicative sensitive receptors as a result of EOPS:

Table 5-10: Predicted change in baseline noise levels at indicative sensitive receptors

Wellpad	Receptor ID	Change in Baseline Noise Levels (dBA)	
		Daytime ($L_{eq,day}$)	Nighttime ($L_{eq,night}$)
Amosing-1	M64H-1	<1	<3
	M74H-1	<1	>3 (3.3)
	M63H-1	<1	<3
Ngamia-3	M97H-1	<1	<1
	M16H-1	<1	<1
	M41H-1	<1	<1
Ngamia-6	M53H-1	<1	<1
	M54H-1 (1)	<1	<1
	M72H-1	<1	<1
	M63H-1	<1	<1
Ngamia-8	M41H-4	<1	<1
	M55H-3	<1	<1
	M53H-4	<1	<1

(1) M54H-1 is a potential receptor both to the east of Ngamia-3 and to the south of Ngamia-8

Midstream

The TIA, shows that the maximum percentage change in traffic is predicted to be less than 1%, 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. This effect will result in less than 1 dB change in the noise level. Truck movements have therefore been scoped out of this noise assessment, due to their negligible impact on traffic noise levels.

5.4.7 Impact Classification

The assessment of impacts takes the results of the effects analysis and applies the impact assessment methodology described in Section 1.

5.4.7.1 Magnitude of the Effect

Table 5-11 presents the criteria which will be used for the noise impact assessment. The magnitude criteria have been developed in accordance with the IFC Noise Guideline discussed in Section 5.4.5, as well as general guidance provided from various directives for noise assessments[17].

[17] The 3dB, 5dB and 10dB intervals are informed by Bies and Hansen (2009)

Table 5-11: Impact assessment parameters for noise

Magnitude	Geographic extent	Duration	Frequency
Noise			
Negligible Project related change in daytime and/or nighttime equivalent noise level ≤ 3 dB and **meets** IFC noise limit at sensitive receptors **Low** Project related change in daytime and/or nighttime equivalent noise level > 3 dB and ≤ 5 dB and **meets** IFC noise limit at sensitive receptors **Moderate** Project related change in daytime and/or nighttime equivalent noise level > 5 dB and ≤ 10 dB and **meets** IFC noise limit at sensitive receptors **High** Project related change in daytime and/or nighttime equivalent noise level >10 dB above baseline or **exceeds** IFC noise limit at sensitive receptors	**Local** Within Upstream Biophysical Impact Assessment Local Study Area or Midstream Impact Assessment Study Area **Regional** Beyond Upstream Biophysical Impact Assessment Local Study Area and Midstream Impact Assessment Study Area **Beyond regional** Transboundary	**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 not reversible	**Infrequent** Effect occurs intermittently but not continuously over the assessment period **Frequent** Effect occurs repeatedly or continuously over the assessment period

5.4.7.2 Determination of Impact

Using the decision matrix presented in Volume II and the definitions in Section 5.4.7.1, the magnitude of the effect at each receptor has been determined using the results of the effects analysis. Volume II presents the route to the classification of the impacts, presenting the magnitude, geographic extent, duration, and frequency for each impact. The impact consequence of noise emissions associated with the Project based on predictable worst-case hour, daytime, and nighttime noise levels is predicted to be negligible or minor at all indicative sensitive receptors and only exceeds Project standards in areas where there is no evidence of residential use.

5.4.8 Mitigation

Beyond the incorporated environmental measures, no further mitigation is required to manage the impacts the Project may have on noise at identified indicative sensitive receptors.

Based on the information provided, the Project is not anticipated to be a source of vibration, therefore mitigation for vibration is not required.

Nevertheless, the following are considerations which will feed into the management plans (section 7):

- Groundworks and installation activities should occur during daylight hours and comply with relevant noise legislation;
- The 2 m bund surrounding each wellpad is a key element of the Project design and is expected to reduce noise. It must be maintained at a height of 2 m prior to any groundworks and installation and throughout operations and decommissioning;
- The construction management plan and environmental compliance plan will include commitment to best practice including incorporated environmental measures and monitoring of noise through operations;
- In the worker health and safety plan there will be a commitment to adequate protection within the wellpad perimeter to meet appropriate occupational health guidelines;
- The Site layout should be designed to minimise vehicle reversing, to minimise use of backup beepers;
- Occupants of all homesteads located within 200 m of the wellpads should be notified prior to the start of groundworks and installation; and
- Where reasonable and practical, vehicles and equipment will be turned off when not in use, unless weather and/or safety conditions dictate the need for them to remain turned on.

5.4.9 Assessment of Residual Impacts

No residual impacts are considered as mitigation is not required.

5.5 Water Resources

5.5.1 Sources of Effects

The potential sources of effects on water resources (i.e. groundwater and surface water levels and flows and, in turn, the availability of water to existing users) that are considered in this assessment are:

- Groundworks for features, such as foundations and basements, that intercept the groundwater table and present a barrier to, or interrupt, original baseline shallow groundwater flow paths;
- Compaction of the ground or laying low permeability material that changes properties of the ground/soil and that reduces infiltration potential, which could change recharge to subsurface aquifers;
- Changes to drainage due to lack of maintenance of existing or planned drainage features, which could affect flood risk; and
- Changes to existing abstractions, which could change groundwater levels and flow directions, and surface water levels and flow rates.

5.5.2 Incorporated Environmental Measures

The following measures relating to the use and management of water within the wellpad areas (and taking account of relevant water management guidance) are incorporated into the design of EOPS:

- All areas of new groundworks and ground compaction will take place within the footprint of the existing wellpads, which already incorporate bunds/drainage systems designed to deal with surface water flows/flooding;
- The water required for operations will not exceed the existing permitted abstraction rates from TKBV's existing water boreholes (Nakukulas 9 and and Ngamia East), as approved by the Water Resources Management Authority (WRMA) under existing permits to use water (WRMA Form 010 as per the Water Act 2002 and the Rules thereunder);
- Project wellpads are designed using a closed drains system that will collect discharge from storage infrastructure (e.g. tanks) during routine operations and maintenance;

- Project wellpads are designed to ensure contact[18] water will be managed separately to non-contact[19] water and will be collected, stored and disposed of; to prevent any unplanned discharges/releases to the environment;
- Any water brought to the surface during production and separated from the oil will be transferred to the evaporation ponds, where all water will evaporate leaving behind a solid residue;
- Wastewater from welfare facilities (e.g. toilets) will be discharged to a waste water treatment facility at the Amosing-1 pad or treatment packages at Ngamia-8. If waste water is collected in a septic tank system, the tanks will be properly designed, installed and maintained to prevent contamination of groundwater. Treated water that will be discharged to the environment will be done so at a rate that will not significantly change existing surface flows or flood risk; and
- Rain and storm water run-off from outside the wellpad areas that collects in perimeter ditches will have no contact with water that falls on, or is used within, the wellpads. The clean run-off water will be allowed to infiltrate to ground or be discharged downstream within the same catchment, without contact with any other sources of water.

5.5.3 Study Area Receptors

The water resources baseline study area for the Upstream component of EOPS comprised the catchment within which the Ngamia and Amosing wellpads are located (Section 1). This has been incorporated into the Upstream Physical Impact Assessment Regional Study Area.

The water resources baseline study area for the midstream component comprised a 100 m buffer to either side of the proposed transport route. This has been incorporated into the Midstream Impact Assessment Study Area.

Within these study areas, the receptors identified as part of the baseline work that are considered in this assessment are:

- Ephemeral surface water and shallow groundwater in the Kalabata River, which is located in a valley to the east of the Ngamia and Amosing wellpads;
- Water in the extensive dendritic network of luggas downstream of the Ngamia and Amosing wellpads;
- Groundwater in aquifers downgradient of the Ngamia and Amosing wellpads, comprising Plio-Holocene sediments and the Miocene Auwerwer volcanics;
- Local community water supplies, including springs, shallow hand dug wells in luggas and hand pumped wells;
- Shallow aquifers predominantly located along river valleys and the edge of the volcanic deposits from which water is abstracted from TKBV wells and used to supply production water and to augment community water supplies (WRMA-permitted abstraction boreholes are Ngamia East, East Lokichar, Nakukulas 9, Nakukulas 10, Kengomo 1, Kengomo 2, Nabolei, Ekunyuk and Ewoi);
- Existing water users – human and livestock; and
- Existing water users – non-human biota (i.e. ecological/aquatic habitats).

5.5.4 Considerations from Stakeholder Engagement

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

[18] Contact water is defined as rainfall, runoff or drainage water which has been in contact with any areas of the site which could be at risk of contamination.

[19] Non-contact water is defined as rainfall, runoff or drainage water which has not at any time been in contact with any areas of the site which could be at risk of contamination, and therefore can be discharged, under control, to the environment.

5.5.5 Key Guidelines and Standards

The standards and guidance that are relevant to the protection of the water environment to which the Project will be expected to conform are as follows:

- Kenyan policy and legislation, including:
  - The National Water Policy, 2012;
  - Environmental Management and Coordination Act (EMCA) (1999) and Amendments (2015);
  - The EMCA (Wetlands, River Banks, Lake Shores and Sea Shore Management Plan) Regulations (2009);
  - The Water Act, (2002) and subsidiary legislation contained including the Water Resources Management Rules (2007) – (Note that draft legislation, 'The Water Bill 2014', will repeal the 2002 Water Act): and
  - International guidelines and standards, including IFC EH&S Guidelines.

5.5.6 Effects Analysis

5.5.6.1 Methods

The impact assessment utilises the source-pathway-receptor concept. The 'source' is the potential source of effect to flows or availability of water. The 'receptor' is the feature/resource or user that has the potential to be affected. The 'pathway' is the viable route(s) by which the receptor could be affected by the source. The sources of potential effect that could affect each receptor (i.e. if there is a possible connection between the source of effect and the receptor) have been determined based on professional judgement. The assessment takes into account the incorporated environmental measures described in Section 5.5.2.

Climate change is not considered in relation to any aspects of this assessment 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.

5.5.6.2 Results

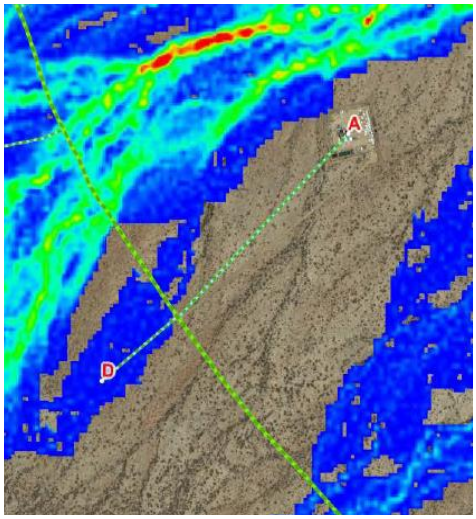
5.5.6.2.1 Assessment of Effects Associated with Groundworks and Installation

The EOPS wellpads are already constructed and are present as part of the baseline.

Recharge to subsurface aquifers can be affected by changes to the properties of the ground/soil through activities such as compaction or laying low permeability material, which can reduce infiltration potential within the footprint of the existing wellpads, which already include a high proportion of prepared surfaces (that are not included in this assessment).

Rainfall runoff generated within the wellpad footprint is currently managed within the wellpad footprint so there would be negligible change in runoff. The internal drainage system will be designed to manage any change in runoff, with non-contact water being allowed to infiltrate.

Given that any new groundworks (soil compaction and/or concreting) will be minor and localised to the existing wellpad areas, and recharge and runoff will have no more than a negligible change; potential effects on water resources (specifically shallow groundwater flow) compared to baseline conditions are considered to be negligible.



The wellpad locations have already been assessed for flood risk (Worley Parsons, 2015). Figures 5-3 and 5-4 show outputs from the preliminary flood model.

Figure 5-3 shows that Amosing-1 wellpad sits on ground unlikely to be affected by extreme flood event (1 in 100 year return period event) due to its location on high ground.

Figure 5-3: Preliminary Flood Modelling 1 in 100 year event, showing Amosing-1 wellpad (location A)

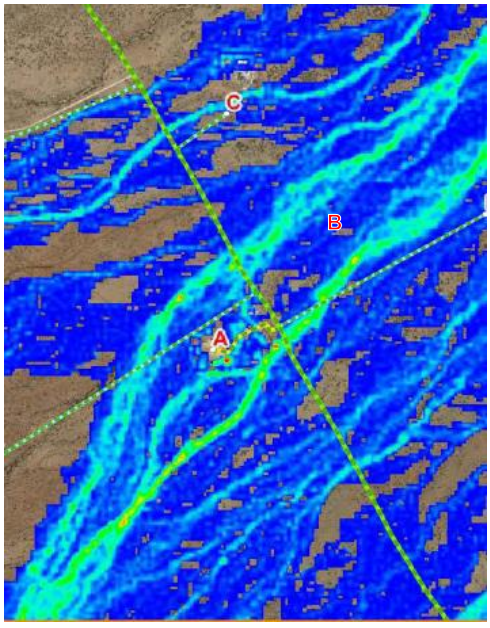


Figure 5-4 shows that Ngamia-3 (located just above the "C"), Ngamia-8 and Ngamia-6 are located (partially or fully) within the area affected by the extreme event flood, although water levels during such an extreme event would be less than 0.1 m. While encountering such an extreme event during the limited life of EOPS is unlikely; existing bunding and drainage surrounding the site should be maintained to ensure that flood waters can be conveyed around.

If the existing bund and drainage is maintained to convey and mange flood flows around the Site with no risk of entering the Site and increasing contact water, flood risk as a result of the proposed groundworks and installation are considered to be negligible.

No new bridges or other features within lugga or river channels are included within the Project description, so there are no changes to water quantity in luggas or river channels.

Figure 5-4: Preliminary Flood Modelling 1 in 100 year event, showing Ngamia wellpads (location A =Ngamia-6, just above location C = Ngamia-3, location B = Ngamia-8) (Source: Worley Parsons, 2015)

5.5.6.2.2 Assessment of Effects Associated with Abstractions

Water supplies for welfare needs during EOPS associated with staff at Kapese Camp will be sourced from within the current permitted volumes. The current volumes of water provided to the local population to augment its water supplies will not be reduced. Therefore, no additional abstraction of ground or surface water will take place and potential changes to water resources compared to baseline conditions are considered to be negligible.

The water cut that comes up with the oil during production comes from the reservoir formation at depth, not from the shallow aquifer that represents the main water resource potential in the area, from which the water for public supply is already abstracted from. Therefore, the removal of water with the oil from the reservoir formation will not affect water resources and the effect is considered to be negligible.

5.5.6.2.3 Assessment of Effects Associated with Discharges

Groundwater levels and flow directions, and surface water levels and flow rates can be affected by new discharges or changes to existing discharges. Water will be used on the wellpads (e.g. in dust suppression and maintenance/cleaning activities) and water will also be brought to the surface during oil production. Sewage will be generated at welfare facilities located at the wellpads.

A waste water treatment plant will be included at both Amosing-1 and Ngamia wellpads. Discharges of treated water will be to the environment (e.g. ground or surface or water) and will meet NEMA standards. Discharges from the treatment plant will be limited to rates and times that would not significantly affect surface water flows. Therefore, there will be no potential changes to water resources compared to baseline conditions and the effects are considered to be negligible.

5.5.7 Impact Classification

The impact assessment criteria used for this assessment are presented in Table 5-12.

Table 5-12: Impact Assessment Criteria for Water Resources

Magnitude	Geographic Extent	Duration	Frequency
Negligible immeasurable or no change to water flows, water levels, or the availability of a water resource or flood risk **Low** Some measureable change in water flows, water levels, or the availability of a water resource or flood risk **Medium** Partial change to a water resource. A sustained change in water levels or flows or flood risk. **High** Complete change to a water resource. E.g. Severe change to flow and levels in a watercourse, water levels in an aquifer or flood risk.	**Local** Upstream Biophysical Impact Assessment Local Study Area **Regional** Upstream Physical Impact Assessment Regional Study Area	**Short-term** Effect is reversible at end of groundworks/installation **Medium-term** Effect is reversible at end of operations **Long-term** Effect is reversible within a defined length of time or beyond closure **Permanent** Effect not reversible	**Infrequent** Effect occurs intermittently but not continuously over the assessment period **Frequent** Effect occurs repeatedly or continuously over the assessment period

5.5.7.1 Determination of Impact

Effects with an impact classification of 'negligible' can only ever have an impact consequence of negligible or minor when using the matrix presented in Section 1.4. As such, there are no 'moderate' or 'high' impact consequences that relate to the assessment of water resources and no additional mitigation is required to reduce the residual impact consequence further.

Although mitigation is not required to lower the impact consequence, additional details about the level of commitment to design and environmental management to keep the impact consequence relating to water resources as 'negligible' or 'minor' are presented below.

5.5.8 Mitigation

Beyond the incorporated environmental measures, no further mitigation is required to manage the impacts the Project may have on water quantity. TKBV will commit to the following management and monitoring measures to ensure impacts remain negligible:

- All perimeter wellpad drainage will be inspected and maintained, in order, to manage the predicted surface water flows, keep contact and non-contact water separate, and allow clean run-off water to infiltrate to ground or be discharged downstream within the same catchment;
- Any changes required to the existing drainage, in order, to manage either non-contact surface water or contact water will be designed to meet relevant guidelines and take into account the following requirements:
  - Drainage should be designed, constructed, and maintained for recurrence periods of at least a 25-year/24-hour event; and
  - Drainage should be designed to manage the movement and discharge of suspended solids to Kenyan effluent discharge guidelines, or to replicate the natural discharge regime.
- Any discharges from the waste water treatment plant will be managed so that they discharge to the environment at rates and times that are appropriate in relation to existing surface flows and do not increase flood risk; and
- Water abstraction rates and groundwater levels will continue to be monitored, in order, to comply with the permit and provide ongoing information on changes in the availability of water resources.

5.5.9 Assessment of Residual Impacts

No residual impacts are considered as mitigation is not required.

5.6 Water Quality

5.6.1 Sources of Effects

The potential sources of effects on water quality (i.e. groundwater and surface water quality or chemistry) that are considered in this assessment are as follows:

- Discharges of untreated sewage or dirty water from latrines or septic tanks;
- Discharge of untreated contact water from within the wellpad footprints;
- Increased suspended solids and sediment transport in surface water resulting from soil movement activities; and
- Well bore heating resulting in heat pollution.

In addition, the following hazards are linked to water quality but are considered in the Environmental Risks and Accidents section (Section 5.12):

- Oil leaks from tanks or pipes;
- Oil leaks during transfer between wells, tanks, pits or tanktainers;
- Leaks of diesel, oil or lubricants from equipment (including pumps, vehicles and generators); and
- Leaks from storage areas for potentially polluting materials (e.g. waste, batteries and chemicals).

5.6.2 Incorporated Environmental Measures

The following measures are incorporated into the design of EOPS:

- Any soil movement, storage or compaction will be undertaken in a manner that limits the creation of loose material or reduces erosion potential, thereby reducing the potential for the generation of increased suspended solids outside of the wellpad;
- Waste water from welfare facilities will be discharged to waste water treatment facilities at either Amosing-1 wellpad and treated water will only be released to the environment once it meets NEMA effluent quality standards;
- Project wellpads are designed using a closed drain system that will collect contact water from production and equipment areas (e.g. around the exploration wells, around tanks, in cellars and in waste segregation/storage areas). The closed system will direct contact water to dedicated collection areas from whence it will be discharged to the evaporation pond. The remaining solid waste will be disposed of off-site by the waste contractor;
- Non-contact and contact water within the pads will be kept separate to reduce the amount of waste water generated. Non-contact water will, where feasible, be returned to the environment via infiltration, or will be used for operational activities to reduce water demand;
- Storm water run-off from outside the wellpad areas that collects in perimeter ditches will have no contact with water that falls on, or is used within, the wellpads. This non-contact run-off will be allowed to infiltrate to ground or be discharged downstream within the same catchment, without contact with any other sources of water;
- All on-site hazardous materials storage will feature a secondary containment system, in line with IFC EH&S guidelines, to prevent the release of pollutants to the environment following failure of primary containment;
- All areas under and around where oil, fuel, chemicals or other hazardous materials are tranfered or stored (inlcuding generators) will be bunded and lined with a low permeability HDPE liner;
- Designated waste storage areas with low permeability linings will be incorporated in the design. All waste will be stored within the wellpads. All waste generated from EOPS activities will be collected in sealed receptacles by a NEMA approved waste transporter for disposal in accordance with the Kenyan waste management regulations of 2006;
- Water spray and dust suppressant will be used on unsealed service roads; and
- All equipment and infrastructure will be operated and maintained in line with manufacturer's recommendations.

5.6.3 Study Area and Receptors

The study area and receptors are the same for water quality as for water resources (quantity) (Section 5.5.3).

5.6.4 Considerations from Stakeholder Engagement

Key issues / questions relating to water quality raised during EOPS ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018 as well as appropriate responses is included in Volume II of the ESIA.

5.6.5 Key Guidelines and Standards

The standards and guidance that are relevant to the protection of the water environment to which the Project will be expected to conform are the same as for water resources (quantity) (Section 5.5.5), plus the following additional items specific to water quality:

- The EMCA (Water Quality) Regulations (2006); and
- The EMCA (Waste Management) Regulations (2006).

The Project standards for water quality are presented in a separate report (Golder, 2016a) and can be provided upon request.

5.6.6 Effects Analysis

5.6.6.1 Methods

The impact assessment utilises the source-pathway-receptor concept. The 'source' is the potential source of effect on water quality. The 'receptor' is the feature/resource that could be affected. The 'pathway' is the viable route(s) by which the receptor could be affected.

The sources of potential effect that could affect each receptor (i.e. if there is a possible connection between the source of effect and the receptor) have been determined based on professional experience. The assessment takes into account the incorporated environmental measures described in Section 5.6.2.

Potential changes in temperature over time within a distance of a well have been calculated using the methodology presented in Prats (1982). The calculations made assume a relatively simple well bore construction comprising a conductor pipe, an open annular area between the conductor and the steel casing (the steel casing itself is not considered for the purpose of the calculation), and a cement grout between the casing and the formation.

The baseline temperature of shallow groundwater is reported to be in the range of 30ºC to 35ºC (Volume II). Oil in the wellbores is heated to a temperature of approximately 70ºC in order to reduce the viscosity of the oil and facilitate pumping. Therefore, there is the potential to heat the ground adjacent to the wells, increasing groundwater temperatures as a consequence. The temperature in the formation has been calculated based on literature properties for the conductor, grout and formation. The change in groundwater temperature can cause an effect.

5.6.6.2 Results

5.6.6.2.1 Assessment of Effects Associated with Groundworks and Installation

The EOPS wellpads are already constructed and are present as part of the baseline. Existing facilities at the wellpads will be used, which limits the need for new groundworks. There will, however, be some new small areas of soil compaction and/or concreting required.

Compaction of soils, maintenance of the 2 m bund on the perimeter and dust suppression will reduce the potential for increased erosion and discharges of solids to surface water. Best practice methods for mixing and using concrete will reduce the potential for chemical pollution and the generation of solids that could be transported in surface water. Separation of contact and non-contact water will minimize contact water generation. Therefore, the potential for a decline in water quality will be reduced and the potential effects on water quality will be negligible.

5.6.6.2.2 Assessment of Effects Associated with Operation

The incorporated environmental measures presented in Section 5.6.2 mean that there are no planned direct discharges of untreated (including untreated sewage or dirty/contact water) liquids from operational activities within the wellpad areas to ground or surface water. All non-contact water will be contained and managed within the wellpad. Therefore, the potential changes to water quality are considered to be negligible.

The thermal effect of heated oil passing through the well as it runs through the shallow aquifers has been assessed.

The calculation indicates that after 100 days of heating, the temperature within approximately 5 m of the well could be elevated by approximately 8ºC above baseline. This increase in temperature reduces as distance from the well increases and is predicted to be approximately 2ºC above baseline at approximately 10 m from the well.

After one year of heating, the predicted temperatures rise to 16ºC above baseline at 5 m from the well, 7ºC above baseline at 10 m from the well and 2ºC above baseline at 50 m from the well.

After 2 years, the temperatures at 50 m are still predicted to be elevated to 2°C above baseline, therefore an equilibrium has been met. Figure 5-5 shows a graph of the predicted groundwater temperature at varying distances. The natural variability of shallow groundwater temperatures in the region is around 5°C and the oil wells are located towards the centre of each wellpad, which is typically about 200 m in diameter.

The predicted heat increase of 2°C at a distance of 50 m on the shallow groundwater aquifer is considered to be negligible, and this change is located within the footprint of the wellpad.

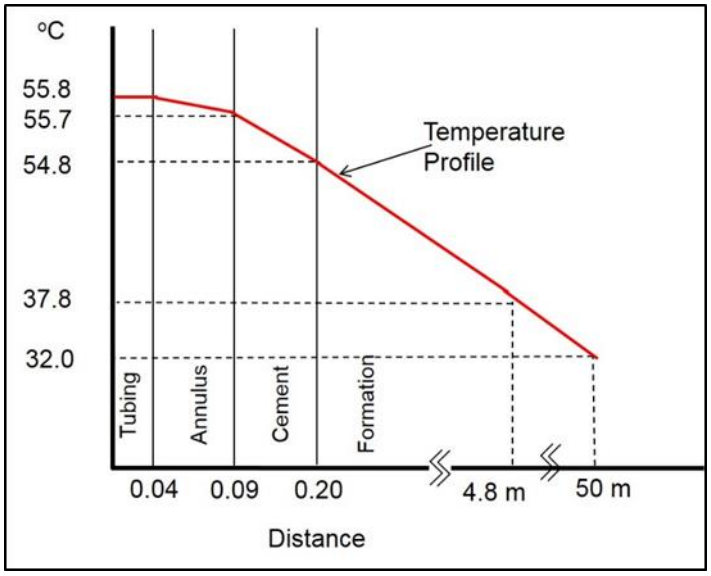


Figure 5-5: Graph of the predicted groundwater temperature at varying distance, at equilibrium (after 1 year)

The potential impacts associated with accidents (e.g. operational spills in the wellpad, or during transport) are considered in the environmental risks and accidents section (Section 5.12).

5.6.7 Impact Classification

The impact assessment criteria used for this assessment are presented in Table 5-13.

Table 5-13: Impact Assessment Criteria for Water Resources (Quantity)

Magnitude	Geographic Extent	Duration	Frequency
Negligible immeasurable or no change to water quality compared to baseline, **Low** Some measureable change in water quality, but concentrations do not exceed water quality standards where baseline quality was better than Project standards. **Medium** Partial change to a water quality. Concentrations exceed Project standards for parameters that are unlikely to affect human or ecological health. **High**	**Local** Upstream Biophysical Impact Assessment Local Study Area **Regional** Upstream Physical Impact Assessment	**Short-term** Effect is reversible at end of groundworks/installation **Medium-term** Effect is reversible at end of operations **Long-term** Effect is reversible within a defined	**Infrequent** Effect occurs intermittently but not continuously over the assessment period **Frequent** Effect occurs repeatedly or continuously over the

Magnitude	Geographic Extent	Duration	Frequency
Measureable change in water quality. Concentrations exceed Project standards for parameters which affect human or ecological health.	Regional Study Area	length of time or beyond closure **Permanent** Effect not reversible	assessment period

5.6.7.1 Determination of Impact

The effects analysis (taking into account incorporated environmental measures) indicates that all potential changes to water quality are predicted to result in effects with 'negligible' magnitude. As such, the geographical extent, duration and frequency of the effects will not change the outcome of the impact classification and all effects will result in a 'negligible' impact classification.

5.6.8 Mitigation

Beyond the incorporated environmental measures, no further mitigation is required to manage the impacts the Project may have on water quality. TKBV will commit to management and monitoring measure to ensure impacts remain negligible. These measures are:

- All construction work will follow the measures presented in the Environment Management Plan (EMP) in order to limit the potential for pollution of the water environment;
- The wellpad closed drainage systems that will collect discharge from equipment (e.g. tanks) will be inspected regularly and maintained to prevent discharges/releases to the environment and unplanned mixing of contact and non-contact water;
- All pipework and sumps will be inspected regularly and maintained to a standard that reduces the potential for unplanned discharges to the environment;
- The Water Management Plan will contain records of the as-built water drainage systems and permitted discharges, along with programmes for inspection, monitoring and maintenance;
- All perimeter wellpad drainage will be inspected and maintained in order to keep contact and non-contact water separate;
- Discharges to the water environment will be designed to meet the relevant environmental standards and will be monitored for compliance against relevant environmental standards. An action plan will be developed that will be followed if Project standards are exceeded; and
- Water quality monitoring in the Physical study area will continue and an action plan will be developed and followed that outlines Project water quality control levels and what to do if these control levels are exceeded.

5.6.9 Assessment of Residual Impacts

No residual impacts are considered as mitigation is not required.

5.7 Landscape and Visual

This section presents the findings of the landscape and visual effects analysis. There are two main components to the assessment:

- Landscape effects – these relate to permanent effects on the fabric, character and scenic quality of the landscape resulting from physical and perceptual changes (i.e. to landform, vegetation cover, or tranquillity of the landscape), whether or not the changes can be seen by the local population; and

- Visual effects - these relate to changes in existing views and the effects of those changes on the current population (for example, residents, workers or visitors).

Whilst landscape and visual effects analysis results are presented in this section, the impact assessment is covered in the social impact assessment and the cultural heritage impact assessment.

5.7.1 Sources of Effects

Potential elements of the Project identified as potential sources of change to the landscape and visual baseline include:

- Installation and operation of EOPS infrastructure, including the storage tanks, flares, welfare cabins and workshops. In particular, the bitutainers and flare stacks are considered to have the potential to cause visual effects as they are the tallest structures proposed;
- Site activity, including movement of people by vehicle or tanktainers; and
- Potential dust plumes and light pollution associated with EOPS operations.

5.7.2 Incorporated Environmental Measures

In relation to landscape and visual, the following environmental measures have been incorporated into the Project design and assumed present in this impact assessment:

- The maintenance of a 2 m bund around the perimeter of the wellpads primarily to reduce effects of noise, but also provides some reduction in visual effects.

5.7.3 Study Area and Receptors

The effects analysis for landscape and visual was undertaken within the Upstream Physical Impact Assessment Regional Study Area, as defined in Section 1, and includes areas up to a distance of 2 km from the wellpads.

Visual receptors are people that might see the proposed development. Visual receptors of the proposed facilities can be broadly categorised into two main groups, namely:

- People who live in the area (sensitive receptors); and
- People who move through the landscape (non-sensitive receptors).

The baseline identified two locations (N-1 and N-6) where homesteads had been located in September 2016 that could afford views of the Ngamia wellpads. However, during the visual survey work in May 2017 these homesteads were unoccupied. There were no receptors identified during the baseline surveys that are near Amosing-1 wellpad. Therefore, Amosing-1 has been scoped out of this assessment.

Even though it is recognised that pastoralist homesteads are, in many cases, temporary, short term and/or unoccupied, receptors N-1 and N-6 will be taken forward as indicative receptors for the purposes of this impact assessment.

5.7.4 Considerations from Stakeholder Engagement

Key issues / questions relating to landscape and visual raised during EOPS ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018 as well as appropriate responses is included in Volume II of the ESIA.

Prominent landscape and visual issues / questions raised during consultation meetings included concerns with the implications of project lighting on the local community.

5.7.5 Key Guidelines and Standards

There are no Kenyan standards or legislation that specifically relate to the assessment of landscape and visual effects. There are also no international guidelines or standards that relate specifically to the subject.

In the absence of Kenyan guidance, the proposed methodology employed for this assessment is based primarily on current UK guidance, namely Landscape Institute with the Institute of Environmental Management and Assessment (2013) *Guidelines for Landscape and Visual Impact Assessment*. Reference has also been made to United States Department of the Interior, Bureau of Land Management (1986) *Visual Resource Inventory*.

5.7.6 Effects Analysis

5.7.6.1 Methods

5.7.6.1.1 Landscape

Geographic Information System (GIS) software was utilised to compare the wellpad footprint against the landscape character area (LCA) plan, specifically for LCA 1, which is presented in Drawing 5.7-1. However, as there is no change to the footprint from the exploration wellpad footprint, which was previously permitted, the landscape assessment has been scoped out of the effects and impact analysis.

5.7.6.1.2 Visual

The visual effects were considered at those receptors described in Section 5.7.3 and an assessment of the degree of change compared to the existing baseline views was made. Visual effects were assessed by:

- Updating the preliminary ZTV mapping and analysis completed at baseline stage to predict the visibility of the main wellpad components. The updated ZTV is shown in Drawing 5.7-2; and
- Generating simplistic computer-generated visualisations to illustrate the size and scale of the wellpad development, as it would be visible from indicative receptors identified above (N-1 and N-6).

The effects on receptors were assessed in relation to change to the composition and quality of the view, the prominence of the development and the distance between the viewer and the development.

The overall prominence of the proposed development is measured in terms of the extent or proportion of the indicative receptor's field of vision that is occupied by the Project components. There is usually a strong correlation between prominence and distance.

The overall effects on view composition, prominence and distance are calculated using the criteria in Table 5-14. The magnitude of effect is based on a qualitative assessment, undertaken using professional judgement, and does not necessarily reflect the potential opinions or perceptions of individuals living, working or travelling through the area (either residential or transient receptors).

Table 5-14: Criteria for determining the magnitude of visual effect

High	Moderate	Low	Negligible
Major change to composition and quality of the view AND/OR The development is dominant and the distance between the viewer and the development is Less than 2 km	Moderate change to composition and quality of the view AND/OR The development is prominent and the distance between the viewer and the development is 2 to 5 km	Low change to composition and quality of the view AND/OR The development is discernible and the distance between the viewer and the development is 5 to 10 km	The development is not visible or barely discernible AND/OR Distance between the viewer and the development is greater than 10 km

5.7.6.2 Results

As long as lighting effects are managed on site (see Section 5.7.8), the indicative receptor locations previously identified were found to be subject to a negligible visual effect.

The tree and scrubland vegetation create a natural barrier between the majority of receptors and the wellpad facilities. Photo Locations N-1 and N-6 were visible from the Ngamia wellpads. Both locations were long vacated and abandoned.

5.7.7 Impact Assessment Classification

All potential landscape character assessment or visual assessments were identified as negligible. The proximity of luggas, dense scrubland thicket, riparian vegetation and vegetation with the berms will confine reduced landscape character to the area adjacent to existing wellpads. Similarly, the tree and scrubland vegetation create a natural barrier between the closest receptor and the wellpad facilities. The results of the effects analysis are incorporated into the cultural heritage and social impact assessments, as necessary.

5.7.8 Mitigation

Beyond the incorporated environmental measures, no further mitigation is required to manage the visual effects the Project may have. However, the following commitments will be made in line with best practice:

- Typical vehicle/plant speed should be controlled at national or project speed limits to reduce dust effects; and
- Directional lighting should be used to minimise light pollution. Lighting should not be directed outwards from the wellpads to reduce disturbance and lighting should be limited where possible on the taller infrastructure within the wellpad, e.g. storage tanks and flare.

5.7.9 Assessment of Residual Impacts

No residual impacts are considered as mitigation is not required.

5.8 Biodiversity

The Project aims to ensure that biodiversity and ecosystem functions are not degraded or lost from the landscape as a result of the Project's development, operation, and decommissioning. Key to this commitment is securing the long-term survival of species and habitats that occur in the Project's area of influence. In essence, these species and habitats should have the same chances of long-term survival with, or without, the Project.

5.8.1 Sources of Effects

The Project has the potential to cause effects on biodiversity during all its phases. The Project description (Section 4.0) has been reviewed and key activities and sources of effects relevant to biodiversity are presented below.

Direct effects on habitats and species:

- Increased elevated perching and nesting points for raptors on oil storage tanks and flare stacks (operation);
- Injury/mortality of individuals and/or local populations of ground-dwelling fauna from increased vehicle traffic in Project area (operation);
- Deposition of dust on vegetation from increased traffic and project activities (groundworks, operation);
- Release and deposition of NO_x, (refer to Chapter 5.3 Air Quality) (operation);
- Sensory disturbance (alteration of normal behaviour, reduction of suitable and available habitat) of species as a result of:
  - The introduction of artificial lighting around the Project site (groundworks and operation); and
  - Increased artificial noise and vibration levels as a result of project activities (e.g., traffic) (groundworks and operation);
- Injury/mortality of individuals and/or local populations of birds, flying mammals and invertebrates due to the presence of flares (operation); and
- Waste generated from the Project activities, including solids and liquids (groundworks, operation and decommissioning).

Indirect effects resulting from the Project site preparation and operation activities including:

- Population influx to nearby settlements during operation, and subsequent increases to natural resource harvest and grazing/browsing pressure on vegetation communities and habitats (operation); and
- Creation of artificial water bodies through the development of process water ponds (operation).

Direct effects resulting from the transport of oil from the Project site to Mombasa including:

- Collision risk to fauna species of conservation concern presented by vehicles passing through protected areas, particularly Tsavo National Park (operation).

Potential sources of effects have been discussed with other technical discipline lead authors to ensure that a coherent and holistic approach has been applied. As such, the biodiversity impact assessment has used results from effects analysis from the following Project disciplines:

- Traffic (Section 5.1);
- Soils, Terrain, Geology and Seismicity (Section 5.2);
- Air Quality (Section 5.3);
- Noise and Vibration (Section 5.4);
- Water Resources (Quantity) (Section 5.5);
- Water Quality (Section 5.6); and
- Social (Section 5.10).

5.8.2 Incorporated Environmental Measures

Incorporated environmental measures to manage traffic, soils, air quality, noise and vibration, water resources, water quality, social effects, and hazard and risk, are considered in the relevant chapters. No environmental measures, specifically pertaining to the management of biodiversity, have been incorporated into the engineering design parameters. However, the measures included in the Project design for other aspects are considered to be useful for the management of potential effects to biodiversity. These include:

- Speed limits of TKBV related traffic will be maintained and enforced;
- Process water will be stored in purpose-built facilities within the well pad areas;
- Internal roads will be maintained so that natural drainage patterns and catchments are changed as little as possible;
- Fuel and chemical storage and usage areas will be demarcated, sealed and bunded, with storm water directed around these areas;
- All fuel or storage tanks will be stored on hard stand to prevent any spills from infiltrating to the underlying soil; and
- Grease and oil traps will be installed at refuelling facilities, workshops and fuel storage depots. Drip trays will be used in the plant and workshops.

In addition, TKBV are developing the invasive species management procedures to:

- Prevent the spread of invasive species and pathogens that may already be present in the surrounding environment;
- Implement prompt and effective rehabilitation and revegetation (with desirable plant species) where applicable;
- Implement of ongoing monitoring in Project-occupied land throughout the life of the Project to ensure early detection of new areas of weed and pathogen spread, identify previously unrecorded invasive species, pest and pathogens, and assess the efficacy of prescribed control measures; and
- Provision of all construction contractors and other subcontractors with a copy of the Tullow invasive species management procedure and secure their commitment to adhere to the measures outlined therein.

5.8.3 Study Area and Receptors

The Study Area for biodiversity within which the baseline studies focused, is defined in Section 1. This local study area was appropriate relative to the scale and nature of the Project Upstream component's potential effects on biodiversity.

The Biophysical Local Impact Assessment Study Area (LSA) (Drawing 5.8-3), also defined in Section 1, incorporates the areas where it is considered that effects from project sources could be detectable for biodiversity receptors. This LSA was defined to account for potential direct and indirect species and habitat receptor effects, such as changes in habitat quality caused by sensory disturbance (light, noise, vibration), air emissions and dust.

The Upstream Regional Impact Assessment Study Area (RSA) was defined as a basis for assessing potential broader indirect, induced effects species and habitat receptors, arising from Upstream components. The Upstream RSA includes the Upstream Study Area, and the areas within the wider catchment boundaries formed by the Turkwell, Kalabata and Kerio Rivers (Drawing 5.8-4).

Midstream Regional Study Area (RSA) includes the road transport route and a 100 m buffer (Drawing 5.8-5). In areas where the transport route traverses through, or is 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 (Drawing 5.8-5). This was undertaken to capture all potential indirect, induced effects potentially arising from the transport of oil.

Habitat Receptors

For the purposes of this assessment, habitat receptors, or ecosystems of concern (Annex 3), were identified according to the following attributes:

- **Internationally recognised sites** of biodiversity importance, such as IBAs, 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 luggas being crossed by the proposed transport routes, or landscape features with importance in maintaining key ecological processes and functions needed to support and maintain important biodiversity attributes.

For the Upstream Regional Impact Assessment Study Area, internationally-recognised sites, protected areas and important habitats identified as habitat receptors are shown on Drawing 5.8-2, and include:

- Northern *Acacia-Commiphora* bushlands and thickets associated with the WWF Ecoregion; and
- Riparian forest, which aligns with the riverine wooded vegetation of van Breugel *et al.* (2015).

For the Regional Midstream Impact Assessment Study Area (Drawing 5.8-5), effects considered on biodiversity were restricted to potential effects associated with increased collision-risk for species. In particular the collision risk in internationally recognised sites, protected areas and important habitats, which are known habitats for faunal species of conservation concern. These include Kinangop Grasslands IBA, Kikuyu Escarpment Forest IBA and Tsavo West National Park and IBA.

Species Receptors

For the purposes of this impact assessment, species of conservation concern (Section 2.9 in Annex 3) were considered as species receptors. In the case of fauna, species were chosen to represent the range of possible groups present in the RSA, and for which possible interaction with Project components could occur. Where receptors were identified that were functionally the same in terms of Project effects, such as nocturnal bat species that may prey on insects attracted to lights, these were grouped together into one functional receptor group. In the case of raptors, threatened species and/or species reliant on perch-hunting strategies were considered individually for impact assessment. These receptors and receptor groups were then taken forward for the impact assessment. A detailed table of receptors used for impact assessment is presented in Annex 4. No flora species of conservation concern occur within the area directly affected by EOPS. Therefore, no flora species receptors were identified.

5.8.4 Considerations from Stakeholder Engagement

Key issues / questions relating to biodiversity raised during EOPS ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018 as well as appropriate responses is included in Volume II of the ESIA.

5.8.5 Key Guidelines and Standards

The biodiversity impact assessment has been completed in accordance with Kenyan legislation, and also to comply with international guidance and best practice, performance standards and convention obligations. The key legislation and standards pertinent to the biodiversity impact assessment are outlined in Section 1.2.

5.8.6 Effects Analysis

This section presents the approach to the identification and assessment of the effects to biodiversity receptors potentially arising from the Project's activities in the Upstream and Midstream Study Areas.

5.8.6.1 Methods

Effects were assessed for Project activities that are likely to result in a measurable environmental change, which could contribute to adverse effects to receptors, relative to baseline or guideline values. Changes in condition were defined as changes to the size or function of a population, habitat, or ecosystem from baseline condition. Methods to estimate change in condition included models, calculations, and qualitative analyses based on available information from baseline reports, scientific literature, and expert consultation.

The following provides some of the criteria used to evaluate the effects:

- Noise is considered to affect species presence and distribution when ambient levels exceeded 45 dBA. This threshold is a general approximation for disturbance of wildlife based upon the threshold for night time disturbance of people defined by the World Bank Group (1999);
- For emissions of NO_x, the vegetation guideline value over which effects are predicted is 30 µg/m^3, averaged over a year (after WHO, 2000). This is the guidance value used in this assessment. Concentrations of NO_2 may have a beneficial effect (that is, increasing growth) at low concentrations in the range of 20-90 µg/m^3 (Hutchinson and Meema, 1987; WHO, 2000, Adam *et. al*., 2008). Above 90 µg/m^3, NO_2 is expected to have a negative effect on vegetation (Amundson and Maclean, 1982, in Adam *et al.,* 2008);
- Dust deposition on vegetation can reduce the quality of habitats or degrade it to a point where it is no longer effective. A clear guideline value to protect vegetation from dust is not available. The guideline value for the loss of human amenity value is based on a threshold of 350 mg/m^2/day. The average daily baseline dust deposition rate at Amosing and Ngamia ranges from 6.6 to 93.1 mg/m^2/day; with the average of the two monitoring locations being 69.5 mg/m^2/day (refer to Section 2.4 Air Quality). The Project's air quality standard is 200 mg/m^2/day;
- Light disturbances will result from most Project infrastructure because facilities, wellpads and other infrastructure must be lit at night to ensure minimum health and safety standards. Interactions between nocturnal receptors (in particular terrestrial invertebrates, birds and bats) and light disturbances are predicted to be most important at the perimeter of each Project component, or within the Project footprint, where light placement may be adjacent to receptor habitat. Lighting can decrease habitat use by nocturnal species adapted to night-time conditions or lead to increased mortality of individuals that may be attracted to lights. For various reviews and examples, see Jetz *et al.* (2003), Bruce-White and Shardlow (2011), and Gleeson and Gleeson (2012);
- Odours can attract certain animals, or they can elicit avoidance behaviours because the odours are associated with human presence. Odours will originate from human presence, petrochemicals and other chemicals, food, and garbage and waste management. Odours are predicted to have low consequences during construction, operations and closure phases;
- The introduction of exotic and invasive species, and/or the spread of established populations of such species;

- Population influx and human pressure. The Project may contribute to the ongoing influx of people into the wider area seeking opportunities; and
- Hazards, such as oil and chemical spills and accidents, have the potential to reduce habitat quality and quantity. However, oil and chemical handling, storage, and spill response are expected to be part of TKBV's standard policies, Environmental Management Plans, and emergency procedures. Furthermore, given the high wax content of the oil, if a leak did occur, it is doubtful that the oil would flow very far. The potential effects of environmental risks and accidents are assessed in Section 5.12.

5.8.6.1.1 Habitat Receptors

Indicators used to assess effects to habitat receptors were changes in:

- Extent;
- Condition;
- Regional representativeness; and
- Landscape connectivity.

Assessment of Effects

Direct (within, and immediately adjacent to the Project footprint) and other non-footprint direct effects (for example, sensory disturbance and edge effects) were superimposed on the habitat mapping in GIS to evaluate the magnitude and extent of effects on habitats.

Loss of habitat due to direct disturbance associated with the Project was quantified by overlaying the current, baseline extent of the habitat with the Project footprint. Additional, indirect effects to habitat receptors were estimated by applying the results of other technical discipline impact analysis to indicate possible changes in habitat quantity and/or quality caused by edge effects, fragmentation, sensory disturbance (light, noise, vibration), and air emissions and dust.

Results for the traffic (Section 5.1), soils, terrain, geology and seismicity (Section 5.2), air quality (Section 5.3), noise and vibration (Section 5.4), water resources (quantity) (Section 5.5), water quality (Section 5.6) and social (Section 5.10) assessments were used in the evaluation of effects on habitats.

No land take will be associated with the proposed transport of oil through the Midstream Study Area; therefore, no direct effects, in terms of habitat loss, are anticipated.

Potential changes in collision risk for species, as a result of increased traffic generated by oil transport, were evaluated based on the results of the traffic assessment (Section 5.1).

5.8.6.1.2 Species Receptors

Indicators used to assess effects to species receptors were:

- Survival and the subsequent ability to reproduce;
- Habitat connectivity;
- Species mobility; and
- Prevalence of changes in habitat quality and quantity from baseline.

The analysis focuses on quantifying potential Project effects relative to baseline conditions.

Potential changes in survival and reproduction were assessed qualitatively by considering potential disturbances (that is, traffic, light, noise, vibration, flares). These disturbances were considered with relation to

known or inferred effects to the survival and reproduction of species for which data on these types of effects are available.

Changes in habitat connectivity were assessed by identifying potential barriers, including sensory barriers, to movement and species mobility.

Species-specific habitat loss was quantified by overlaying known species distribution data with the proposed Project footprint. At the species level, the concept of a self-sustaining[20], ecologically effective population was used as a benchmark when describing the magnitude of an effect.

5.8.6.2 Results

This section characterises and predicts the potential effects on species and habitat receptors, taking into account incorporated environmental measures described in Section 5.8.2, during the groundworks and installation, operation and decommissioning phases.

5.8.6.2.1 Groundworks and Decommissioning

The anticipated effects and associated impacts are expected to be similar for the groundworks and decommissioning phases. Therefore, for the intents of this impact assessment, the impact associated with these two phases have been considered together.

Habitat Loss and Fragmentation

- No direct loss of habitat will occur in the Project footprint of the oil production wells and processing. All production wells and well pads are already existing.
- There is potential for the introduction/spread of invasive plant species by the vehicles being used for groundworks and decommissioning.
- The compaction groundwork on the Project roads between wellpads and Kapese camp may present a barrier to movement and/or sensory disturbance for species receptors in the vicinity of the road upgrade. No additional barriers to movement for faunal species receptors are predicted – well pads are already existing and have been fenced.

Sensory disturbance – Noise, lighting, vibration

- The activities associated with the groundworks and installation are predicted to have a negligible effect on noise levels (Section 5.4); therefore, the potential sensory disturbances to fauna receptors, arising from noise, are predicted to be negligible during groundworks and installation.
- No additional site lighting during groundworks and installation is proposed. Therefore, no additional effects, in terms of sensory disturbance due to lighting, over and above those already experienced, are anticipated.
- The compaction groundwork on the Project roads will generate additional sources of noise and dust; potentially creating sensory disturbances to species receptors in the vicinity of the roads.

[20] A self-sustaining population is one that will be maintained into the future with a low risk of extirpation (local extinction). Long-term population persistence is the outcome of maintaining viable populations and maintaining or achieving self-sustaining populations is frequently applied as a conservation target by conservation biologists and resource managers (Fahrig 2001; Nicholson *et al*. 2006; Ruggiero *et al*. 1994; With and Crist 1995). By definition, self-sustaining populations are not populations at the brink of extirpation; they are healthy, robust populations capable of withstanding environmental change and accommodating random population processes (Fahrig 2001).

Water quality and quantity

- The potential changes in the quantity and quality of surface and groundwater flows are considered negligible (Section 5.5), and, hence, no subsequent effects on groundwater-dependent habitat receptors, such as riparian forest, are predicted.

5.8.6.2.2 Operation

Predicted effects on biodiversity during the operational phase of the Project relate to changes in habitat integrity as a result of disturbance and/or changes to behaviour of fauna species receptors as a result of long-term noise and lighting, changes in air quality in the vicinity of wellpads, and increased risk of injury/mortality to individuals/populations as a result of collisions with vehicles in the Upstream and Midstream Study Areas, and flares in the Upstream Study Area.

Habitat Loss and Fragmentation

- All production well pads are already existing and have been fenced, therefore, no additional barriers to movement for faunal species will be presented by the well pads during operation.
- Increased traffic levels generated by 28 tanktainer movements per day, may restrict some movement for certain species receptors.

Sensory disturbance – Noise, lighting, vibration

- Noise emissions associated with the operations phase have the potential to increase baseline noise levels at receptors in the vicinity of the well pads. Noise modelling suggests that daytime and night-time noise level exceedances associated with the project activities in the Upstream Study Area will be largely restricted to the immediate footprint of the well pads, and will not extend significantly beyond the fence line (Section 5.4).
- Negligible sensory disturbance due to visual impact are anticipated during the day. However, increased sensory disturbances to nocturnal species receptors could occur as a result of the long-term lighting regime, and flaring activities.
- Increased vehicle movements, transporting produced oil between the well pads and the EPF, could affect species and habitat receptors within the Upstream Study Area.
- Increased traffic on the A1, B2, A104 and A109 routes in the Midstream Study Area, as a result of the Project, will consist of 28 tanktainer movements a day, which is considered to be a negligible increase compared to existing traffic volumes (Annex 1). Therefore, any increases in sensory disturbances to species arising from an additional traffic during the Project's operation are likely to be negligible in Kinangop Grasslands IBA, Kikuyu Escarpment Forest IBA and Tsavo West National Park IBA.

Water resources and quality

- No additional groundwater abstraction, to that already permitted, will occur during operation. Therefore, potential changes to water resources compared to baseline conditions are considered to be negligible (Section 5.5), and no significant effects on habitat or species receptors are predicted.
- The operation of produced-water evaporation ponds within the well-pads may act as an attractant to wildlife during the life of the project. The natural presence of surface water in the Upstream Study Area is not common, and there is a likelihood that birds (in particular), invertebrates and small to medium-sized mammals may be attracted to the produced-water evaporation ponds as a water source. The produced water that will go to the evaporation ponds is expected to include 200 mg/l solids, and ≤30 ppm oil-in-water content. There is a potential for deleterious effects to species consuming or bathing in that water.

Air emissions and dust

- Nitrogen oxide (NO_x) is predicted to exceed project standards (one-hour mean = 200 µg/m^3) within the direct well pad footprints only, dropping to levels below the project standard outside of these areas (Section 5.3). Elevated NO_x levels will persist beyond the footprint, and within the Upstream Study Area around Amosing, in particular. However, these are predicted to be below the Project standard of 30 µg/m^3.
- Dust generated by vehicular traffic on the internal connector roads within the Upstream Study Area, are expected to be negligible assuming incorporated measures are in place.

Injury/mortality of species receptors

- Increased traffic on the C46 and internal connector roads in the Upstream Study Area could result in increased collision risk for species receptors. In addition, increases in road kill in the Upstream Study Area could attract scavenging species receptors, such as White-backed Vulture (*Gyps africanus*), Lappet-faced Vulture (*Torgos tracheliotus*) and Striped Hyena (*Hyaena hyaena*), which may then themselves be subject to increased collision risk.
- Increased traffic on the A1, B2, A104 and A109 routes in the Midstream Study Area, as a result of the Project, will consist of 28 tanktainer movements a day. This increased traffic could directly increase collision risk for species associated with Kinangop Grasslands IBA, Kikuyu Escarpment Forest IBA and Tsavo West National Park and IBA. However, impacts associated with the increased traffic generated by the tanktainers, in the context of the existing and predicted future traffic levels, is negligible (Section 5.1).
- Produced gas, excess to that which can be used in power generation, will be dispelled via a flare system. During flare start-up, the flare presents a risk of injury/mortality to perching and flying species receptors (that is, raptors and bats) within the Upstream LSA. The flare also presents a risk of injury/mortality to flying invertebrates, which may be attracted to the emitted light and heat. This could affect invertebrate species receptors, and indirectly may affect insectivorous mammal and bird receptors through reductions in available prey resources in the local area.

5.8.7 Impact Classification

The assessment of impacts takes the results of the effects analysis and applies the impact assessment methodology described in Section 1.4 Impact Assessment Methodology.

5.8.7.1 Magnitude of the Effect

Table 5-15 details the magnitude of effect criteria used for the quantitative assessment of potential impacts on biodiversity.

Table 5-15: Impact assessment parameters for biodiversity

Magnitude	Geographic Extent	Duration	Frequency
Negligible Individuals will not be affected; disturbance to habitat integrity (area, quality, composition, configuration, processes, and functions) will be absent, or transient. **Low** Impacts could affect individuals; that is, in the case of fauna receptors, individuals may become disturbed, but not injured, with some minor disturbance to habitat receptor integrity (area, quality, composition, configuration, processes, and functions). For flora receptors, individual plants may be destroyed. **Moderate** Impacts would affect individuals detrimentally, with injury or death of individuals. The local population may be affected through the loss of individuals, but not the local population and/or species as a whole. The integrity of habitat receptor's integrity may be affected detrimentally. **High** Impacts will affect the viability of the local habitat or local population of a receptor and/or the species as a whole.	**Local** Upstream Study Area Midstream Study Area **Regional** Regional study area	**Short-term** Effect is reversible at end of construction/closure **Medium-term** Effect is reversible at end of operations **Long-term** Effect is reversible within a defined length of time or beyond closure **Permanent** Effect not reversible	**Infrequent** Effect occurs intermittently, but not continuously, over the assessment period **Frequent** Effect occurs repeatedly or continuously over the assessment period

5.8.7.2 Sensitivity and/or Importance of Receptors

The sensitivity and/or importance of species and habitat receptors and the sensitivity/importance rating for each receptor group is presented in Annex 4. For the purposes of this assessment, Vultures are considered to have a very High sensitivity/importance because of their IUCN threat status. The sensitivity of raptors considers their IUCN threat status and if they rely on elevated perches for hunting; as such, the sensitivity for raptors is presented individually for species of concern.

5.8.7.3 Determination of Impact

Using the methodology presented in Section 1, the impacts and consequences are determined. The assessment includes the incorporated environmental measure and the mitigation applied by specific technical disciplines, where these are appropriate to biodiversity, that is, traffic, water, air quality, noise and vibration.

Table 5-16 presents the classification of each impact where overall consequence is predicted to be moderate or higher. Annex 4 presents the route to the classification of the impacts, presenting the magnitude, geographic extent, duration and frequency for all impacts.

The ecological implications of an assessed effect are gauged at the regional level for species and habitat receptors, which is a more ecologically relevant scale. As noted above, regional-level effect is determined by combining magnitude, geographic extent and duration of the effect and may be:

- Negligible: No detectable effect to a receptor;
- Low: Detectable effect, but within known or inferred ability for a receptor to absorb, without loss to structural integrity (e.g., self-sustaining population), or ecological function at the regional scale;
- Moderate: effect near limits or slightly beyond known or inferred ability for a receptor to absorb, without loss to structural integrity (e.g., self-sustaining population), or ecological function at the regional scale; or
- High: effect well beyond known or inferred ability for a receptor to absorb, without loss to structural integrity (e.g., self-sustaining population), or ecological function at the regional scale.

Finally, the regional-level effect is combined with sensitivity, using the matrix presented in Volume II to derive overall consequence. For biodiversity, the four consequence levels are defined as:

- Negligible: no measurable adverse impacts to receptor from the Project;
- Minor: impact level acceptable to viability of receptor; mitigation is adequate and achievable, but monitoring may be necessary;
- Moderate: impact level requires follow up action, including the possibility of offsetting to achieve no-net-loss (NNL); monitoring necessary to evaluate continued viability or integrity of receptor and provide opportunities for adaptive management; and
- Major: impact level requires higher-level mitigation (such as, offsetting) to achieve NNL; implies proximity to, and risk of exceedance of, biodiversity standards; monitoring necessary to evaluate continued viability of receptor and provide opportunities for adaptive management.

Habitat Receptors

Table 5-16 presents the overall impact consequence rating for habitat receptors in the Upstream and Midstream Study Areas.

Impacts to Tsavo National Park, Kinangop Grasslands IBA, and Kikuyu Escarpment Forest IBA in the Midstream Study Area could be moderate. Increased traffic in the Midstream Study Area could present collision risk to species in these protected areas. The effects could occur at the local scale. The duration would be medium-term. These three receptors have a very high sensitivity because they are internationally recognised protected areas. Therefore, the impacts are considered minor.

Species Receptors

Table 5-16 presents the overall impact consequence rating for species receptors in the Upstream and Midstream Study Areas.

Impacts to ground-foraging or carrion-feeding species such as Greater Spotted Eagle (*Clanga clanga*), Bateleur (*Terathopius ecaudatus*) and vultures in the Upstream Study Area could be minor to moderate. Increased traffic risk in the Upstream Study Area could present a collision risk if individuals are resting on the roadway or scavenging off roadkill. The effects could occur at the regional scale. The duration would be medium-term. These receptors have a medium (Bateleur) and very high (Greater Spotted Eagle, vultures) sensitivity because

they are internationally recognised protected species. Therefore, the impacts are considered minor for the Bateleur, and moderate for the Greater Spotted Eagle and the vultures.

Similarly, impacts to Steppe Eagles, Pallid Harriers, Bateleurs, Eastern Imperial Eagles, Greater Spotted Eagles, Saker Falcons, Sooty Falcons, Lesser Kestrels, Martial Eagles, and Crowned Eagles could result in possible mortality from the gas flares if an appropriate start-up protocol is not in place. That is, individuals could be attracted to these flares for reasons including using the flare stacks as elevated perching posts during hunting; or attracted to the potentially increased numbers of flying insect prey (attracted by the flares), or through curiosity. The effects would occur at the local scale. The duration would be medium term. The sensitivity of the individual raptor species receptors varies between Medium and Very High according to conservation status (most are internationally-recognised protected species) and individual species's reliance on using perch structures for hunting strategies. Therefore, the predicted impact consequence ranges between moderate and major.

Impacts to those identified raptors and vultures may arise from possible deleterious effects of drinking produced water from the evaporation ponds. Consumption and/or bathing in this water could pose negative health effects, which could result in mortality of individuals. The effects could occur at the local scale. The duration would be medium-term. In this context, these receptors have very high sensitivity because they are internationally-recognised protected species. Therefore, the impacts are considered moderate.

Table 5-16: Impact consequence where overall consequence is moderate or higher, prior to mitigation

Receptor	Project phase	Key source of impact	Impact consequence
Greater Spotted Eagle	Construction and closure	Vehicle movements presenting collision risk	Moderate
Vultures			Moderate
Large mammals	Operation	Site lighting at night, affecting faunal species movement patterns and foraging habits.	Moderate
Volent small mammals (incl. bats)			Moderate
Vultures	Operation	Increased traffic risk in Upstream Study Area presenting collision risk to species receptors	Moderate
Greater Spotted Eagle			Moderate
Steppe Eagle	Operation	Gas flares – attraction to light/heat, change in population dynamics, possible mortality	Major

Receptor	Project phase	Key source of impact	Impact consequence
Eastern Imperial Eagle Greater Spotted Eagle Saker Falcon Martial Eagle	Operation	Gas flares – use of stacks as perches for hunting, resulting in injury/ mortality when flares are started up	Major
Crowned Eagle Sooty Falcon Lesser Kestrel			Moderate
Raptors (as a group)	Operation	Produced water ponds attract species receptors; consumption and/or bathing in water has negative health effects	Moderate
Vultures			Moderate

5.8.8 Mitigation

The following section describes, at a high level, the mitigation measures that will be required for biodiversity, ecology and protected areas. These mitigation measures follow the mitigation hierarchy (sensu, BBOP 2012), and will be detailed in the Biodiversity Action Plan.

5.8.8.1 Avoidance

Avoidance measures include:

- The reuse of existing or remnant access roads, where possible; and
- Avoid lighting on the access roads.

5.8.8.2 Minimisation

Minimisation measures are measures taken to reduce the duration, intensity and/or extent of effects to species and habitats receptors that cannot be completely avoided, as far as is practically feasible. Minimisation measures include:

- Habitat Loss and Fragmentation:
  - Limit areas of surface disturbance, including the extent of any groundworks on project roads (e.g. cutting of drains and grading, resulting in additional land-take and erosion development), to avoid loss of habitat; and
  - TKBV will commit to exert influence, where possible, to ensure that upgrade works to the C46 road, completed by a third-party, do not present a barrier to movement of faunal species.
- Introduction/Spread of invasive species:
  - Prompt and effective rehabilitation and revegetation (with desirable plant species) of disturbed areas;
  - Minimisation of unnecessary disturbance of natural areas;

  - Implementation of ongoing monitoring in Project-occupied lands throughout the life of the Project to ensure early detection of new areas of weed and pathogen spread, identify previously unrecorded invasive species, pest and pathogens, and assess the efficacy of prescribed control measures; and
  - Provision of all construction contractors and other subcontractors with a copy of the Tullow invasive species management procedure and secure their commitment to adhere to the measures outlined therein.
- Increased pressure on species (loss/mortality) and habitats (degradation) due to easier vehicular access via upgraded road network for transport of harvested natural resources to market, potentially stimulating demand:
  - TKBV commit to a hiring policy in line with the mitigations set out in Section 5.10.8;
  - TKBV commit to a disclosure and stakeholder engagement process to describe the limited job opportunities on EOPS, as set out in Section 5.10.8;
  - No hunting or collection of timber, flora and fauna by staff and/or contractors to be permitted;
  - Mandatory environmental onboarding for all workers and contractors that highlights conservation issues and species-specific sensitivities; and
  - All workers (excluding those already living in the Upstream area) should be accommodated to prevent development of unplanned settlements in the vicinity of the fields, which may attract additional opportunity seekers.
- Sensory disturbance – noise generated during groundworks at well pads and roads:
  - Limit hours to daylight during groundworks to avoid nocturnal species receptor activity periods (that is, nocturnal species); and
  - Minimise higher frequency noises, such as reverse beepers on vehicles – these can be replaced with less intrusive sounds, while retaining their safety function.
- Sensory disturbance – long-term lighting of Project infrastructure at night during operation:
  - Wherever practicable, do not use bare light bulbs, or any lighting pointing upward or outwards, particularly at the periphery of the Project footprint;
  - Use the minimum number and brightness of lights required for safety and security;
  - Wherever practicable, use narrow spectrum bulbs to minimise the range of species affected by lighting (for example, longer wave length red or yellow bulbs rather than “natural” or white light);
  - Implement a Light Management Plan, where lighting that is not needed at a given time is turned off; and
  - Retention of at least 10 m of unlit habitat (for example, on either side of riparian forest in luggas, which are key commuting habitat for fauna) to prevent loss of habitat connectivity.
- Collision risk to fauna receptors in Upstream LSA, and Tsavo West National Park, Kinangop Grassland IBA and Kikuyu Escarpment IBA in the Midstream Study Area:
  - TKBV will commit to the restriction of construction traffic and operation tanktainer movements to daylight hours to reduce the risk of vehicle collisions;
  - In order to minimise the risk of collision with protected species, additional designated rest stops should be located outside national park boundaries; and
  - Education of drivers to avoid, where practical and safe, collision with road killed animals and other carrion in cases where scavengers are eating from the carcasses.

- Gas flares presenting a risk of mortality to birds:
  - Adoption of a start-up protocol for the flares so start up only occurs during daylight and ensure no perching birds are present at start up; and
  - The Biodiversity management plan will include a process for frequent checks for evidence of presence of birds across the wellpad specifically around the flare. Should mortality occur there will be a process for review of operational practices, e.g. flaring times.
- Produced water evaporation ponds with 200 mg/l solids, and ≤30 ppm oil-in-water content may present a risk of deleterious effects to species receptors (particularly birds) consuming or bathing in that water:
  - Effective wildlife exclusionary devices should be installed to prevent wildlife mortality. Netting appears to be the most effective method of keeping birds from entering produced water evaporation ponds (USFWS, 2009). Where faunal species enter the ponds, provisions such as crawl boards should be installed to enable a safe exit; and
  - Consideration in the waste management plan for immediate clean-up of any excess oil discharged into the produced water evaporation pond to prevent mortalities of species receptors.

5.8.8.3 Decommissioning/Reclamation

Should decommissioning apply at the end of EOPS, i.e. the wellpad sites will not be adopted by FFD:

- Reclamation of all disturbed areas with indigenous species after decommissioning to approximate pre-existing vegetation; and
- Areas no longer required for the Project should be closed and reclaimed to natural vegetation as soon as possible.

5.8.8.4 Offsetting

The proposed mitigation measures are expected to reduce predicted impacts to minor or negligible consequence; therefore, no offsetting proposals have been developed at this time.

5.8.9 Assessment of Residual Impacts

Table 5-17 presents the residual impacts following application of mitigation identified in Section 5.8.8. All residual impacts reduce to minor or negligible following effective mitigation

Table 5-17: Assessment of residual impacts for Biodiversity

Receptor	Project phase	Impact	Impact consequence before mitigation	Mitigation	Residual impact consequence
Large mammals, Volent small mammals	Operation	Site lighting at night, affecting faunal species movement patterns and foraging habits.	Moderate	■ Wherever practicable, do not use bare light bulbs, or any lighting pointing upward or outwards, particularly at the periphery of the Project footprint. ■ Use the minimum number and brightness of lights required for safety and security. ■ Where practicable, use narrow spectrum bulbs to minimise the range of species affected by lighting (for example, longer wave length red or yellow bulbs rather than “natural” or white light). ■ Implement a Light Management Plan, where lighting that is not needed at a given time is turned off. ■ Retention of at least 10 m of unlit habitat (for example, on either side of riparian forest in luggas, which are key commuting habitat for fauna) to prevent loss of habitat connectivity.	Minor
Greater Spotted Eagle Bateleur	Operation	Increased traffic risk in Upstream Study Area presenting collision risk to species receptors	Moderate	■ Restrict construction traffic and operation tanktainer movements to daylight hours to reduce the risk of vehicle collisions. ■ Restrict vehicle speed limits.	Negligible
Vultures			Moderate		Negligible
Steppe Eagle Pallid Harrier Bateleur Eastern Imperial Eagle	Operation	Gas flares – attraction to light/heat, perching opportunities,	Moderate to Major	■ Start up of flares will only occur during daylight hours. ■ Start up protocol for flares to ensure no perching birds.	Minor

Receptor	Project phase	Impact	Impact consequence before mitigation	Mitigation	Residual impact consequence
Greater Spotted Eagle Saker Falcon Sooty Falcon Lesser Kestrel Martial Eagle Crowned Eagle		change in population dynamics, possible mortality			
Raptors (as a group)	Operation	Produced water ponds attract species receptors; consumption and/or bathing in water has negative health effects	Moderate	■ Install measures to restrict ingress and access to water by species receptors.	Negligible
Vultures			Moderate		Negligible

5.9 Ecosystem Services

The Project aims to ensure that adverse environmental impacts on ecosystem services as a result of the Project's development, operation, and closure are avoided, or minimised, thereby sustaining the supply of priority ecosystem services to beneficiaries and maintaining Project operational performance. This can be achieved via the preservation and maintenance of the condition of the ecosystems that supply priority ecosystem services, throughout all phases of the Project, as well as limiting the potential for an increase in demand for priority services as a result of the Project.

5.9.1 Sources of Effects

The Project has the potential to cause effects on priority ecosystem services[21] during all its phases, through changes in the physical landscape and socio-economic context. The Project description (Section 4.0) has been reviewed, and key activities and sources of effects relevant to priority ecosystem services are presented below.

Direct effects on priority ecosystem services:

- Groundworks (compaction) and maintenance of project roads connecting wellpads and Kapese Camp (groundworks and operations);
- Improved vehicular access could facilitate easier and more frequent transport of harvested/produced natural resources (e.g. firewood and charcoal) to local markets, stimulating increased demand for these provisioning ecosystem services in the vicinity of project roads (operation);
- Deposition of dust on vegetation communities supplying wild foods and medicinal plants, generated by increased traffic and project activities (groundworks, operation and decommissioning); and
- Change in Air Quality (NO_2/NOx) potentially affecting faunal species that deliver pollination ecosystem services (Section 5.3) (operations).

Potential sources of effects have been coordinated with other contributors to the ESIA to ensure that a coherent and holistic approach has been applied. As such, the ecosystem services impact assessment has used results from impact analysis, and, where relevant, mitigation and residual impacts analysed from the following Project disciplines:

- Traffic (Section 5.1);
- Soils, Terrain, Geology and Seismicity (Section 5.2);
- Air Quality (Section 5.3);
- Noise and Vibration (Section 5.4);
- Water Resources (Quantity) (Section 5.5);
- Water Quality (Section 5.6);
- Landscape and Visual (Section 5.7);
- Biodiversity (Section 5.8);
- Social (Section 5.10);
- Cultural Heritage (Section 5.11); and
- Environmental Risks and Accidents (Section 5.12).

[21] Priority Services include (1) ecosystem services upon which the local beneficiaries depend for their livelihoods, health, safety, and/or culture, and for which project activities may affect supply; and (2) ecosystem services that the Project is directly dependent upon for operations, and as such could prevent the project from achieving planned operational performance (Landsberg *et al.*, 2013).

5.9.2 Incorporated Environmental Measures

Incorporated environmental measures to manage traffic, soils, air quality, noise and vibration, water resources, water quality, social effects, and environmental risks and accidents are considered in the relevant chapters. No environmental measures specifically pertaining to the management of ecosystem services have been incorporated into the engineering design parameters. However, some of the measures included in the Project design for other aspects are considered to be useful for the management of potential effects to ecosystem services, minimising the amount of additional mitigation measures that may be required following impact assessment. These include:

- Speed limits will be maintained and enforced – this will reduce noise and minimise disturbance to beneficiaries whose cultural identity and sense of space is linked to the largely undisturbed landscape setting, and minimise dust deposition to possible sources of medicinal and food plants adjacent to the internal road network;
- Directional lighting of site as appropriate, and no lighting on access roads - this will minimise light pollution and the visual amenity of the landscape for beneficiaries whose cultural identity and sense of space is linked to the largely undisturbed setting;
- Produced water will be stored in purpose-built facilities within the wellpad areas, where it will to evaporate – this negates the need for discharge of any treated water to the environment, and potential changes in the quality of the freshwater supply;
- Internal roads will be maintained so that natural drainage patterns and catchments are changed as little as possible – this will assist in maintaining the ability of ecosystems to regulate water flows and timing, soil stability, and control erosion;
- Influx of people opportunity seeking will be minimised by TKBV commitment to effective communication with stakeholders regarding limited job opportunities relating to EOPS, and ensuring that contractors adhere to TKBV recruitment and employment policy;
- Water abstraction for Project supply will be within currently permitted volumes, which are understood to be sustainable in terms of ongoing supply both for the Project and people who rely on below-ground freshwater resources; and
- TKBV is committed to preventing deliberate/inadvertent invasive species introductions and minimising the spread of existing populations of invasive species and has developed invasive species management procedures that address the issue. This will contribute to the maintenance of ecosystem integrity, and, therefore, the ecosystems' capacity to supply provisioning, cultural and supporting services.

5.9.3 Study Area and Receptors

Study Area

The Biophysical Local Impact Assessment Study Area (LSA) (Drawing 1.5-2), also defined in Section 1, incorporates the areas where it is considered that effects on ecosystem services could occur. This LSA was defined to account for potential indirect habitat receptor effects, such as changes in habitat quality caused by sensory disturbance (light, noise, vibration), air emissions, dust, cultural heritage and biodiversity.

The study area for the social baseline assessment (which includes Turkana Central, Turkana South and Turkana East) was used as a regional study area (RSA) to characterise demand for ecosystem services.

No review of ecosystem services, or assessment of impacts, 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 as a result of the oil transport activities in the Midstream Study Area. These activities will use existing road routes.

Receptors

For the purposes of this assessment, receptors include priority *Provisioning*, *Cultural* and *Regulating* ecosystem services and their beneficiaries[22]. *Supporting* ecosystem services have no specific/direct beneficiaries for a project of this scale, and because impacts to these are captured within the *Provisioning, Regulating* and *Cultural* categories for this Project, supporting ecosystem services are not included as receptors in the effects analysis for impact assessment.

The ecosystem services receptors for assessment of impacts are listed below; ecosystems supplying the services are shown on Drawing 5.9-1.

Services upon which the Project could Impact

- Food: including grazing/browsing resources for livestock that are raised for meat, milk, and wealth, and wild foods harvested/hunted by people.
- Medicinal Plants: Over 21 plant species with medicinal uses are used by local people in the Upstream Study Area.
- Biomass Fuel: Fire wood and charcoal is the primary energy source for cooking; charcoal is also an important source of livelihood in the Upstream Study Area.
- Wood and fibre: Timber and leaves are used in home construction, the making of traditional utensils and ceremonial articles.
- Freshwater: Beneficiaries are traditionally reliant on drinking water obtained from hand-dug wells in areas of shallow groundwater (such as, luggas). Installed wells for drinking water supply are located in or near settlements. In addition, water points provided by TKBV are replenished with groundwater abstracted from the Kalabata lugga near Nakukulas.
- Cultural sites: Sacred trees[23] (elder trees, shade trees, ceremonial trees) beneath which the men of the community and elders gather to discuss community issues, politics, marriages, general affairs, and trees used for marriages, ceremonies, and initiation rites (Drawing 5.9-1).
- Educational and inspirational values: The contribution of the landscape to the local people's sense of place; *ere* system of grazing/habitation rights; initiation sites; passing down of traditional knowledge.
- Pollination: Beneficiaries are reliant on pollination services for the maintenance of vegetation communities that supply grazing/browsing resources and wild foods, for example, *Acacia* spp. seed pods.

Services upon which the Project is dependent

- Freshwater: The Project is reliant on the continued supply of freshwater, which is abstracted from groundwater (Volume II).
- Regulation of water flows and timing: The Project is reliant on the hydrological system regulation of water run-off and groundwater recharge, particularly for maintenance of freshwater supply; and infrastructure could be affected as a result of flood events.

5.9.4 Considerations from Stakeholder Engagement

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

[22] Beneficiaries are defined as people and/or a project which are the users of ecosystem services derived from the surrounding environment/ecosystem. Benefits gained can be either physical or psychological, and can be obtained actively or passively, directly or indirectly

[23] Sacred trees have not been exhaustively mapped within the Biophysical Local Impact Assessment Study Area. There are known sites near Nakukulas, outside of the study area and possibly more within the study area.

5.9.5 Key Guidelines and Standards

The guidance provided in the below-listed documents was followed in conducting the impact assessment for ecosystem services. These documents represent international best practices and standards in ecosystem services review and impact assessment:

- Landsberg *et al.* (2013): Weaving ecosystem services into impact assessment. World Resources Institute; and
- IPIECA (2011): Ecosystem services guidance – Biodiversity and ecosystem services guide and checklists. The International Petroleum Industry Environmental Conservation Association.

5.9.6 Effects Analysis

The following sections summarise expected impacts on Priority ecosystem services.

5.9.6.1 Methods

Ecosystem services are the benefits that people and/or a project (the beneficiaries) obtain from ecosystems (IFC, 2012). Kenyan legislation and policies pertaining to biodiversity conservation and wildlife management do not specifically define what constitutes an ecosystem service; therefore, for the purposes of this assessment, the definitions of ecosystem services were based on those used by Landsberg *et al.* (2013) (Table 5-18).

Table 5-18: Ecosystem services categories (Landsberg et al., 2013)

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.
Cultural services	Aesthetic, spiritual, recreational and other cultural values e.g., sacred sites, traditional meeting areas, traditional knowledge, sense of place.
Regulating services	Control of the natural environment e.g., maintenance of key ecological processes, groundwater recharge, erosion control, water quality.
Supporting services	Natural processes essential to resilience, and functioning of ecosystems. e.g., primary production, soil formation and conservation, nutrient cycling.

The Project's area of influence hosts a wide range of ecosystem services. The assessment of the impacts of the Project on priority[24] ecosystem services involved the following steps:

- Identifying relevant ecosystem services supplied within the Upstream Study Area (Volume II);
- Prioritisation of ecosystem services for impact assessment. Establishing the baseline for the priority ecosystem services, by identifying ecosystems that supply services, and their capacity to supply services; and identifying the beneficiaries who use those services, that is, the demand for the services; and
- The impact assessment process (aligned with the World Resources Institute's (WRI) approach (Landsberg *et al.,* 2013) assesses the impacts of the Project on ecosystem services used, or depended on by others, and the dependence of the Project on ecosystem services. This in turn provides assessment of impact on beneficiaries.

[24] Priority ecosystem services are those upon which local beneficiaries depend for livelihoods, health, safety, or culture, and which the project may affect (Type I); and those services that could prevent the project from achieving planned operational performance (Type II)

5.9.6.2 Results

Supporting ecosystem services have no specific/direct beneficiaries, nevertheless, impacts to these are captured within the *Provisioning, Regulating* and *Cultural* categories for this project. Therefore, they were not included in the prioritisation exercise and are not included in the effects analysis.

5.9.6.2.1 Provisioning Services

Grazing/browsing resources for livestock

- No direct loss of ecosystems will occur in the Project footprint of the oil production wells and processing. The wellpads are already existing; and
- Influx of opportunity seekers to nearby settlements, may result in increased numbers of livestock utilising the same available grazing/browsing resource, with subsequent effects on the quality and quantity of that resource.

Wild Foods

- Influx of opportunity seekers could stimulate increased hunting activity[25] (Ecosystem Services Baseline) for wild fauna meat supply in the vicinity of the Upstream LSA; and
- The potential for increased numbers of livestock and people during project operation could affect the quality and quantity of wild food sources available in the vicinity of the Upstream LSA.

Medicinal Plants

- Improved vehicular access via Project roads and the C46 could facilitate easier and more frequent transport of harvested medicinal plants to local markets, stimulating increased demand for these provisioning ecosystem services. This could affect the quantity and quality of the vegetation communities supplying the resources, as well as decreasing the populations of the medicinal plants themselves.

Biomass fuel

- Influx of opportunity seekers could result in increased demand for fire wood and charcoal, with subsequent effects on the quality and quantity of vegetation communities supplying that resource; and

Materials for construction and crafts

- Influx of opportunity seekers could affect the quantity of wood sources available because of increased demand for home and boma construction, firewood and charcoal production; increased levels of grazing and browsing by livestock could exacerbate degradation of vegetation, further limiting the capacity of the communities to supply timber for construction and crafts; and

Freshwater supply

- The proposed Project water use will be within the limits already permitted for the existing facilities. Local beneficiaries traditionally source water from relatively shallow, hand-dug wells in surface sands in luggas (and are supplemented with tanked water derived from the Project water use); and
- The Project is reliant on continuing supply of this service, via groundwater abstraction, to achieve operational performance.

5.9.6.2.2 Regulating Service

Regulation of water timing and flows

- Abstraction of groundwater from existing TKBV boreholes will be operated under the existing permit and monitored to ensure no degradation of water sources for other users. Therefore, project abstraction is unlikely to affect downstream aquatic systems, and groundwater dependent ecosystems.

[25] Children hunt squirrels, rabbits and birds. Historically, people hunted larger game moving some distance to get that game. There is a possibility that the improved roads could facilitate this again

Soil Stability and Erosion Control

- The potential for increased numbers of opportunity seekers during project operation, accompanied by their herds of livestock, could exacerbate soil erosion, particularly around settlements and water points.

Pollination

- Pollination is recognised as a priority service because of the Turkana people's reliance on wild fruits and seed pods as a source of food for themselves and livestock. Although no significant effects on pollinator species (in particular, invertebrates, birds, bats) are predicted for the Project; localised effects on pollination service delivery within 100 m of the wellpads could occur, due to changed pollinator patterns associated with the change air quality levels and night-time lighting in the vicinity of the Project footprint.

5.9.6.2.3 Cultural Services

Ethical and Spiritual Values

- Sacred sites, such as elder/shade trees; and other forms of intangible cultural heritage within the Upstream Study Area, such as traditional knowledge (e.g. knowledge associated with traditional home construction, wooden utensil carving, sourcing medicinal and food plants) and the value of an ere, are intrinsically linked with natural ecosystems – particularly riparian forest. Changes in the ecological integrity of ecosystems that supply the service (e.g. as a result of wood harvest for charcoal production) are likely to affect the ability of local communities to benefit from this ES. However, alternative sources and supply areas are readily available.

5.9.7 Impact Classification

The assessment of impacts takes the results of the effects analysis and applies the impact assessment methodology described in Section 1.4 Impact Assessment Methodology.

5.9.7.1 Magnitude of the Effect

Table 5-19 presents the magnitude of effect criteria used for the semi-quantitative assessment of potential impacts on the supply and demand of ecosystem services.

Volume II presents the route to the classification of all the impacts, including the magnitude, geographic extent, duration and frequency for each impact and the consequence, once the receptor sensitivity has been considered.

Table 5-19: Impact assessment criteria for ecosystem services

Magnitude	Geographic Extent	Duration	Frequency
Negligible No predicted change from baseline. Supply of priority ecosystem services will not be affected. Demand for priority ecosystem services will not increase. **Low** Where the impact affects the ecosystems in such a way that the system's capacity to supply priority services is slightly affected, that is, the supply base of priority services is slightly affected. Measurable, but small changes could occur. The demand for ecosystem services is slightly elevated from baseline. **Moderate**	**Local** Biophysical local study area **Regional** Biophysical Regional study area **Beyond regional –** Greater than regional study area, including transboundary	**Short-term** Effect is reversible at end of construction **Medium-term** Effect is reversible at end of operations **Long-term** Effect is reversible within a defined length	**Infrequent** Effect occurs intermittently but not continuously over the assessment period **Frequent** Effect occurs repeatedly or continuously over the assessment period

Magnitude	Geographic Extent	Duration	Frequency
Where the impact affects the ecosystems in such a way that the system's capacity to supply priority services is moderately affected, that is, the supply base of priority services is moderately affected. Measurable changes could occur. The demand for ecosystem services is elevated from baseline. **High** Where the impact affects the ecosystems in such a way that the system's capacity to supply priority services is substantially affected to the extent that they will be temporarily or permanently cease to be supplied. The demand for ecosystem services is noticeably elevated from baseline.		of time or beyond closure **Permanent** Effect not reversible	

5.9.7.2 Sensitivity and/or Importance of Receptors

The categories of sensitivity and/or importance of priority ecosystem services receptors are presented in Volume II. The following receptors are categorised as having a high or very high sensitivity/importance:

- Food – grazing/browsing resources for livestock (High);
- Freshwater (High);
- Cultural sites (including sacred trees) (Very high); and
- Educational and inspirational values (including elder trees) (High).

5.9.7.3 Determination of Impact

Using the decision matrices presented in Section 1.4.4 Impact Assessment Methodology, and the receptors defined in Section 5.9.3, the impacts and consequences are determined. The assessment of impacts considers the environmental measures already included in the Project design, as presented in Section 5.8.2 Incorporated Environmental Measures. The assessment also considers the mitigation applied by specific technical disciplines, where these are appropriate to ecosystem services, that is, traffic, water, air quality, noise and vibration, landscape and visual, cultural heritage, social and biodiversity.

Table 5-20 presents the classification of each impact, where overall consequence is predicted to be moderate or higher. Volume II presents the route to the classification of the impacts, presenting the magnitude, geographic extent, duration and frequency for all impacts.

The socio-ecological implications of an assessed effect for ecosystem service receptors are determined by combining magnitude, geographic extent and duration of the effect and may be classified as:

- Negligible: no detectable effect on beneficiaries as a result of changes to an ecosystem service and no change from ecosystem service baseline scenario;

- Low: detectable effect, but within known or inferred ability of beneficiaries to absorb without loss to social functions and well-being. Small changes prevail on the cultural/social functions/process as a result of project implementation;
- Moderate: effect near limits of beneficiaries' ability to absorb effects without loss to social functions and well-being. Cultural/social functions/processes continue, albeit in a modified way as a result of project implementation; or
- High: effect well beyond the ability of beneficiaries to absorb effects without loss to social functions and well-being. Changes to cultural/social functions/process are drastic and commonly irreversible.

Finally, the impact classification is combined with sensitivity using the matrix given in Volume II to derive overall consequence or significance. For ecosystem services, the four consequence levels are defined as follows:

- Negligible: no measurable adverse impacts to priority ecosystem services from the Project;
- Minor: impact acceptable, with the maintenance of supply of priority ecosystem services achieved; mitigation is adequate and achievable, but monitoring may be necessary;
- Moderate: impact requires follow up action; monitoring necessary to evaluate continued supply of ecosystem service and well-being of impacted communities; and
- Major: impact requires additional mitigation; implies proximity to and risk of exceedance of good international industry standards; monitoring necessary to evaluate continued viability of ecosystem service and well-being of impacted beneficiaries.

Table 5-20 presents the overall consequence rating for ecosystem service receptors in the Upstream Study Area, for which moderate or major consequences are predicted.

5.9.7.3.1 Groundworks and Installation, and Decommissioning

No moderate or major impacts have been identified during these periods in the life of the project.

5.9.7.3.2 Operation

Population influx and improved access for people seeking natural resources

Provisioning Services: Even with the small number of new workers, the perception of renewed employment can generate in-migration to the area.

Therefore, there is a potential for an increase in opportunity seekers to nearby settlements (e.g., Nakukulas and Lokicheda), which would increase demand for priority provisioning ecosystem services by local beneficiaries, for both subsistence and livelihood/income generation purposes.

A conservative assumption has been made, that pre–mitigation, at the commencement of production, regardless of lack of job opportunities, there is a potential for the influx of opportunity seekers. This could lead to influx of people seeking natural resources for subsistence use (e.g., wild foods, medicinal plants, firewood, charcoal, construction and craft materials) and access grazing for livestock. The increased demand for natural resources, in particular grazing/browsing resources for livestock, could exacerbate degradation of the vegetation communities, further compromising their ability to maintain supply of the provisioning services.

TKBV need to actively manage any potential for influx and associated degradation of the associated ecosystem services.

The magnitude of the potential impact on service supply and demand on a local scale would be of medium-term duration. The sensitivity of the affected provisioning services varies (Volume II), and the impact consequence for all provisioning services is *Moderate* (Table 5-20).

Table 5-20: Impact consequence where overall consequence is moderate or higher, prior to mitigation

Receptor	Project phase	Key source of impact	Impact consequence
Food – grazing/browsing resources for livestock	Operation	Population influx, and improved access for people seeking to harvest natural resources. Subsequent increases in demand for natural resources, and degradation of ecosystems supplying services.	Moderate
Medicinal plants			Moderate
Biomass fuel			Moderate

5.9.8 Mitigation

The following section describes, at a high level, the mitigation measures that will be required for ecosystem services for which moderate and major impacts are predicted. The measures include those reiterated from specialist studies that are specific to potential impacts on the supply of ecosystem services, as well as additional, ecosystem service-specific mitigation measures based on the guidance provided by IPIECA/OGP for oil and gas project impacts and dependencies (IPIECA, 2011). These mitigation measures follow the mitigation hierarchy (sensu, BBOP 2012), and will be detailed in the management plans, to ensure that the beneficiaries that are most reliant on priority ecosystem services within the Project area of influence are suitably accommodated.

5.9.8.1 Avoidance

Avoidance measures include:

- Reuse existing or remnant road networks; and
- In cases where the Project or third-party contractors associated to the project or related infrastructure may effect cultural heritage features (such as elder/shade trees) that are essential to the identity and/or cultural, ceremonial, or spiritual aspects of beneficiaries' lives, priority should be given to the avoidance of such impacts. TKBV are committed to taking all possible measures to influence all third-party contractors working in the Upstream area to ensure the avoidance of impacts on such cultural heritage features.

5.9.8.2 Minimisation

Provisioning Services

- Influx management measures should be developed to address appropriate measures to mitigate the expected Project-associated in-migration effects on provisioning services;
- Building on the engagement resources described above, TKBV commit to ensure that all labour needs and recruitment (including by contractors) will be disclosed through Community Resource Centres and Tullow engagement staff. TKBV commit to making sure all government and settlement leadership understand that there will be no hiring from the Kapese ISB or any other Project facilities (Casual labour hiring is described in more detail below);
- TKBV are committed to a disclosure and stakeholder engagement campaign, which will be designed to explain the limited jobs available during EOPS, as well as the procedures that people must follow to get employment. Community leaders and residents should be encouraged to report any evidence of outsiders moving into the area for reasons other than traditional movements of pastoral groups;
- TBKV are to commence a study to review options for supporting local communities via community investment in developing sustainable herding practises, or other activities that provide alternative food sources and income (it is envisaged that this will be developed further for FFD);

- Enforcement of a strict bans or guidelines on hunting/gathering/purchasing wild foods for all Project personnel;
- TKBV commit to surveys of medicinal plant use, wild food use and biomass fuel use (wood and charcoal), to ascertain the baseline usage and set up triggers in the social management plans for identifying where degradation occurs. It is envisaged that this will be developed further for FFD;
- TBKV are to commence a study to review the supply cheap fuel alternatives to charcoal to local markets and evaluate opportunities; and
- Surface water runoff management must be maintained to ensure no long-term change to floodplains, luggas or river channels, which could affect ecosystems' capacity to regulate water flow and control erosion.

Cultural Services

- The environmental setting for sacred sites close to construction/operation areas should be protected through demarcation of no-go areas for vehicles and Project personnel;
- Cultural heritage management measures will be developed (see Section 5.11.8) to include procedures to minimise potential effects on sacred sites. The plan should be disseminated amongst Project personnel to engender respect for local cultural heritage and traditions. TKBV will commit to providing training; and
- Measures to reduce light pollution should be put in place to limit changes in people's sense of space arising from visibility of the Project at night.

5.9.8.3 Reclamation

- Long-term rehabilitation plans that include revegetation of disturbed habitat should be initiated for disturbed ground adjacent to project roads and within the Project footprint, in an effort, to restore any lost capacity to supply ecosystem services. It is envisaged that this will be developed further for FFD

5.9.9 Assessment of Residual Impacts

Table 5-21 presents the residual impacts following application of mitigation identified above. All residual impacts reduce to minor or negligible consequence following effective mitigation.

During the operation phase, the residual impacts on grazing for livestock and biomass fuel are expected to be concentrated in close proximity to settlements where demand for these services is highest, becoming less pronounced with increasing distance from these centres of demand.

Residual impacts on the ongoing supply of medicinal plants are also expected to occur in a similar pattern, as the health-seeking behaviour of communities traditionally reliant on the use of medicinal plants are difficult to predict (Volume II). Beneficiaries may not be inclined to avail of western-type medical facilities for economic and social reasons.

Table 5-21: Assessment of residual impacts for ecosystem services

Receptor	Project phase	Impact	Impact consequence before mitigation	Mitigation	Residual Consequence
Food – grazing/browsing resources for livestock	Operation	Population influx to nearby settlements, and improved access 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 measures. ■ Support local communities in developing sustainable herding practises, ecotourism or other activities that provide alternative food sources and income. ■ Surveys of medicinal plant use, wild food use and biomass fuel use (wood and charcoal), to ascertain the baseline usage and set up triggers in the social management plans for identifying where degradation occurs (developed further for FFD); ■ TBKV are to commence a study to review the supply cheap fuel alternatives to charcoal.	Minor
Medicinal plants			Moderate		Minor
Biomass fuel			Moderate		Minor

5.10 Social

5.10.1 Sources of Effects

The key consideration related to the sources of effects and impacts is that EOPS will be implemented using only existing infrastructure. The EPF and other technical infrastructure will be situated on existing wellpads and all administrative and logistics, including worker accommodation, will be operated from the existing facilities. As a result, no additional land will be required as part of the Project.

The sources of economic effects relate to taxes and other payments, as well as employment and increased purchasing of good and services. An increased workforce of 61 people, all non-TKBV contractors, will be utilised for the EOPS, but all workers will be housed at the ISB, requiring no additional accommodation facilities and no additional integration with communities. All new workers are expected to be indirect or contractor employees. There will be no TKBV-direct hires as part of the Project.

The transport of up to 2,000 barrels/day is reliant upon the movement of 14 tanktainers per day from the EPF to the KPRL facilities in Mombasa. The movement of these vehicles, especially in the areas of relative insecurity, will require additional security measures from the Company, which are not accounted for in the aforementioned 61 people.

Sources of effects related to the improvement of roads and transport infrastructure are not included in this analysis since these changes are implemented and managed by KeNHA, with the exception of the new access road from Amosing to the C46 road.

5.10.2 Incorporated Environmental Measures

No environmental measures pertaining specifically to social effects have been incorporated into the engineering design, other than those incorporated for other environmental reasons and thereby indirect social effects. These are discussed in other biophysical environmental sections (Sections 5.1 to 5.9).

5.10.3 Study Area and Receptors

The Upstream Social Baseline Study Area for EOPS included the communities and institutions within the biophysical regional study area. In also includes Major Rural Settlements in Turkana South and East.

The Upstream Social Impact Assessment Study Area is located in Turkana and is limited to the two Sub-county administrative units or Constituencies of Turkana East and Turkana South, which will house various components of the project infrastructure.

The Midstream Impact Assessment Study Area is defined as the towns and settlements adjacent to the transport route from Amosing-1 to Mombasa.

The definition of receptors used in the land use study are presented in Volume II. However, for social impacts, there is one broad receptor, Project-affected Peoples (PAP). This includes individuals and households occupying traditional mobile settlements and in permanent settlements, including non-organised groups with a particular area of interest or that may be vulnerable. Such groups might include elderly, people with disabilities and ethnic minorities.

5.10.4 Considerations from Stakeholder Engagement

Key issues / questions relating to social considerations raised during EOPS ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018 as well as appropriate responses is included in Volume II of the ESIA.

Prominent social related issues / queries raised during consultation meetings were focused around concerns for employment, land use and ownership, community health and safety, social maladies and security. Specific

topics included the potential for community displacement, health concerns associated with site operational activities and influx implications for sexual health.

5.10.5 Effects Analysis

5.10.5.1 Administrative Divisions and Governance Structure

No impact topics have been identified in relation to administrative divisions and governance structure. Therefore, impact analysis or consideration of impacts is not considered any further in this assessment.

5.10.5.2 Demographics

One impact category has been identified in relation to demographics: influx and migration. Population change, whether increasing or decreasing, can have both positive and negative consequences. New migrants can increase economic opportunities and expand the demand for goods and services.

Local population changes are currently complex due to a number of factors, including (but not limited to):

- A volatile security situation;
- An increase in employment linked to devolved government, is said to be causing a rural-to-urban shift;
- Traditional movement of people as it relates to pastoralism, for which there is insufficient capacity to collect data on migratory groups; and
- Anecdotal evidence that some influx into Lokichar is due to oil exploration and appraisal (E&A) activities.

Therefore, precise reasons for current influx cannot be identified and the rate of influx is difficult to quantify.

EOPS is expected to offer around 61 Turkana employment opportunities for a period of 2 years. During EOPS, migration of job seekers to nearby major rural settlements is expected. However, additional employment and work opportunities from the Project are small in relation to existing E&A activities and provide little incentive for people to move closer to the Project area just because of EOPS.

The potential effects come from a perceived change in the shift from E&A to production. Moving into the production phase creates the impression that more work is to follow. If this stimulates even small increases in population, it can put a strain on existing infrastructure and services if not managed appropriately. Information from key informant interviews during the baseline data collection phase suggests that small increases in population and the expectation of changes in the future can put pressure on housing and associated facilities, generating make-shift structures that serve as guest houses. From a health perspective, increased outsiders can increase rates of diseases such as tuberculosis, rates of sexually transmitted diseases and HIV.

5.10.5.3 Infrastructure and Services

The size of the Project and intention to use existing infrastructure (the only road improvements directly related to the project are the improvements from Amosing to the C46 road) means that there are no direct effects on existing infrastructure.

There will be no change to local waste infrastructure or services. All non-hazardous and hazardous wastes generated by EOPS will be managed by the TKBV NEMA licensed waste handler and transported to a NEMA approved waste management facility.

As part of sanitation waste water treatment, waste water will be treated at the site, and treated water that meets NEMA effluent discharge standards will be released periodically. All production wastewater will be managed in evaporation ponds on site.

Water usage will not exceed existing permitted abstraction rates form existing water boreholes (Nakukulas 9 and Ngamia East) and the existing permit is valid for the duration of the Project.

In regard to electricity, each wellpad is required to provide power on a standalone basis. Either gas or diesel generators will be used at each site. This will not influence public electricity supply, and in this area, there is no public electricity supply.

Healthcare for employees associated with the EOPS Project will be provided through existing medical facilities and medics currently employed at Kapese. Any accidents or incidents will be managed as far as possible by the Contractor and TKBV. Local emergency services along the road route will be engaged in the development of the Emergency Response Plan. The Emergency Response Plan will be used to inform stakeholder engagement with local communities.

Impacts related to changes in road infrastructure are outside the scope of the impact assessment.

Therefore, impact analysis or consideration of impacts related to infrastructure and services is not considered any further in this assessment.

5.10.5.4 Economics, employment and livelihoods

Five impact categories have been considered in relation to economics, employment and livelihoods:

- Taxes and other payments;
- Direct employment;
- Contractor (indirect) employment opportunities;
- Business opportunities and local content; and
- Inflation.

Livelihoods based on land and natural resource use are considered in Section 5.10.5.5 under Land Use and Ownership. Ecosystems Services impacts have been addressed in Section 5.9.

Taxes and other payments

The impacts of taxes and other payments are predicted to be positive to net economic contribution, which should extend throughout the operations phase of the work.

Table 5-22 presents all payments made by TKBV in Kenya from 2014 to 2017. In Kenya, all payments are at the corporate level.

Table 5-22: Transparency Disclosure 2017: Kenya (all figures $000)

Year	Income taxes	Licence fees	Infrastructure Improvements	VAT	With-holding tax	PAYE & national insurance	Custo-ms duties	Training allowa-nce	Total
2014	-	132	732	198	17,989	21,235	817	321	41,450
2015	9	486	-	157	9,003	21,634	993	958	33,240
2016	9	614	-	162	1,864	9,852	65	924	13,490
2017	1	451	195	156	1,911	14,392	407	765	18,278

Source: Tullow Annual Report and Accounts 2014, 2015, 2016 and 2017.

Additional payments to be made for the EOPS Project are not available at this time. Revenue from the Project will be subject to the terms of the Petroleum Act, which is currently pending in the Kenyan Senate following

amendments to the formula in 2016. This proposed formula currently provides for 75% share to the national government, 20% to the local county government, and 5% to local communities[26].

EOPS 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 FFD project is completed. In addition, revenue sharing will be subject to the provisions of the draft Petroleum Bill, 2017; which is currently under consideration in the Senate.

While tax contributions are generally considered to be positive, their impact can have mixed results. Kenya is not a candidate country to the Extractive Industry Transparency Initiative (EITI) but has committed to implementing a progressive and transparent policy and legislative framework for all extractive activities, including transparency in licensing procedures, publication of contracts, and environmental and conservation and labour requirements in line with international standards.

Direct employment opportunities

All additional employment opportunities are expected to be indirect or contractor employment. There is no direct employment for TKBV and therefore no impacts related to direct employment.

Contractor (indirect) employment opportunities

Unemployment levels in Turkana County are estimated at 70% in contrast to national figures of 42%. There is only a 6% proportion of the population who are wage earners (Turkana County Government, 2013).

Table 5-23 presents trends in total contractor employment from June 2016 to September 2018. For EOPS it is expected that a total contractor skilled workforce of 30 to 60 people will be required for commissioning. The required skilled work force for operations is expected to be 20 to 25 people working in a two-shift system. During operations, there is predicted to be 61 Turkana employment opportunities (details presented in Section 4). Additional EOPS contractor employment is therefore approximately 7% increase from the overall total recorded in 2017.

Table 5-23: Contractor Employment Trends

Month	Expat	Other Kenyans	Turkana	Total	Other Kenyans %	Turkana %
Jun-16	8	193	284	485	40%	59%
Jul-16	7	162	266	435	37%	61%
Aug-16	8	169	285	462	37%	62%
Sep-16	9	167	293	469	36%	62%
Oct-16	10	173	305	488	35%	63%
Nov-16	9	246	408	663	37%	62%
Dec-16	44	358	590	992	36%	59%
Jan-17	133	365	660	1158	32%	57%
Feb-17	134	363	661	1158	31%	57%

[26] The definition of local communities in this context is unknown

Month	Expat	Other Kenyans	Turkana	Total	Other Kenyans %	Turkana %
Mar-17	165	355	619	1139	31%	54%
Apr-17	130	375	633	1138	33%	56%
May-17	114	382	680	1176	32%	58%
Jun-17	118	371	858	1347	28%	64%
Jul-17	104	352	816	1272	28%	64%
Aug-17	119	397	709	1225	32%	58%
Sep-17	108	428	739	1275	34%	58%
Oct-17	122	405	744	1271	32%	59%
Nov-17	42	353	681	1076	33%	63%
Dec-17	38	316	551	905	35%	61%
Jan-18	37	291	548	876	33%	63%
Feb-18	38	311	556	905	34%	61%
Mar-18	38	285	548	871	33%	63%
Apr-18	39	283	484	806	35%	60%
May-18	35	282	419	736	38%	57%
Jun-18	33	289	431	753	38%	57%
Jul-18	21	276	395	692	40%	57%
Aug-18	32	291	377	700	42%	54%
Sep-18	33	286	418	737	39%	57%

Employment and new jobs are generally considered a positive social impact. However, the overall direction of new employment opportunities is mixed. Well-administered human resources policies need to be put in place and adhered to. Job creation can exacerbate existing social divisions and, in some cases, generate local conflict if job seekers do not trust that recruitment and human resource policies are not transparent. This is true of all employment, but especially relevant if contractors have not been informed about core labour rights and best practices.

Business opportunities and local content

Similar to employment, the business opportunities created by the procurement of goods and services are generally considered to be a positive social impact with the additional purchasing power adding stimulus to the economy. Also, in a similar way, this can have less impact and even negative impact if the procedures are not transparent.

There are no specific financial figures on the additional procurement related to EOPS at this time.

Inflation

Inflation is a negative impact that can often accompany the influx of new workers, even if contained to a workers' camp. The additional economic purchasing power can drive up the cost of local goods and services, making it even more expensive for local residents to meet their needs.

While it is difficult to demonstrate that inflation is caused by Project activities, the potential impact can be felt by those with the least ability to give feedback.

5.10.5.5 Land Use and Ownership

There is no additional land take or earth moving required by the groundworks and installation activities for EOPS, only compaction of existing land to prepare for construction.

Effects analysis results are presented in Volume II. In summary, EOPS would not affect land uses that take place in areas surrounding the wellpads, and most are compatible with and are undertaken around the existing wellpads (eg. livestock grazing, plant gathering, access to water points).

The effect of EOPS on homesteads and other uses of land in the study areas will be negligible and mitigation is not required. Consideration has been given to two impact categories: physical displacement and economic displacement or the loss of livelihoods.

Physical displacement

The possibility for physical displacement was considered in the context of impacts related to noise and air emissions from the wellpads.

No homesteads have been observed during baseline data collection, nor are expected to be located in the future with the areas affected by exceedances in noise or air quality due to emissions during project groundworks/installation and operation.

Therefore, no physical displacement is expected during the EOPS part of the Project. The project will utilise existing facilities to the maximum potential and there will not be a requirement for additional land acquisition.

Economic displacement

The possibility for economic displacement was also considered in the context of impacts related to noise and air emissions from the wellpads. Similar to physical displacement, no economic displacement is expected during the EOPS part of the Project.

EOPS will have negligible impact on peoples' use of land or use of natural resources given the size and extent of areas outside of wellpads where Air Quality predictions exceed the project standard is extremely small compared with the extent of land areas and natural resources in the close vicinity of the wellpads. People would not be required to move their homesteads and livestock grazing and other uses of land in the study areas would not be affected.

5.10.5.6 Community Health and Safety

Five impact categories have been considered in relation to community health and safety:

- Road traffic accidents;
- Sexually Transmitted Diseases (STDs), including HIV;
- Camp Facilities Management;
- Environmental Modification and Vector-related Diseases; and
- Environmental Health Determinants.

Road traffic accidents

The TIA describes the risks associated with increased movement of vehicles and mobile equipment in more detail. There are potential health risks associated with the Upstream components and the movements of Light Duty Vehicles, tanktainer trucks, buses and other mobile equipment in the infield roads of the local study area. Further consideration for RTAs is included in the Hazards and Accidents Section (Section 5.12).

Children are likely an especially vulnerable group to pedestrian vehicle accidents as they are likely to be relatively naïve to the risks of road and pedestrian safety. In the baseline data collection key informants reported that Road Traffic Accidents had become increasingly common, with poor driving practices, poor conditions of roads and unroadworthy vehicles all contributory factors.

Sexually Transmitted Diseases, including HIV

HIV/AIDS and Sexually Transmitted Diseases (STDs) are a challenge in Turkana County, with the prevalence of HIV higher than the national average. Consistent knowledge of HIV transmission and prevention measures is poor in Turkana County.

The Social baseline presents evidence of increasing disease trends, the association of STIs with migration of people and the past oil E&A activities attracting job and opportunity-seeking migrants. Therefore, there is a risk that the development of the EOPS Project may influence STD trends. Sections of the skilled workforce will be hired from outside of the study area, with this group a potential high risk as they as they work in remote settings away from their normal partners for extended periods and have disposable income.

Camp Facilities Management

Action and activities within the workplace and at the Kapese ISB have the potential to cause health impacts if these are not effectively recognised and managed. While it is recognised that the Kapese ISB will serve more than just the EOPS Project, the potential impacts are grouped as a whole as it is not possible to separate them.

Potential effects include the potential for overcrowding to occur if the demand for available bed space exceeds the supply and workers are forced to share rooms. Poor hygiene in camps and rooms may exacerbate this risk, with the potential for communicable disease transmission; especially conditions transmitted by droplets (respiratory) or close contact (e.g. TB and meningitis). These infective conditions can have workplace health implications, but also have the potential to spread into adjacent communities and with the weak health system may lead to an increase in local disease transmission, with vulnerable groups particularly susceptible (children, underlying disease, elderly).

The management of waste and wastewater is addressed in the Waste Management Plan. This aspect is not considered to lead to any adverse effect.

Creation of localised habitats for vector proliferation may give rise to an increased risk for localised transmission of disease, with those transmitted by flies and mosquitoes (malaria and arbo-viruses) of particular importance. While the potential effects are likely to be limited to a localised area in the camp and work area (and thus pose a workplace risk), there is the potential for these conditions to spread into the surrounding communities.

Environmental Modification and Vector-related Diseases

Modification of the environment around the oilfields through site preparation and operations may increase the potential for mosquitoes to proliferate, with higher vector densities potentially giving rise to an increased risk for malaria transmission. This will be most marked during site preparation where suitable breeding sites may be created through levelling and compaction of ground. Use of water in these activities may promote pooling of water and create a suitable habitat for mosquito breeding. As the usual environment is extremely dry this has the potential to extend breeding periods and create localised areas of risk.

There is also the risk for this to extend along the in-field roads, as dust suppression activities through wetting roads may increase pooling of water in ruts and along the side of the roads in drainage areas. This again has the risk to create local habitats for breeding of mosquitoes and increased the risk for localised malaria transmission.

Environmental Health Determinants

Potential environment health determinants that may have an influence on human health are described in more detail in the environmental sections of the ESIA. For the EOPS Project the most important potential impacts include air quality, noise and vibration, water quality, waste management and management of hazardous chemical substances. This section seeks to cross-reference environmental disciplines that may have a residual impact (following implementation of mitigation defined in the environmental technical chapters) on people.

Traffic

Increased traffic represents less than 1% of the background traffic on the A1 and C46, even if considering all Project vehicles moving during peak hours. Therefore, the Project does not degrade the existing Level of Service[27] or result in an increase in the likelihood of vehicles needing to queue.

Soils, Terrain, Geology and Seismicity

Environmental impacts if incorporated environmental measures and project execution complied with environmental management plans are predicted to be negligible.

Air Quality

No significant air emissions were identified. The area within which air emissions could exceed project standards are limited to within the existing wellpads with the exception of no more than 100 m south of Amosing-1 wellpad and 20 m outside the northern corner of Ngamia-8 wellpad. There are no homesteads within this zone of exceedance, nor was livestock grazing observed in the area.

Noise and Vibration

No significant noise impacts will occur on homesteads. The zone of exceedance does not extend beyond the wellpads by any significant distance and no livestock grazing observed in the area directly surrounding the wellpads.

Water Resources and Quality

Environmental impacts if incorporated environmental measures and project execution complied with environmental management plans are predicted to be negligible.

Landscape and Visual

All potential landscape character assessment or visual assessments were identified as negligible. The proximity of luggas, dense scrubland thicket, riparian vegetation and vegetation with the berms will confine reduced landscape character to the area adjacent to existing wellpads. Similarly, the tree and scrubland vegetation create a natural barrier between the closest receptor and the wellpad facilities.

Biodiversity, Ecology and Protected Areas

[27] Level of Service, according to the Kenyan definition, is the quantitative stratification of quality of service, divided into six letters with LOS A (free flow of traffic) being the best and LOS F (stop and go, congestion) being the worst.

One major and some moderate unmitigated Impacts are predicted relating to potential for influx, site lighting, traffic, gas flares and ponded water. However, with the effective implementation of mitigation, residual impacts can be managed at minor or negligible.

Ecosystem Services

Moderate unmitigated Impacts are predicted relating to potential for influx and grazing for livestock. However, with the effective implementation of mitigation, residual impacts can be managed at minor or negligible.

Cultural Heritage

In considering indirect effects of environmental disciplines (air, noise and visual), all potential effects on living cultural heritage receptors were assessed to be minor to negligible.

There are negligible or minor impacts shown from other environmental disciplines on PAPs, therefore the impacts identified to direct Environmental Health Determinants are predicted to be negligible.

5.10.5.7 Education

No impact topics have been identified in relation to education. Indirect impacts, such as the potential of influx creating a demand on existing education infrastructure, are covered in other sections.

5.10.5.8 Social Maladies

Social maladies similar to other impact topics like influx and inflation cannot be monitored in quantitative terms, but commonly observed and frequently mentioned by key informants and participants in focus group discussions. Such impacts are not easily distinguished from other dynamics and the introduction of more salaried employment has been observed in Lodwar and Lokichoggio to cause a rise in substance abuse, commercial sex work and crime.

The scale of EOPS will be relatively small, but the formal establishment of rest stops for transport and the overall movement of vehicles will increase the potential for increased social maladies.

5.10.5.9 Social Capital and Conflict

In relation to social capital and conflict, two impact categories have been considered: inter-ethnic conflict and community cohesion within Turkana County.

Inter-ethnic conflict

EOPS is likely to affect the context of the conflict between Turkana and Pokot. Baseline information suggests a general improvement of the dynamic between the two ethnic groups from the highest levels of violence seen in 2015. However, there has been an increase in cattle raids and inter-ethnic violence since fieldwork conducted in 2016. The fieldwork also outlined numerous potential triggers for renewed violence, including disagreements over natural resource use, land disputes and accusations across ethnic lines of banditry along the A1 highway that connects Turkana and West Pokot Counties.

Project traffic will generate daily movements through territory that has recently seen violence between the two groups. This trip from Turkana and across West Pokot will be a daily reminder about the development of oil and has the possibility to further debates about County boundaries, job distribution and revenue sharing.

Tanktainers will also be a target for bandits and robberies, requiring increased security along the transport route.

Community cohesion within Turkana County

Within Turkana, social capital and community cohesion will remain strained. The overall high expectations about community benefits are widespread and the actual benefits will not meet expectations, particularly given the size of EOPS. Misunderstandings about employment and why many jobs are given to skilled workers from

outside the area of influence can create jealously that has the potential to create community conflict. Many research interviews confirm the broad expectation that local employment will be generated by industrial development. However, the number of jobs and definition of "local" is understood very differently across the study area.

Another factor in community cohesion is the perception that KPR officers have been diverted away from protecting local communities toward protecting a private sector company. This perception, even if untrue, has the potential to cause further discontent and protests if not appropriately addressed.

Even prior to the Project starting, key informants and other leaders have described growing tension between youth and elders, as well as a gradual shift away from overall respect toward elders and traditional livelihoods.

If left unaddressed, misunderstandings about the oil industry have the potential to negatively affect Turkana. This has and will continue to lead to grievances and to an overall deterioration of community cohesion.

5.10.6 Impact Classification

As described in Section 1, the methodology for evaluation of social impacts will differ from the evaluation of environmental 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. Table 5-24 presents the magnitude of effect criteria and other criteria which will be used for the impact assessment for social themes.

Table 5-24: Impact assessment criteria for social themes

Direction	Consequence	Geographic Extent	Duration
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) **Mixed direction** mixed directions or no net benefit or loss to the affected person(s)	**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) **High consequence** Predicted to seriously change quality of life.	**Local** Local Impact Assessment Study Area **Regional** Upstream Study Area and Midstream Study Area **National** Kenya	**Short-term** Effect is reversible at end of groundworks/ 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 not reversible

5.10.7 Determination of Impact

The rationale behind all impact classifications is presented in the subsequent paragraphs and is tabulated in Volume II. Only the moderate or high consequence rated impacts, which require mitigation, are presented in Table 5-25.

Demographics

The impact from influx has a mixed direction. While new migrants can increase economic opportunities and expand the demand for goods and services, they can also add pressure to existing infrastructure, which are

already in poor condition. The consequence of change is predicted to be moderate. Even with the small number of new workers, the perception of renewed employment can generate migrants coming into the area. The geographic extent of change would be local and changes would be medium-term. The impact consequence rating prior to mitigation is Minor.

Economics, Employment and Livelihoods

The impact on taxes and other payments has a mixed direction. The impacts of taxes and other payments are generally positive given the net economic contribution. However, the impact is mixed based on the potential for tax payments to increase corruption if not monitored. The consequence is considered to be low given that additional payments for the EOPS are expected to be relatively small to the extent that they will not change taxes and other payments to the extent that it would change quality of life in Turkana. The geographic extent will be national and duration is medium-term. The impact consequence is positive.

The impact on Contractor (indirect) employment opportunities has a mixed direction. Additional employment is a positive impact, but new jobs can exacerbate existing social divisions and, in some cases, generate local conflict if job seekers do not trust that recruitment and human resource policies are not transparent. The consequence is moderate, geographic extent will be regional as most positions are expected to be filled by residents in the County. The duration is medium-term. The impact consequence is positive.

This impact of inflation has a negative direction as it is expected to impact the people in the local Project area. The consequence is low given the relatively small increase in salaried employment and local content specifically related to EOPS. The expected geographic extent will be local. The duration is short-term. Overall impact consequence rating prior to mitigation is Minor.

Community Health and Safety

The inherent impact of road traffic accidents has a moderate negative consequence, local geographical extent and a medium duration. Overall impact consequence prior to mitigation is Moderate.

The impact on Sexually Transmitted Diseases has a negative direction, with a potential moderate consequence, a regional geographical extent and a long-term duration. Overall impact consequence prior to mitigation is Moderate.

The impact on Vector-related Diseases related to a modification of the environment around wellfields has a negative direction, with a potential low consequence, a local geographical extent and a medium-term duration. Overall impact consequence prior to mitigation is Minor.

Social Maladies

The impact has a negative direction and the consequence is moderate given that many of the increasing trends are already observable and widespread throughout the County. The geographic extent of change would be local and changes would be medium-term. The impact consequence prior to mitigation is Moderate.

Social Capital and Conflict

The impact on inter-ethnic conflict is negative by direction and the consequence is low given the scale of the EOPS Project. The geographic extent of change is local and the duration is medium-term. The overall impact consequence prior to mitigation is Minor.

The impact on community cohesion is negative by direction. The consequence is moderate. The geographic extent of change is local and the duration if medium-term. The overall impact consequence prior to mitigation is Moderate.

Table 5-25: Impact assessment summarised results for social themes

Impact topic	Project phase	Key source of impact	Impact Consequence
Road traffic accidents	Commissioning/ Operations	Increased Project traffic	Moderate
Sexually Transmitted Infections, including HIV	Commissioning/ Operations	Increased salaried employment and influx of commercial sex workers	Moderate
Social maladies	Commissioning/ Operations	Migrants coming into the area of influence; traffic rest stops and new areas of economic activity	Moderate
Community cohesion	Commissioning/ Operations	Increased oil development in an area with very limited experience of industry	Moderate

5.10.8 Mitigation

This section discusses existing policies and procedures aimed at reducing negative impacts and increasing Project benefits and commitments around EOPS which will inform monitoring and management procedures.

The impact analysis in Section 5 identified that the following topics would not have any impacts resulting from EOPS:

- Administrative divisions and governance structure;
- Infrastructure and services;
- Land Use and Land Ownership; and
- Education.

Negative impacts predicted to be minor or negligible have not been considered further below. However, impact topics that were predicted to be “mixed” in direction are considered to demonstrate how mitigation aims to increase benefits. In such instances, impacts can be expected to be more positive as a result of the Project’s efforts.

One critical mitigation commitment applicable to all impact topics is TKBV’s continuation of its stakeholder engagement work, as set forth in the Project Stakeholder Engagement Plan (SEP). This cross-cutting plan sets the Projects commitments as it relates to information disclosure and consultation. It also sets out a set of engagement methods and events that are intended to maximise participation and to be appropriate for a given stakeholder group’s needs and preferences.

Information about TKBV is often presented with support of a team of Village Socialisation Officers (VSOs) who are situated in all the primary settlements in the Project area of influence. These are employees of TKBV, but they also live in settlements with the idea that they can accurately support the provision of information to local communities, as well as contact TKBV when there are unanticipated problems.

Implementation of the SEP and effective response to grievances (Section 5.10.4) is essential in managing all impact categories described below.

5.10.8.1 Demographics

Influx and migration

Impacts related to influx are not specifically linked to new workers coming into the area for the Project, but rather misunderstanding and rumours that have the potential to revive the arrival of opportunistic job seekers into the area.

Building on the engagement resources described above, TKBV commit to ensure that all labour needs and recruitment (including by contractors) will be disclosed through Community Resource Centres and TKBV engagement staff. TKBV commit to making sure all government and settlement leadership understand that there will be no hiring from the Kapese ISB or any other Project facilities (casual labour hiring is described in more detail below).

TKBV are committed to a disclosure and stakeholder engagement campaign, which will be designed to explain the limited jobs available during EOPS, as well as the procedures that people must follow to get employment. Settlement leaders and residents should be encouraged to report to the government any evidence of outsiders moving into the area for reasons other than traditional movements of pastoral groups.

TKBV commit to additional efforts to obtain regular population data for the Kochodin and Lokichar locations. Data will be collected no less than every six months and will be analysed to identify any areas of potential influx.

5.10.8.2 Economic, employment and livelihoods

Taxes and other payments

TKBV has been an early adopter of the EU Accounting Directive (2013/34/EU), which are implemented on the Reports on Payments to Governments Regulations. This requires UK companies in the extractive sector to publically disclose payments made to governments in countries where they operate. These payments have been and will continue to be disclosed in the company-wide Annual Reports.

Given the importance or transparency in tax payments, as well as the likely influence on other companies, the residual impact of these commitments is likely to increase benefits and reduce the risk that payments to all levels of government can be misused. The residual impact is considered to be positive.

Contractor (indirect) employment

Contractor employment is predicted to be positive, but minor prior to mitigation due to the mixed aspects of the impact. Community work interruptions have been common and the expectation for employment is extremely high. Managing such issues is difficult within a company, but the risk is even greater when multiple contractors hire workers themselves, especially if they are unfamiliar with TKBV's internal policies.

TKBV is committed to the development and implementation of a Human Resources Contractor Guideline, prior to commencement of EOPS that will be used to manage contractor employment. Compliance with the Guideline will be a contractual obligation for all contractors. It recognises that recruitment procedures vary due to the level of the role and location of the job, yet sets out a minimum set of points that all contractors must follow:

- Open advertising of all vacancies through community offices, Turkana County Government offices and relevant Chief's Offices;
- A transparent, objective and fair selection criteria and procedure;
- Thorough scrutiny of identification documents and certificates submitted;
- Adherence to the local content policy;
- Adherence to opportunity sharing agreements;
- Appropriately communicate to candidates at different levels of the exercise;

- Display names of candidates selected;
- Maintain documents for periodic audits;
- Adherence to the Tullow Code of Conduct; and
- Candidates submit Certificate of Good Conduct.

A key part of 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.

TKBV's Contractor Procedures for Local Procurement explain that "local communities are likely to agitate for open and transparent action when they feel the process of procuring local goods and services does not meet their expectations, which may result in work stoppages, blockades and verbal and/or physical threats of violence".

To manage these risks, multiple policies are already in place. At the corporate level, the Policy Statement on Human Rights includes a commitment to respect fundamental labour rights and international labour standards, as set out in the Universal Declaration of Human Rights and the International Labour Organization's Declaration on Fundamental Principles and Rights at Work. This complements the core International Labour Organisation (ILO) that make up the basis of IFC Performance Standard 2.

TBKV are committed to the continued implementation of the policy on TKBV Contractor Non-technical Risk Management requires contractors to undertake all work in alignment with TKBV approach to management of Non-Technical Risks. Within the policy, all contractors must support TKBV's own efforts through the planning, resourcing, execution, monitoring and reporting of an agreed Non-Technical Risk (NTR) Management Plan. TKBV's own standard includes guidance on:

- Cultural Induction;
- Human Resource Guidelines for Contractors including employee grievance mechanism;
- Local Content Guidelines on Employment and Local Procurement;
- Community Grievance Management Procedure;
- Cultural Heritage including requirements for Chance Find Protocol; and
- Applicable guidelines as defined within the TKBV's Environmental and Social Management System.

The Contractor Non-Technical Risk Management procedure provides the basis for helping contractors to follow TKBV internal commitments. The rationale for the procedure is to ensure that TKBV Contractors are both aware of, understand and comply with NTR management requirements as defined by requirements defined by Kenyan law, Tullow Group and international standards. TKBV are committed to Management of TKBV Contractor NTR performance is a key aspect of field level risk management and of Tullow reputation.

In relation to workforce management, contactors must comply (and TKBV are committed to ensuring commitment) with TKBV's Local Content Guidelines on Employment and Local Procurement in the recruitment of personnel and sub-contractors. Within these guidelines, contractors are provided with sample contracts that include critical elements relevant to Performance Standard 2, including:

- Contract period;
- Salary/payment;

- Benefits;
- Hours of Work;
- Overtime;
- Annual leave;
- Confidentiality; and
- Notice period.

The Contractor Procedure – Local Procurement requires all contractors to provide a Local Procurement Plan a minimum of eight weeks prior to the time when goods and services are required. This plan is to be provided to the Field Area Manager and is then shared with appropriate government authorities to assess the needs to consider sharing formulas with local communities.

In cases of recruitment for casual workers, contractors must follow internal procedures and coordinate any such hiring with the Field Area Manager. Any need must be formally outlined in a written plan two weeks prior to hiring and include the number of casuals needed, duration of employment daily rate and commencement of work. These needs are announced in public meetings to be coordinated with the TKBV Social Performance team and Location or Sub-location Chiefs. After a minimum of two days, a public meeting is held that will include Chief, public, contractor representative and TKBV representatives (Field Stakeholder Engagement Officers, Field Area Manager or similar). Meetings are meant to produce two identical lists of nominees, both signed by the Chief in attendance: one for the contractor and one to be kept by TKBV for record keeping. Workers are to sign a document with the proposed terms of hiring. Contractors are responsible for all inductions for casual workers, provision of relevant PPE and informing workers of their roles and duties. Prior to termination, workers must be given one week's notice, at a minimum.

To manage complaints, TBKV must ensure that contractors are committed to ensuring their workers use a grievance mechanism, which is to be copied by the contractor and provide to the Field Area Manager, or to utilise the TKBV Community Grievance Management Procedure operated by the Field Social Performance team.

With these procedural requirements, TKBV reduces the risk of misunderstandings or the potential for nepotism in the management of contractor employment. For issues that are unanticipated, clear and widely distributed grievance procedures are in place. The residual impact is considered to be positive.

Business Opportunities and Local Content

TKBV are committed to ensuring all EOPS opportunities will be advertised publicly at the TKBV Community Resource Centres in Lodwar, Lokichar, Nakukulas and Lokori and at the Enterprise Development Centre in Lokichar.

EOPS opportunities will be advertised online with the above commitment.

Business opportunities are limited for EOPS but will be managed transparently. Unanticipated issues related to local content will be captured by the existing grievance procedures. The residual impact is considered to be positive.

5.10.8.3 Community Health and Safety

Road Traffic Accidents

To reduce the likelihood of negative impacts associated with road traffic accidents, TKBV will develop road safety campaign information that will be targeted to road users and pedestrians, with a focus on communities that reside or travel along the infield roads most used by Project traffic.

Any road traffic accident or related incident will be carefully monitored within the Transport Management Plan. Data will be regularly available and used to identify potential "hot spots" where additional interventions may be needed.

As a part of the management of mobile equipment and machinery within the framework of the Project's Transport Management Plan, TKBV will include a procedure to assess fitness-to-work of drivers, supported by specific medical surveillance programmes and the development and enforcement of a drug and alcohol policy and programme for all work-related vehicles. The Transport Management Plan will include specific workplace health and safety programmes for the management of mobile equipment and machinery, including driver training, fatigue management, vehicle roadworthiness, over-speeding.

TVBV are committed to ensuring that contractor's fleet management controls will include the installation of on-board electronic speed governors or similar tracking devices.

The additional management and mitigation commitments are expected to reduce the impact for a residual impact consequence of Minor.

Sexually Transmitted Diseases, including HIV

TKBV will put a HIV policy in place prior to commencement of EOPS. The policy will make it clear that HIV voluntary screening will be private and stress that test status will not be used in anyway in employment decision, underlining the importance of the principles of non-discrimination.

Camp facilities must be operated on a closed status, reducing opportunities for transactional sexual activity between the employees/contractors and vulnerable local communities.

The Kapese Camp Rules to prohibit the external fraternization of the workforce with the local community. This will need to be developed and signed off as policy and be incorporated into the any contractor Non-Technical Risk (NTR) Management Plan, described above. The code should include provisions that place severe restrictions and sanctions for non-compliance, and while it may be challenging to enforce fully, it will act as a deterrent and reduce risk in relation to other interventions.

Given the risks related to long distance truck drivers, TKBV commit to ensuring Transport contractors will conduct an education and awareness programme on STD/HIV risks. The Transport contractor will ensure employees have access to voluntary screening and testing for STI/HIV and condoms. Care and treatment programmes will be available (provided through employment insurance).

The policy and capacity building commitments are expected to reduce the potential impact of STDs, reducing the residual impact to Minor.

Environmental Modification and Vector-related Diseases

TKBV are committed to minimizing the development of suitable vector breeding sites. This may involve backfilling, draining and management of any area that may, or has collected water, and that may increase the vector densities in the area. This is to be focussed where there are human settlements and pooling of water may increase vector breeding with a risk for localised disease transmission.

TKBV are committed to development of workplace malaria and vector control programmes with a strong focus on source reduction as well as education and awareness on bite prevention activities and the need to seek early medical care in the event of the development of suspicious symptoms.

Environmental Health Determinants

Mitigation and management of potential environment health determinants are described elsewhere in Section 5, under the relevant Environmental discipline headings.

5.10.8.4 Social Maladies

TKBV are committed to implementing a strategy to control the cultural awareness of outsiders coming to Turkana for the first time and to ensure all employees and contractors to accept the standards the Company has set in its Code of Ethical Conduct.

The Human Resources Guidelines for Contractors requires all new employees must be taken through a structured mandatory induction program on the new job, Environmental Health and Safety standards, Tullow Code of Ethical Conduct, HR Policies & Procedures (i.e. payslip and statutory deductions) as well as other expectations placed on those who work in TKBV operations. This structured induction program will be run in a language that the employee is most familiar with, this could be either English or Swahili; where necessary the services of a translator to translate the induction to local dialect should be procured. All duly inducted employees must sign the induction checklist for records, which must also be countersigned by the contractor's Site Manager.

As explained above, TKBV will develop an information campaign on STD/HIV that will be targeted to workers and settlements in the area. The nature of this programme is to make people more aware of the risks before engaging in risky behaviour, particularly commercial sex work.

TKBV is committed to the on-going promotion of the grievance mechanism to give project-affected settlements opportunities to address any complaint they may have.

TKBV is committed to thorough implementation of the Code of Ethical Conduct and information programmes on STI/HIV, as well as the active promotion of the grievance mechanism are expected to reduce the impact of social maladies. The residual impact is expected to be Minor.

5.10.8.5 Social Capital and Conflict

Inter-ethnic conflict

TKBV is committed to implementing the Voluntary Principles on Security and Human Rights. A key commitment in this process is that all TKBV business units include and evaluation of the potential likelihood, severity and operation impact of:

- Crime;
- Civil unrest/disorder;
- Terrorism;
- Kidnap/Piracy;
- Threat of armed conflict or war (local/national/international);
- Disgruntled employee; and
- Risks to communities resulting from our business's security arrangements in areas of operation.

TKBV is committed to instating a cross-functional team, inclusive of stakeholders, which will be engaged to define mitigation activities designed to reduce the impacts arising from each security risk, security controls and countermeasures to reduce prevailing risks and provide layered protection around critical or sensitive activities, response activities aligned to escalation alert levels for security related incidents and resources required to implement security controls and response activities. TKBV will be responsible for updating risk registers or assessments where the risks or vulnerability result in changes to the risk profile.

Security controls will be designed to deter, detect, delay and respond to any threat, external or internal, that has a potential to impact people, physical assets or proprietary information. The access to TKBV sites will be controlled to prevent the entrance of unauthorised personnel, vehicles and prohibited items and security will be

included in journey management procedures where specific security risks are identified. Convoys will be escorted as far as Kainuk to prevent impact on trucking.

Security plans and response levels will be developed such that they are scaled according to the activities, associated risks, vulnerabilities and applicable regulatory requirements. Plans will be approved by senior manager responsible for the activity and endorsed by the appropriate Safety, Sustainability and External Affairs (SSEA) Manager.

The risk assessment described above will be used to identify potential impacts and risks to communities resulting from TKBV's security arrangements in support of the activity. In cases where impacts are identified, a cross-functional team will be engaged to:

- Review risk assessment to understand level of security risk facing the Company and the community;
- Prepare a Stakeholder Analysis to identify, understand and consider the concerns, interests and relationships of stakeholders;
- Work with stakeholders to develop mitigation activities designed to reduce the impacts arising from security arrangements;
- Determine training needs analysis for contracted security provider and TKBV employees;
- Review licensing and authority of Private and Public Security Resources to be engaged; and
- Develop and implement a complaints and grievances mechanism commensurate with the risk rating, and document through the TKBV Incident Reporting System.

Training records and performance against Key Performance Indicators will be documented by private security service providers, and formally assessed by the TKBV managers on a periodic basis.

Public security forces, as a general rule, will only be used where there is no alternative and limited to provide general area security outside of TKBV sites and respond to security incidents in accordance with their jurisdiction.

Within Kenya, on-going monitoring of Turkana and national security incidents is conducted. Monthly reporting highlights trends in relation to security, brief descriptions of incidents and information that can be used to mitigate security risks.

All employees and visitors receive specific security briefing as part of the SSEA induction and orientation process, including:

- An overview of local security risks and controls;
- Personal security responsibilities and reporting requirements; and
- Detail of relevant response actions for security incidents.

Refresher training is provided to all employees at least annually or when risk levels are elevated.

While few of the mitigation commitments above are directly related to inter-ethnic conflict, they attempt to make sure employees, contractors and visitors to TKBV facilities are informed as much as possible about security risks.

5.10.8.6 Community cohesion within Turkana County.

The impact related to community cohesion is linked to high expectations, the challenge of meeting those expectations in conditions of great needs and presenting enough information so that all observers believe in the procedural fairness of TKBV's activities. The main mitigation commitment is to on-going stakeholder engagement.

Since 2015, TKBV has adopted an information management system to capture the results of stakeholder meetings and allow for better analysis to verify the effectiveness of environmental and social management. This system will be used to monitor and track potential problems among local communities. As needed, new information campaigns will be created to correct misunderstandings and address other unanticipated impacts that are identified through continued engagement.

Engagement commitments are expected to be an early warning system for impacts that negatively affect community cohesion. Regular engagement is expected to make the residual impact Minor.

5.10.9 Assessment of Residual Impacts

Some impact topics below were assessed as positive prior to mitigation. They are included in the table since they were also judged to have a mixed direction – both positive and negative impacts. The section on mitigation aims to present commitments to reduce the negative impacts and they therefore have a change when the residual impact is presented.

All impacts listed in Table 5-26 are reduced by stakeholder engagement and the promotion of the grievance mechanisms. Therefore, they are not repeated as impact-specific mitigation.

Table 5-26: Assessment of residual impacts for social themes

Impact Topic	Project Phase	Impact	Impact consequence before mitigation	Mitigation	Residual Impact consequence
Road traffic accidents	Commissioning/Operations	Increased road accidents	Moderate	■ Information campaign on traffic safety ■ Monitoring and investigation of accident data ■ Transport Management Plan ■ Speed control devices	Minor
Sexually Transmitted Diseases, including HIV	Commissioning/Operations	Increase infections	Moderate	■ HIV Policy ■ Closed camp ■ Code of Conduct ■ Non-Technical Risk (NTR) Management Plan ■ Pre-employment screening for STIs ■ Information campaign on STIs	Minor
Social maladies	Commissioning/Operations	Increased crime, commercial sex work and social maladies	Moderate	■ Code of Conduct ■ Information campaign on STDs	Minor
Community cohesion	Commissioning/Operations	Deterioration of community cohesion	Moderate	■ Information management system ■ Community Health, Safety and Security Plan	Minor

5.11 Cultural Heritage

5.11.1 Sources of Effects

It is proposed that no additional land take will be required for EOPS as the existing wellpads and infrastructure, which were permissibly developed during exploration, will be utilised and re-purposed. As no new ground disturbance is proposed (i.e. any activity which 'breaks ground' or that causes sub-surface compaction), direct impacts upon cultural heritage assets are not considered possible and so have been scoped out of the cultural heritage impact assessment. The compaction described in the Project description (Section 4) will be limited in terms of the depth of subsoil affected and confined to areas of previously disturbed ground where there are no known cultural heritage assets recorded.

Indirect sources of effect, however, are possible and so have been considered further in this assessment. This includes potential effects upon the assets themselves, as well as upon their setting. Indirect sources of effect likely to result from EOPS include:

- Noise and vibration effects resulting from operation activities, including operating facility equipment, flaring of gas and vehicular transport of crude oil. The noise and vibration impact assessment (Section 5.4) has been used to inform the cultural heritage impact assessment;
- Air quality effects resulting from operation activities, including emissions from facility equipment and vehicles. The effects of deposited dust and particulate matter in particular are considered. The air quality impact assessment (Section 5.3) has been used to inform the cultural heritage impact assessment; and
- Visual effects upon the setting of assets. The landscape and visual effects analysis (Section 5.7) has been used to inform the cultural heritage impact assessment.

A Traffic Impact Analysis was also completed, the results of which have been considered and accounted for in the noise and vibration, air quality and visual assessments.

5.11.2 Incorporated Environmental Measures

A fundamental design parameter for EOPS, as outlined in the Project description (Section 4), is that existing wellpads and infrastructure will be utilised and re-purposed, thereby eliminating the need to develop additional land or cause further ground disturbance. Incorporated environmental measures to manage air quality, noise and visual effects are considered in the relevant chapters. No environmental measures pertaining specifically to cultural heritage have been incorporated into the engineering design.

5.11.3 Study Area and Receptors

The study area for baseline cultural heritage data collection included both the Upstream and Midstream components of EOPS. It comprised the four wellpads (Amosing-1, Ngamia-3, Ngamia-6 and Ngamia-8) and the full extent of the proposed road route (including infield roads) with a 250 m buffer applied from the boundaries of the wellpads, and a 100 m buffer around the road route.

The Upstream Biophysical Impact Assessment Local Study Area and Midstream Impact Assessment Study Area (as detailed in Section 1) will be used in the cultural heritage impact assessment to analyse any potential noise, air quality or visual effects upon cultural heritage receptors.

Using the assets recorded during the baseline study and the expected sources of effects described in Section 5.11.1, a number of receptors have been identified for inclusion in the effects analysis. Direct sources of effects have been scoped out of the assessment, so the criteria for selecting assets to be considered in the effects analysis were:

- Archaeological assets located within the study area that are considered to have a wider setting (i.e. excluding findspots) of medium, high or very high sensitivity (no low sensitivity sites were identified);

- All living cultural heritage assets located within the study area with medium, high or very high sensitivity (no low sensitivity sites were identified); and
- Intangible cultural heritage within the study area with medium, high or very high sensitivity (no low sensitivity sites were identified).

The criteria for receptor sensitivity are presented in Volume II. The receptors included in the effects analysis are summarised in Table 5-27 and the locations (of tangible receptors[28]) are shown in Drawing 5.11-1. No tangible cultural heritage assets recorded in the Upstream are expected to be affected by EOPS. Only intangible assets in the Upstream will be considered in the effects analysis. Six assets identified in the midstream have been carried forward as receptors in the effects analysis.

Consideration has also been given to the potential for undiscovered archaeological remains to be affected by EOPS. No new land take is proposed and the Specific Site Assessments (SSAs) conducted during exploration recorded no archaeological remains. As such, this potential has been determined to be very low and undiscovered archaeological remains have not been included in the effects analysis.

Table 5-27: Receptors included in the Cultural Heritage Effects Analysis

Type	Receptor(s)
Archaeology	■ TR-006 and TR-007 (Burials).
Living Cultural Heritage	■ TR-001 (Lokichar Mosque); ■ TR-002 (Full Gospel Church of Kenya); ■ TR-011 (Kapenguria Cells); and ■ TR-013 (Italian Church for Prisoners of War).
Intangible Cultural Heritage	■ Turkana culture including Nomadic pastoralism; and ■ Use of the local environment for subsistence.

5.11.4 Considerations from Stakeholder Engagement

Key issues / questions relating to cultural heritage raised during EOPS ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018 as well as appropriate responses is included in Volume II of the ESIA.

5.11.5 Key Guidelines and Standards

The cultural heritage impact assessment has been completed in accordance with Kenyan legislation. The National Museums and Heritage Act (2006) is the key legislation pertinent to the cultural heritage impact assessment.

To meet good practice, the impact assessment has been completed in line with what would be expected for compliance with IFC Performance Standard 8: Cultural Heritage (2012a) (including accompanying guidance - Guidance Note 8: Cultural Heritage (2012b)).

5.11.6 Effects Analysis

5.11.6.1 Methods

The sources of effect upon cultural heritage receptors will be limited to indirect effects. As such, the effects analysis methodology for cultural heritage incorporates the results of the effects analyses for noise and vibration

[28] Identified elements of intangible cultural heritage are widely practised throughout the region (including the whole Upstream area) and so are not specific to one settlement or location.

(Section 5.4), air quality (Section 5.3) and landscape and visual (Section 5.7). Cultural heritage receptors were subsequently compared spatially with the results of these effects analyses using Geographic Information System (GIS) software.

The combined effects of these disciplines were evaluated to complete a holistic qualitative analysis of the effects of EOPS upon cultural heritage receptors. Any receptor for which a negligible effect is predicted was not considered further in the impact assessment.

The results and conclusions of the cultural heritage assessment are also considered in the ecosystem services assessment (Section 5.9).

5.11.6.2 Results

Archaeology

- **Air Quality** – There are no archaeological receptors located within an area where the quantitative model indicates that there is a predicted exceedance of any of the accepted Air Quality Standards (AQS). Therefore, a negligible air quality effect upon archaeological receptors is anticipated. The qualitative assessment also indicates a negligible air quality effect on archaeological receptors;
- **Noise** – The quantitative noise model indicates that there will be a negligible noise effect upon archaeological receptors (during both day and night), with no receptors located within an area where the baseline level or IFC standard will be exceeded. The qualitative assessment also indicates a negligible noise effect along the transport route; and
- **Visual** – The visual assessment indicates that there will be a negligible visual effect upon archaeological receptors, with no receptors within the Zone of Theoretical Visibility (ZTV).

Based upon these indirect effects, it is considered that the overall effect upon the two archaeological receptors will be negligible.

Living Cultural Heritage

- **Air Quality** – There are no living cultural heritage receptors located within an area where the quantitative model predicts an exceedance of the AQS. Therefore, a negligible air quality effect upon living cultural heritage receptors is anticipated. The qualitative assessment also indicates a negligible air quality effect on living cultural heritage receptors, both around the wellpads and along the road route;
- **Noise** – The quantitative noise model indicates that there will be a negligible noise effect upon living cultural heritage receptors (during both day and night), with no receptors located within an area where the baseline level or Project standard will be exceeded. The qualitative assessment indicates a negligible noise effect along the transport route; and
- **Visual** – The visual assessment indicates that there will be a negligible visual effect upon living cultural heritage receptors, with no receptors within the ZTV.

Based upon these indirect effects, it is considered that the overall effect upon living cultural heritage receptors will be negligible.

Intangible Cultural Heritage

It is considered that the overall effect on nomadic pastoralism and use of the environment for subsistence will be negligible. Air quality and noise effects are limited to the land immediately surrounding the wellpads and so, in the wider geographical context, EOPS will have a negligible effect upon these widespread intangible cultural practices.

The potential impact on Turkana culture as a result of social effects from EOPS, which can affect individual fundamental elements of culture, such as social cohesion, are detailed in the Social assessment (Section 5.10).

Where localised air quality and noise effects are noted (affecting less than 1 km^2), which may deter or restrict the practices of nomadic pastoralism and subsistence, any necessary mitigation are considered in the context of the Social assessment (Section 5.10). It is considered that these localised effects will have a negligible effect on intangible cultural resources as a whole in the region.

5.11.7 Impact Classification

The assessment of impacts takes the results of the effects analysis and applies the impact assessment methodology described in Section 1.

5.11.7.1 Magnitude of the Effect

Table 5-28 details the criteria used for the quantitative assessment of potential impacts on cultural heritage receptors.

Table 5-28: Impact assessment parameters for cultural heritage

Magnitude[(a)]	Geographic extent	Duration	Frequency*
Negligible No predicted change from baseline for tangible or intangible cultural heritage receptors. **Low** Anticipated effect on tangible or intangible cultural heritage receptors is slight – considered to be of 'nuisance' value. **Moderate** Anticipated effect on tangible or intangible cultural heritage receptors is moderate. It is considered that the receptor will be changed resulting in modifications to cultural functions and processes.[(a)] **High** Anticipated effect on tangible or intangible cultural heritage receptors is severe. It is considered that the receptor will be wholly changed so that cultural functions and processes are significantly limited or lost entirely.[(a)]	**Local** Within Upstream Biophysical Impact Assessment Local Study Area or Midstream Impact Assessment Study Area **Regional** Exceeds Upstream Biophysical Impact Assessment Local Study Area or Midstream Impact Assessment Study Area **Beyond regional –** transboundary	**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 not reversible	**Infrequent** Effect occurs intermittently but not continuously over the assessment period **Frequent** Effect occurs repeatedly or continuously over the assessment period *if effect duration is permanent then frequency is not considered

(a) An expanded definition of the magnitude criteria for living cultural heritage, intangible cultural heritage and archaeological is presented in Volume II.

5.11.7.2 Determination of Impact

The impact classification of all impacts on cultural heritage receptors have been determined to be negligible. As such, the impact consequence[29] of all impacts on cultural heritage receptors is either negligible or minor. The impact classification process for all cultural heritage receptors is presented in Volume II.

[29] Impact consequence will be determined for some technical areas by consideration of the importance/sensitivity of the receptor in combination with the impact classification

The minor impacts predicted are for the three elements of intangible cultural heritage. These minor impacts are predicted despite the negligible impact classification because of the very high sensitivity of the receptors.

5.11.8 Mitigation

It is considered that the impact consequence at all cultural heritage receptors will be negligible or minor. As such, no specific mitigation measures are required or proposed.

Nevertheless, the construction management plan, traffic management plan and cultural heritage management plan will all include commitments to best practice. A chance finds procedure will also be established, which will be followed during groundworks and installation within the wellpad. In addition, TKBV has a procedure to carry out Cultural Surveys via NMK before commencing any construction works in areas deemed to be culturally sensitive. The traffic management plan will ensure that transportation vehicles are kept to the designated roads and that rest stops are not located in culturally sensitive locations.

The minor impacts on intangible cultural heritage are a function of the receptor sensitivity as opposed to any predicted effects. The social management plan, in its consideration of issues like social cohesion, will address how best to manage impacts to intangible elements of cultural heritage.

The contractors should be committed to monitoring during groundworks. In the unlikely event that archaeological remains are discovered during groundworks and installation, TKBV and their contractors must commit to an evaluation being made by NMK archaeologists as to whether further detailed excavation is required.

Although negligible or minor impacts are predicted, TKBV will ensure that their contractors adopt best practice to ensure that any potential effects on cultural heritage assets are minimised. In addition, TKBV will seek to exert an influence over third party contractors, such as those completing the road improvement works along the midstream, to minimise potential impacts on cultural heritage assets.

5.11.9 Assessment of Residual Impacts

No residual impacts are considered as all impacts predicted are negligible.

5.12 Environmental Risks and Accidents

The Environmental Risk and Accidents section of the ESIA includes an evaluation of Environmental and Industrial Hazards and the probability of their occurrence to assess the risk of unplanned natural and industrial events which could cause environmental or social impacts by adversely affecting the environment or public safety.

This is necessary both to meet national ESIA requirements and specify that the environmental and social management measures emerging from the assessment process should incorporate measures for “emergency preparedness and response”.

The study area for the Environmental Risk and Accidents assessment is the combination of the Upstream Physical Impact Assessment Regional Study Area and the Midstream Impact Assessment Study Area (defined in Section 1).

5.12.1 Hazards to be Considered

This assessment will provide clear guidelines on the avoidance, response to and management of unplanned events. Such events and their consequences are likely to include but not be limited to those outlined below:

Natural Hazards

- Natural seismicity (earthquakes) on built structures, wells and wellpads which may lead to loss of containment or well casing integrity (potential for contamination via surface water or groundwater pathways), and to vibration-sensitive built structures or equipment which may lead to operational failure;
- Heavy rainfall, high wind speeds, flooding or other extreme weather event damaging infrastructure and causing potential for operational failure;
- Fires and damage to Project facilities/infrastructure caused by lightning strike; and
- Dust storms.

Industrial Hazards

- Induced seismicity (due to well testing/ oil production) resulting in risk of well casing failure or failure of built infrastructure;
- Structural or mechanical failure from vehicle/plant collision or other human error;
- Accidental discharges from systems that are normally isolated (e.g. evaporation ponds);
- Well casing/grout integrity failure and down hole collisions during drilling interventions and production;
- Emergency crude release from EPF;
- Emergency gas release from degassers;
- Blow outs from generators, explosions or integrity failure resulting in emergency releases of gas from wells or the EPF;
- Well heater failure leading to pump or well integrity failures;
- Failure in flaring leading to unplanned emissions;
- Diesel spills from vehicles or generators;
- Road Traffic Accident within the wellpad; and
- Road Traffic Accident on public roads.

5.12.2 Considerations from Stakeholder Engagement

Key issues / questions relating to environmental risks and accidents raised during EOPS ESIA consultation meetings in July (Nairobi) and September/October (Turkana) 2018 as well as appropriate responses is included in Volume II of the ESIA.

Prominent issues / questions raised during stakeholder meetings associated with environmental risks and accidents included concerns with safety measures for fuel transportation and the potential for road collisions.

5.12.3 Environmental Risks and Accidents Assessment

For each of the hazards listed in Section 5.12.1, a consequence rating and its probability of occurring have been assigned according to the definitions given in Figure 5-6. Hazard consequence and probability are then combined to give the risk level of each hazard (Table 5-29). All hazards and risk levels take into account the mitigation presented in the technical discipline sections of this ESIA.

EOP S ENVIRONMENTAL AND INDUSTRIAL RISKS AND ASSOCIATED CONSEQUENCES	CONSEQUENCE				
	1	2	3	4	5
	INSIGNIFICANT	MINOR	MODERATE	HIGH	MAJOR
Environment	Lasting days or less; limited to very small area; no environmentally sensitive receptors	Lasting weeks; limited to small area; no environmentally sensitive receptors	Lasting months; impact on an extended area (kilometres); area with some environmental sensitivity	Lasting years; impact on an extended area (kilometres); environmently sensitive habitat	Permanent impact; affects a whole basin or region; highly sensitive habitats
Reputation / Stakeholder / public	awareness/ concern from specific individuals; Minor disturbance of local culture/ social structures	concern/ complaints from certain groups/ organizations; Some reversible impacts on local population.	Isolated complaints from community members/ stakeholders; reversible impacts on local population.	local/ regional public concern and reactions; irreversible impacts on local population (health, property)	national/ international public attention and repercussions; irreversible impacts on local/ regional population (fatality)

PROBABILITY			RISK RATING				
ALMOST CERTAIN	5	The unwanted event occurs in order of one or more times per year & is likely to reoccur within 1 year	11 (M)	16 (S)	20 (S)	23 (H)	25 (H)
LIKELY	4	The unwanted event occurs less than once per year & is likely to reoccur within 5 years	3 (M)	12 (M)	17 (S)	21 (H)	24 (H)
POSSIBLE	3	The unwanted event can occur during the life of the porject & is unlikely to reoccur with any more frequency that every 10 years	4 (L)	8 (M)	13 (S)	18 (S)	22 (H)
UNLIKELY	2	The unwanted event is unlikley to occur during the lifetime of the project & is unlikely to reoccur with any more frequency that every 25 years	2 (L)	5 (L)	9 (M)	14 (S)	19 (S)
RARE	1	The unwanted event has never been known to occur in the business or it is highly unlikely that it will occur within 25 years	1 (L)	3 (L)	6 (M)	10 (M)	15 (S)

Risk Rating	Risk Level	GUIDELINES FOR RISK MATRIX
21 to 25	H - High	A high risk exists, appropriate mitigation strategy to be devised immediately.
13 to 20	S - Significant	A significant risk, appropriate mitigation strategy to be devised as soon as possible.
6 to 12	M - Medium	A moderate risk, appropriate mitigation strategy to be devised as part of the normal management process.
1 to 5	L - Low	A low risk, monitor risk, no further mitigation required.

Figure 5-6: Risk matrix for the assessment of environmental risks and accidents

Table 5-29: Environmental risk assessment

Hazard No.	Hazard	Consequence	Receptor	Consequence rating	Probability	Risk	Management Plan
Natural hazards							
1	Natural seismicity (earthquakes) on built structures, wells and wellpads, vibration-sensitive built structures or equipment	Loss of containment or well casing integrity	Soil, surface water and/or groundwater contamination	Moderate	Rare	Medium	■ Emergency Response Plan ■ Water Management Plan ■ Environmental Monitoring Plan
		Damage to containment structures or storage of hazardous, combustible or explosive materials					
2	Heavy rainfall, high wind speeds, flooding or other extreme weather	Overtopping, or Damage to containment structures or storage of hazardous, combustible or explosive materials	Soil, surface water and/or groundwater contamination	Moderate	Rare	Medium	■ Emergency Response Plan
3	Lightning strike	Vegetation fire	Project facilities, project infrastructure, workforce	Minor	Rare	Low	■ Emergency Response Plan
		Effect on air quality due to smoke from fire	Project facilities, project infrastructure, workforce, terrestrial fauna/flora	Minor	Rare	Low	
4	Dust storms	Damage to site infrastructure and potential operational failure	Project facilities, project infrastructure, project schedule	Minor	Rare	Low	■ Operational Management Plan

Hazard No.	Hazard	Consequence	Receptor	Consequence rating	Probability	Risk	Management Plan
		Safety/health effects on workforce	Workforce on site	Minor	Rare	Low	
Industrial hazards							
5	Induced seismicity (due to well testing/oil production) on built structures, wells and wellpads, vibration-sensitive built structures or equipment	■ See hazard no.1					
6	Structural or mechanical failure, vehicle/plant collision or other human error	■ See hazard 1					
7	Accidental discharges from evaporation ponds	Uncontrolled leaks and spills	Soil, surface water and/or groundwater contamination	Minor	Unlikely	Low	■ Emergency Response Plan ■ Operational Management Plan
8	Well casing/grout integrity failure and down hole collisions during drilling interventions and production	■ See hazard 1					

Hazard No.	Hazard	Consequence	Receptor	Consequence rating	Probability	Risk	Management Plan
9	Emergency crude release from EPF	■ See hazard 1					
10	Emergency gas release from degassers	Inhalation, ingestion or absorption of hazardous substances by site workers	Workforce on-site	High	Unlikely	Significant	■ Hazardous Materials Management Plan ■ Emergency Response Plan ■ Operational Management Plan
11	Blow outs from generators, explosions or integrity failure	■ burns, Blast damage, absorption of hazardous substances by site workers	Workforce on-site	High	Unlikely	Significant	■ Emergency Response Plan ■ Operational Management Plan
12	Well heater failure leading to pump or well integrity failures	■ See hazard 10 & 11					

Hazard No.	Hazard	Consequence	Receptor	Consequence rating	Probability	Risk	Management Plan
13	Failure in flaring leading to unplanned emissions	Inhalation, ingestion or absorption of hazardous substances by site workers and local communities	Workforce on-site and local communities, birds and flying mammals	Moderate	Unlikely	Moderate	■ Hazardous Materials Management Plan ■ Emergency Response Plan ■ Operational Management Plan
14	Diesel spills from vehicles or generators	■ See hazard 1					
15	Road Traffic Accident within the wellpad	Damage to containment structures or storage of hazardous, combustible or explosive materials	■ See hazard 1				
		Vehicle collision causing injury or death	Workforce on-site	Major	Rare	Significant	■ Operational Management Plan ■ Traffic Management Plan ■ Emergency Response Plan

Hazard No.	Hazard	Consequence	Receptor	Consequence rating	Probability	Risk	Management Plan
16	Road Traffic Accident on public roads	Hazardous material spills	Soil, aquatic resources and water resources, Other human road users (including pedestrians)	Major	Rare	Significant	■ Hazardous Materials Management Plan ■ Traffic Management Plan ■ Emergency Response Plan
		Vehicle collision causing injury or death	Other human road users (including pedestrians)	Major	Possible	High	■ Traffic Management Plan ■ Emergency Response Plan ■ Community Health, Safety and Security Plan
		Vehicle collision with sensitive biodiversity receptors	biodiversity receptors (e.g. mammals)	Major	Unlikely	Significant	
		Damage to public infrastructure	Roadside infrastructure such as bridges and powerlines.	Moderate	Possible	Significant	

5.12.4 Mitigation

Management of unplanned events which require an element of environmental or social risk management have been incorporated into the ESIA and will be incorporated into its associated Management Plans (Section 7).

6.0 CUMULATIVE IMPACTS

No other major developments have been identified within the study area that have the potential to generate cumulative impacts with the EOPS Project. However, the improvements being made to the transport route from Amosing-1 to Eldoret may lead to cumulative effects, which must be managed by TKBV and those responsible for the improvements. The mitigation measures described in Section 5 identify where TKBV should seek to exert influence over third parties to manage the environmental and social risks from improving transport routes and to manage the reputational risk of EOPS and TKBV, who are perceived as being linked to these improvements even though the road improvements are outside of the scope of EOPS and therefore not assessed herein.

Improved Access (by KeNHA)

The upgrade works on the C46 road, which links the Amosing and Ngamia fields to Lokichar, could lead to improved vehicular access on this road. This may stimulate charcoal manufacture for transport to local markets, incentivise local beneficiaries to intensify and commercialise harvest of other natural resources, such as medicinal plants and construction material, which could result in increased degradation of habitat receptors. In addition, this could lead to a greater collision risk for species receptors in the Upstream Study Area and degradation of ecosystems supplying services.

Opportunity seekers have been moving to urban areas like Lokichar for reasons related to the County devolution process and the discovery of oil, and to take advantage of the better infrastructure offered in the urban setting. Many residents living in urban settings like Lokichar are former pastoralists and try to maintain small herds of animals as social ties are consolidated via exchange of animals, exacerbating grazing pressure and habitat degradation around settlements. Key informant interviews indicated that the poor state of the roads was a barrier to more rapid influx, and improved roads would promote influx. Further influx to Lokichar is expected to drive increased demand for priority ecosystem services, contributing to impacts in the wider area.

Rest Stops

Although the rest stops used by the logistics contractor are existing and have been audited by TKBV, the improvement to the transport route to Eldoret could lead to an increase in use of the same rest stops by third parties. This increased use could increase the risk of STDs due to the likely increase in availability of sex workers. Strict implementation of strategies described in Section 5.10.8 should be applied by TKBV to ensure no unmanaged contribution to influx at rest stops is made by TKBV employees or contractors.

7.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

An Environmental and Social Management Plan (ESMP) compiles a set of management, mitigation and monitoring measures to be taken during groundworks and installation, operation (including maintenance) and decommissioning to manage key potential environmental and social impacts identified in this ESIA.

The ESMP for EOPS includes the following sections, which will be developed into management plans prior to commencement of EOPS and which will be "living documents", that will need to be updated as appropriate throughout operations:

- Groundworks and Installation Management Plan;
- Environmental Compliance Plan;
- Water Management Plan;
- Biodiversity Management Plan;
- Social Management Plan, including:
  - Workers Health and Safety Plan;
  - Community Health, Safety and Security Management Plan;
  - Human Resources Plan;
  - Local Content and Procurement Plan; and
  - Community Investment Plan;
- Traffic and Transport Management Plan;
- Hazardous Materials Management Plan; and
- Emergency Preparedness and Response Plan.

The following sections present the commitments made in this ESIA which will be addressed with procedures and actions in these plans.

7.1 Groundworks and Installation Management plan

TKBV have made the following commitments in this ESIA, which will be incorporated into the Groundworks and Installation Management Plan and addressed with procedures and actions:

- Ensure the use of soil management practises which reduce the potential for increased soil erosion and contamination of soil;
- Groundworks and installation activities should occur during daylight hours and comply with relevant noise legislation;
- Occupants of all homesteads located within 200 m of the wellpads should be notified prior to the start of groundworks and installation;
- The reuse of existing or remnant access roads, where possible;
- The 2 m bund surrounding each wellpad be maintained at a height of 2 m prior to any groundworks and installation;
- Limit areas of surface disturbance, including the extent of any groundworks on Project roads (e.g. cutting of drains and grading, resulting in additional land-take and erosion development), to avoid loss of habitat;
- A cultural heritage "chance finds" procedure, which will be followed during groundworks and installation within the wellpad; and
- The environmental setting for sacred sites close to groundworks areas should be protected through demarcation of no-go areas for vehicles and Project personnel.

7.2 Environmental Compliance Plan

The Environmental Compliance Plan will describe the practices and policies required to demonstrate environmental compliance in line with the environmental permitting of the Project and the commitments to meet national and international regulation presented in the ESIA. This plan will include triggers, controls relating to compliance to Project standards, the approaches to demonstrating environmental monitoring and reporting.

TKBV have made the following commitments in this ESIA, which will be incorporated into the Environmental Compliance Plan and addressed with procedures and actions:

- Ensure the use of soil management practises which reduce the potential for increased soil erosion and contamination of soil;
- Any discharges from the waste water treatment plant will be managed so that they discharge to the environment at rates and times that are appropriate in relation to existing surface flows and do not increase flood risk;
- Pipe work and sumps will be inspected regularly and maintained to a standard that reduces the potential for unplanned discharges to the environment;
- Waste material will be segregated, handled, stored and disposed of;
- Control measures to prevent releases of waste or residue to the environment (such as HDPE linings);
- Monitoring of emissions and noise through operations, including monitoring frequency, locations, control level and actions should a control level be exceeded;
- Minimise higher frequency noises, such as reverse beepers on vehicles – these can be replaced with less intrusive sounds, while retaining their safety function;
- The 2 m bund surrounding each wellpad be maintained at a height of 2 m throughout operations;
- Directional lighting should be used to minimise light pollution. Lighting should not be directed outwards from the wellpads to reduce disturbance and lighting should be limited where possible on the taller infrastructure within the wellpad, e.g. storage tanks and flare;
- Where practicable, use narrow spectrum bulbs to minimise the range of species affected by lighting (for example, longer wave length red or yellow bulbs rather than “natural” or white light;
- Retention of at least 10 m of unlit habitat (for example, on either side of riparian forest in luggas, which are key commuting habitat for fauna) to prevent loss of habitat connectivity; and
- The environmental setting for sacred sites close to construction/operation areas should be protected through demarcation of no-go areas for vehicles and Project personnel.

7.3 Water Management Plan

The Water Management Plan will give details of all water management on site including flow control structures and drainage, as-built water drainage systems and permitted discharges, protocols on site for environmental protection, along with programmes for inspection, monitoring and maintenance. The plan will also describe the procedure should any unplanned discharge occur to the environment.

TKBV have made the following commitments in this ESIA, which will be incorporated into the Water Management Plan (WMP) and addressed with procedures and actions:

- Any discharges from the waste water treatment plant will be managed so that they discharge to the environment at rates and times that are appropriate in relation to existing surface flows and do not increase flood risk;
- Management of non-contact surface water or contact water will be designed to meet relevant guidelines and take into account the following requirements:

  - Drainage should be designed, constructed, and maintained for recurrence periods of at least a 25-year/24-hour event; and
  - Drainage should be designed to manage the movement and discharge of suspended solids to Kenyan effluent discharge guidelines, or to replicate the natural discharge regime.
- Inspection and maintenance procedures for perimeter wellpad drainage in order to manage the predicted surface water flows, keep contact and non-contact water separate, and allow clean run-off water to infiltrate to ground or be discharged downstream within the same catchment;
- Discharges to the water environment will be monitored for compliance against relevant environmental standards, including monitoring frequency, locations, control level and actions should a control level be exceeded;
- Water abstraction rates and groundwater levels will continue to be monitored in order to comply with the permit and provide ongoing information on changes in the availability of water resources; and
- Minimizing the development of suitable vector breeding sites. This may involve backfilling, draining and management of any area that may, or has collected water, and that may increase the vector densities in the area.

7.4 Biodiversity Management Plan

The Biodiversity Management Plan (BMP) supports conservation through the implementation of practical operational methods and conservation program management. Protocols and training will be identified to conserve the biodiversity of the Project area.

TKBV have made the following commitments in this ESIA, which will be incorporated into the BMP and addressed with procedures and actions:

- Prevention of deliberate/inadvertent invasive species introductions and minimising the spread of existing populations of invasive species and has developed invasive species management procedures that address the issue;
- Prompt and effective rehabilitation and revegetation (with desirable plant species) of disturbed areas;
- Minimisation of unnecessary disturbance of natural areas;
- Implementation of ongoing monitoring in Project-occupied lands throughout the life of the Project to ensure early detection of new areas of weed and pathogen spread, identify previously unrecorded invasive species, pest and pathogens, and assess the efficacy of prescribed control measures;
- Provision of all construction contractors and other subcontractors with a copy of the Tullow invasive species management procedure, and secure their commitment to adhere to the measures outlined therein;
- Adoption of a start-up protocol for the flares so start up only occurs during daylight and ensure no perching birds are present at start up;
- A process for frequent checks for evidence of presence of birds across the wellpad specifically around the flare. Should mortality occur there will be a process for review of operational practices, e.g. flaring times;
- Effective wildlife exclusionary devices should be installed to prevent wildlife mortality. Netting is likely to be the most effective method of keeping birds from entering produced water evaporation ponds. Where faunal species enter the ponds, provisions such as crawl boards should be installed to enable a safe exit;
- Reclamation of all disturbed areas with indigenous species after decommissioning to approximate pre-existing vegetation;
- Surveys of medicinal plant use, wild food use and biomass fuel use (wood and charcoal), to ascertain the baseline usage and set up triggers in the social management plans for identifying where degradation occurs, which could include plant nurseries or alternative fuel studies. It is envisaged that this will be developed further for FFD; and

- Long-term rehabilitation plans that include revegetation of disturbed habitat should be initiated for disturbed ground adjacent to Project roads and within the Project footprint, in an effort to restore any lost capacity to supply ecosystem services.

7.5 Social Management Plan

Social Management Plan describes the immediate and future commitments to manage and mitigate impacts identified in the ESIA with a view to minimizing impacts and maximising benefits for Project affected stakeholders. Some stakeholders will be more affected than others.

The following sections present the commitments made by TKBV in this ESIA, which will be incorporated and addressed with procedures and actions.

Workers Health and Safety

- Adequate protection within the wellpad perimeter to meet appropriate occupational health guidelines.
- Mandatory environmental onboarding for all workers and contractors that highlights conservation issues, cultural heritage/sacred sites and species-specific sensitivities.
- Workplace malaria and vector control programmes with a strong focus on source reduction as well as education and awareness on bite prevention activities and the need to seek early medical care in the event of the development of suspicious symptoms.
- Ensure that contractors are committed to ensuring their workers use a grievance mechanism, which is to be copied by the contractor and provide to the Field Area Manager, or to utilise the TKBV Community Grievance Management Procedure operated by the Field Social Performance team.
- A strategy to control the cultural awareness of outsiders coming to Turkana for the first time and to ensure all employees and contractors to accept the standards the Company has set in its Code of Ethical Conduct.
- Enforcement of a strict bans or guidelines on hunting/gathering/purchasing wild foods for all Project personnel.

Community Health, Safety and Security

- Influx management measures to mitigate the expected Project-associated in-migration effects on provisioning services.
- Gathering of regular population data for the Kochodin and Lokichar locations from the government. Data will be collected no less than every six months and will be analysed to identify any areas of potential influx.
- An HIV policy in place prior to commencement of EOPS
- Implementation of the Voluntary Principles on Security and Human Rights.
- The initiation of a cross-functional team, inclusive of stakeholders, which will be engaged to define mitigation activities designed to reduce the impacts arising from each security risk, security controls and countermeasures to reduce prevailing risks and provide layered protection around critical or sensitive activities, response activities aligned to escalation alert levels for security related incidents and resources required to implement security controls and response activities.

Human Resources

- Disclosure and stakeholder engagement process to describe the limited job opportunities on EOPS.
- All labour needs and recruitment (including by contractors) will be disclosed through Community Resource Centres and TKBV engagement staff. TKBV commit to making sure all government and settlement leadership understand that there will be no hiring from the Kapese ISB or any other Project facilities.
- The development and implementation of a Human Resources Contractor Guideline, prior to commencement of EOPS that will be used to manage contractor employment. Compliance with the Guideline will be a contractual obligation for all contractors.

- Continued implementation of the policy on TKBV Contractor Non-technical Risk Management requires contractors to undertake all work in alignment with TKBV approach to management of Non-Technical Risks. Within the policy, all contractors must support TKBV's own efforts through the planning, resourcing, execution, monitoring and reporting of an agreed Non-Technical Risk (NTR) Management Plan.
- Management of TKBV Contractor NTR performance is a key aspect of field level risk management and of Tullow reputation.
- In cases of recruitment for casual workers, contractors must follow internal procedures and coordinate any such hiring with the Field Area Manager. Any need must be formally outlined in a written plan two weeks prior to hiring and include the number of casuals needed, duration of employment daily rate and commencement of work. These needs are announced in public meetings to be coordinated with the TKBV Social Performance team and Location or Sub-location Chiefs.

Local Content and Procurement

- All local EOPS opportunities will be advertised publicly at the TKBV Community Resource Centres in Lodwar, Lokichar, Nakukulas and Lokori and at the Enterprise Development Centre in Lokichar prior to the time when goods and services are required.

Community Investment

- TBKV are to commence a study to review the supply of fuel alternatives to charcoal to local markets and evaluate opportunities.

7.6 Traffic and Transport Management

The Traffic and Transport Management Plan (TTMP) will give details of training and procedures for all drivers, protocol for vehicle inspection and maintenance, and the protocol should any unplanned events occur on site and off site that could cause harm to local communities or the environment.

The TTMP will also present protocols that will be followed to reduce the potential for accidents during oil transport (e.g. working hour restrictions, speed limits and routeing), and the procedures that will be followed following leaks and spills.

TKBV have made the following commitments in this ESIA, which will be incorporated into the TTMP and addressed with procedures and actions:

- TKBV will commit to the restriction of construction traffic and operation tanktainer movements to daylight hours to reduce the risk of vehicle collisions;
- In order to minimise the risk of collision with protected species, no night time driving will occur adjacent to national park boundaries;
- Ensuring that contractor's fleet management controls will include the installation of on-board electronic speed governors or similar tracking devices;
- A road safety campaign information that will be targeted to road users and pedestrians, with a focus on communities that reside or travel along the infield roads most used by Project traffic;
- A procedure to assess fitness-to-work of drivers, supported by specific medical surveillance programmes and the development and enforcement of a drug and alcohol policy and programme for all work-related vehicles;
- Education of drivers to avoid, where practical and safe, collision with road killed animals and other carrion in cases where scavengers are eating from the carcasses;
- Given the risks related to long distance truck drivers, TKBV commit to ensuring Transport contractors will conduct an education and awareness programme on STD/HIV risks. The Transport contractor will ensure employees have access to voluntary screening and testing for STI/HIV and condoms. Care and treatment programmes will be available (provided through employment insurance).

- The Transport Management Plan will include specific workplace health and safety programmes for the management of mobile equipment and machinery, including driver training, fatigue management, vehicle roadworthiness, over-speeding.

7.7 Hazardous Materials Management

The Hazardous Materials Management Plan will describe all protocols and regulations required to be adhered to by best practice and by the regulators. The procedures for all transport, handling, storage and disposal of hazardous materials will be addressed.

The plan will describe the procedure should any unplanned discharge of hazardous material occur to the environment. TKBV have made the following commitment in this ESIA, which will be incorporated into the TTMP and addressed with procedures and actions:

- All hazardous materials will be identified, segregated, handled and stored as outlined in the Hazardous Materials Risk Management Plan (such as HDPE linings).

7.8 Emergency Preparedness and Response

The Emergency Preparedness and Response Plan will detail mitigation measures associated with the consequences of natural and industrial hazards. Emergency preparedness will be a key training for all staff and TKBV will ensure that the local emergency services are well versed in their procedures and agree the responsibilities of all parties prior to the commencement of groundworks and installation. The necessary permits will be obtained.

The Emergency Preparedness and Response Plan will describe procedures, in the event of a natural or industrial hazard, to safely exit/access and respond to any such event. They could include, but would not be limited to:

- Safe exit from the site in the event of a flood;
- Protocol in case of fire or explosion on site or en-route;
- Protocol in the case of an environmental spill or unplanned discharge; and
- Protocol in case of a seismic event.

Tullow's Emergency Preparedness Standard (2015) also requires the company to undertake an exercise which involves the Identification and Assessment of credible risks and states that "credible emergency scenarios" shall be documented, based on the business unit and operational risk registers/assessments and include an evaluation of the potential likelihood, severity and operational impact of:

- Medical emergencies (Illness, Injury, Fatality);
- Road transport incidents;
- Natural disasters;
- Fire and/or explosion;
- Hazardous release to the environment (including well control);
- Community protest or targeted demonstrations; and
- Security incidents (crime, civil disorder, terrorism, kidnap, piracy, war).

Decommissioning

The plan will define all roles and responsibilities for decommissioning activities relating to the Project legacy, assuming that the infrastructure will not be adopted by FFD activities.

8.0 CONCLUSION

The ESIA evaluated potential impacts on traffic, soils, geology and seismicity, air quality, noise and vibration, water quality, water resources, and landscape and visual impacts and concluded that all impacts associated with the Project would be negligible. Impacts to biodiversity, ecology and protected areas were considered to be moderate and major in some cases, however, with the adoption of mitigation measures identified in the ESIA, are all reduced to either minor or negligible. For potential impacts associated with the socio-economic environment, a number of initially negative impacts can, with the proposed mitigation in place, result in positive benefits.

No other major developments have been identified within the study area that have the potential to generate cumulative impacts with the EOPS Project. However, the improvements being made to the transport route from Amosing-1 to Eldoret may lead to cumulative effects, which must be managed by TKBV and those responsible for the improvements. These other developments include the upgrade works on the C46 road and development of rest stops on the transport route. These are anticipated to result in improved access, leading to pressure on ecosystem services, influx and migration and potential increases in sexually transmitted diseases, which TKBV are committed to managing using the Traffic and Transport Management Plan and Social Management Plans.

An Environmental and Social Management Plan (ESMP) will compile a set of management, mitigation and monitoring measures to be taken during groundworks and installation, operation (including maintenance) and decommissioning to manage key potential environmental and social impacts identified in this ESIA.

9.0 REFERENCES

Adam SEH, Abdel-Banat BMA, Sakamoto A, Takahashi M and Morikawa H. 2008. Effects of atmospheric nitrogen dioxide on Mulukhiya (*Corchorus olitorius*) growth and flowering. *American Journal of Plant Physiology* 3 (4): 180-184

Bies, D. A. and Hansen, C. H. 2009. *Engineering Noise Control: Theory and Practice.* Taylor and Francis, New York

British Geological Survey, 1993: The geothermal activity and geology of the northern sector of the Kenya Rift Valley. Research Report SC/93/1.

Bruce-White C and Shardlow M. 2011. *A Review of the Impact of Artificial Light on Invertebrates*. Buglife – The Invertebrate Conservation Trust

Dempf, H.M. 2014. Hybrid Pastoralists – Development interventions and new Turkana identities. Max Planck Institute for Social Anthropology Working Papers. Working Paper No. 156

Golder Associates Ltd. 2016a. *South Lokichar Basin Upstream Component ESIA Project Standards*

Golder Associates Ltd. 2016b. *Review of IFC Noise Guideline and Kenya Noise Regulation Sound Level Limits – South Lokichar Basin Project*

Fahrig L. 2001. How Much Habitat is Enough? *Biological Conservation* 100:65-74

Gleeson J and Gleeson D. 2012. *Reducing the Impacts of Development on Wildlife.* CSIRO Publishing, Collingwood

Hutchinson TC and Meema KM.1987. Effects of Atmospheric Pollutants on Forest, Wetlands and Agricultural Systems. NATO ASI Series. *Advanced Science Institute Series G: Ecological Sciences*. Volume 16. Springer-Verlag. New York, NY

International Finance Corporation (IFC), 2007a. *Environmental, Health, and Safety (EHS) Guidelines. General EHS Guidelines.* Geneva, Switzerland

International Finance Corporation (IFC), 2007b. *Environmental, Health, and Safety (EHS) Guidelines for Onshore Oil and Gas Development.* Geneva, Switzerland

International Organization for Standardization (ISO), 1993. *ISO 9613-1:1993* Acoustics: *Attenuation of Sound During Propagation Outdoors. Part 1: Calculation of the Absorption of Sound by the Atmosphere*. Geneva, Switzerland

International Organization for Standardization (ISO), 1996. *ISO 9613-2:1993* Acoustics: *Attenuation of Sound During Propagation Outdoors. Part 2: General Method of Calculation*. Geneva, Switzerland

Jetz W, Steffen J and Linsenmair KE. 2003. Effects of light and prey availability on nocturnal, lunar and seasonal activity of tropical nightjars. *Oikos* 103:627–639

Kenyan Government. 2009. *The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) Regulations.* Nairobi, Kenya

National Museums and Heritage Act, 2006. Republic of Kenya

Nicholson E, Westphal MI, Frank K, Rochester WA, Pressey RL, Lindenmayer DB and Possingham HP. 2006. A New Method for Conservation Planning for the Persistence of Multiple Species. *Ecology Letters* 9:1049-1060

Prats, M., 1982: Thermal Recovery. Society of Petroleum Engineers Monograph Series Volume 7

Presidency, Republic of Kenya, 2015. Governancy and Anti-corruption Efforts in Kenya. Accessed 10 July 2017 at: http://www.president.go.ke/2015/08/02/joint-commitment-between-the-government-of-the-republic-of-kenya-and-the-government-of-the-united-states-of-america-to-promote-good-governance-and-anti-corruption-efforts-in-kenya

Price M., 2014a: Kenya Water Study Update. 7 July 2014

Price M., 2014b: Kenya Hydrogeology/Water Resources Study: A brief update. 8 July 2014.Price M., 2015: Conceptual Hydrology of the Lake Turkana Basin. Report 3.1 for Tullow Oil, dated June 2016

Ruggiero LF, Hayward GD, and Squires JR. 1994. Viability Analysis in Biological Evaluations: Concepts of Population Viability Analysis, Biological Population, and Ecological Scale. *Conservation Biology* 8:364-372

USFWS. 2009. Migratory bird mortality in oilfield wastewater disposal facilities. U.S. Fish & Wildlife Service Wyoming Ecological Services Field Office 5353 Yellowstone Road—308 Cheyenne, WY 82009 (307) 772-2374 http://www.fws.gov/mountain-prairie/ contaminants/contaminants1b.html, accessed 18 July 2017

With KA and Crist TO. 1995. Critical thresholds in species responses to landscape structure. *Ecology* 76:2446-2459

World Bank Group. 1999. *Pollution Prevention and Abatement Handbook, 1998: Toward Cleaner Production*. In Collaboration with the United Nations Environment Programme and the United Nations Industrial Development Organization. The World Bank Group, Washington, D.C.

World Health Organization. 2000. *Air Quality Guidelines for Europe, Second Edition*. WHO Regional Publications, European Series, No. 91. Copenhagen, Denmark

Worley Parson Consulting. 2015: Infrastructure and Logistics Concept Study - Phase 1 Development, Kenya. Water Management, Flood Risk Assessment Report. 10 June 2015

Signature Page

Golder Associates (UK) Ltd

Harvey Rich
ESIA Project Coordinator

Andrew Morsley
ESIA Project Manager

Date: 27 November 2018

JLM/CR/AJM/TGF/HR/ES

Company Registered in England No.1125149
At Attenborough House, Browns Lane Business Park, Stanton-on-the-Wolds, Nottinghamshire NG12 5BL

VAT No. 209 0084 92

DRAWINGS

Drawing 1.5-1: Collated Upstream Baseline Study Areas

Early Oil Pilot Scheme

Key

- Noise Quality Upstream Study Area
- Air Quality Upstream Study Area
- Landscape Upstream Study Area
- Soil Upstream Study Area
- Groundwater and Surface Water Upstream Local Study Area
- Groundwater and Surface Water Upstream Regional Study Area
- Cultural Heritage Upstream Study Area
- Biodiversity Upstream Local Study Area
- Watercourse

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared by:	Reviewed by:	Approved by:
1654017	LD 01/09/2017	CR 04/08/2017	AM 04/08/2017

TULLOW OIL plc

GOLDER

Cavandish House, Bourne End, SL8 5AS, UK.

N

Scale (at A3): 1:150,000

0 0.5 1 2 3 4 5 Kilometres

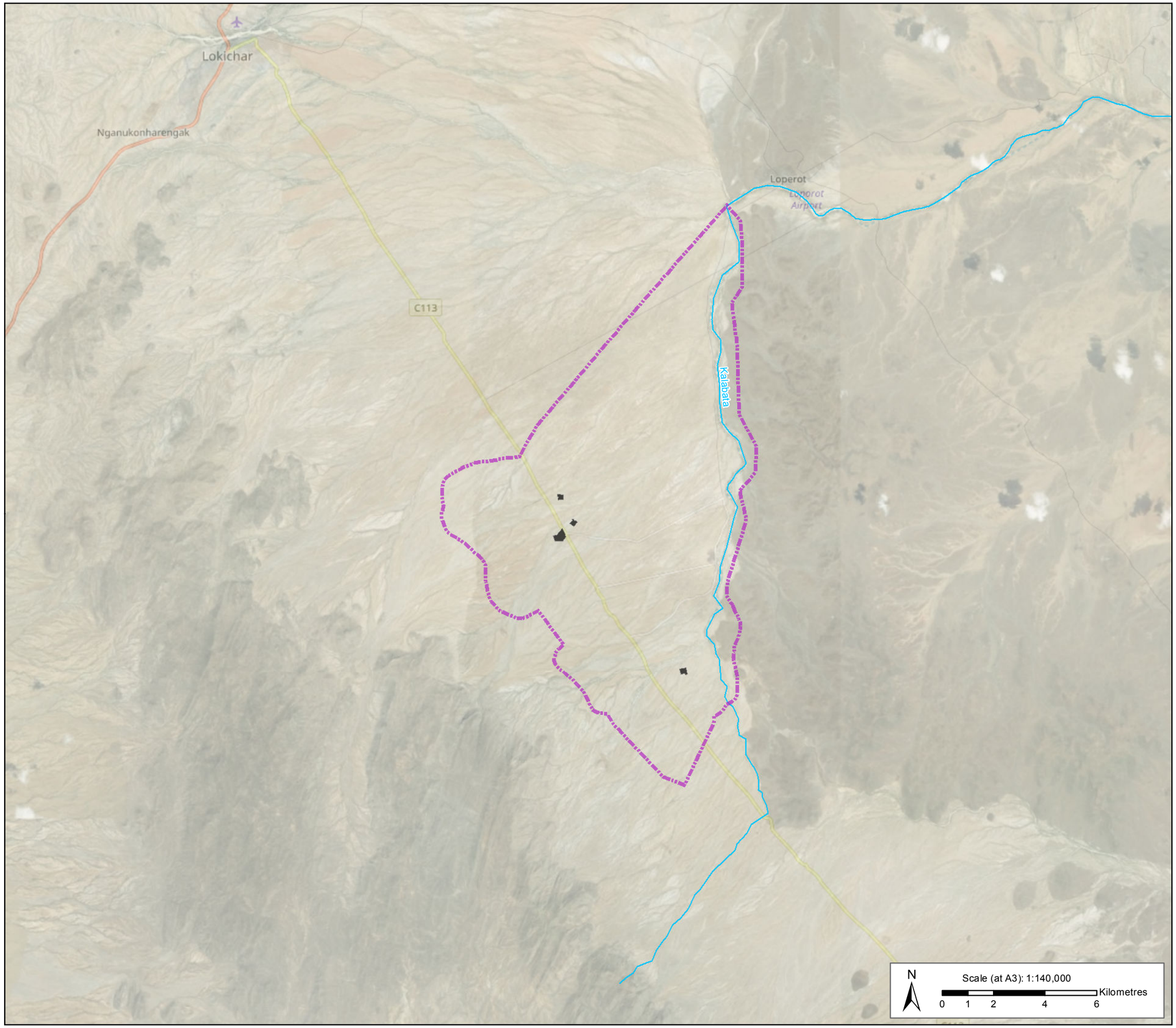
Map path: Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_701\02_PRODUCTION\MXD\1654017-701-OG-290-F1.5-1-Baseline-Upstream-Study-Areas.mxd

Drawing 1.5-2: Upstream Biophysical Impact Assessment Local Study Area

Early Oil Pilot Scheme

Key

- Upstream Biophysical Impact Assessment Local Study Area
- Well Pad
- Watercourse



Coordinate System: WGS 1984 UTM Zone 36N

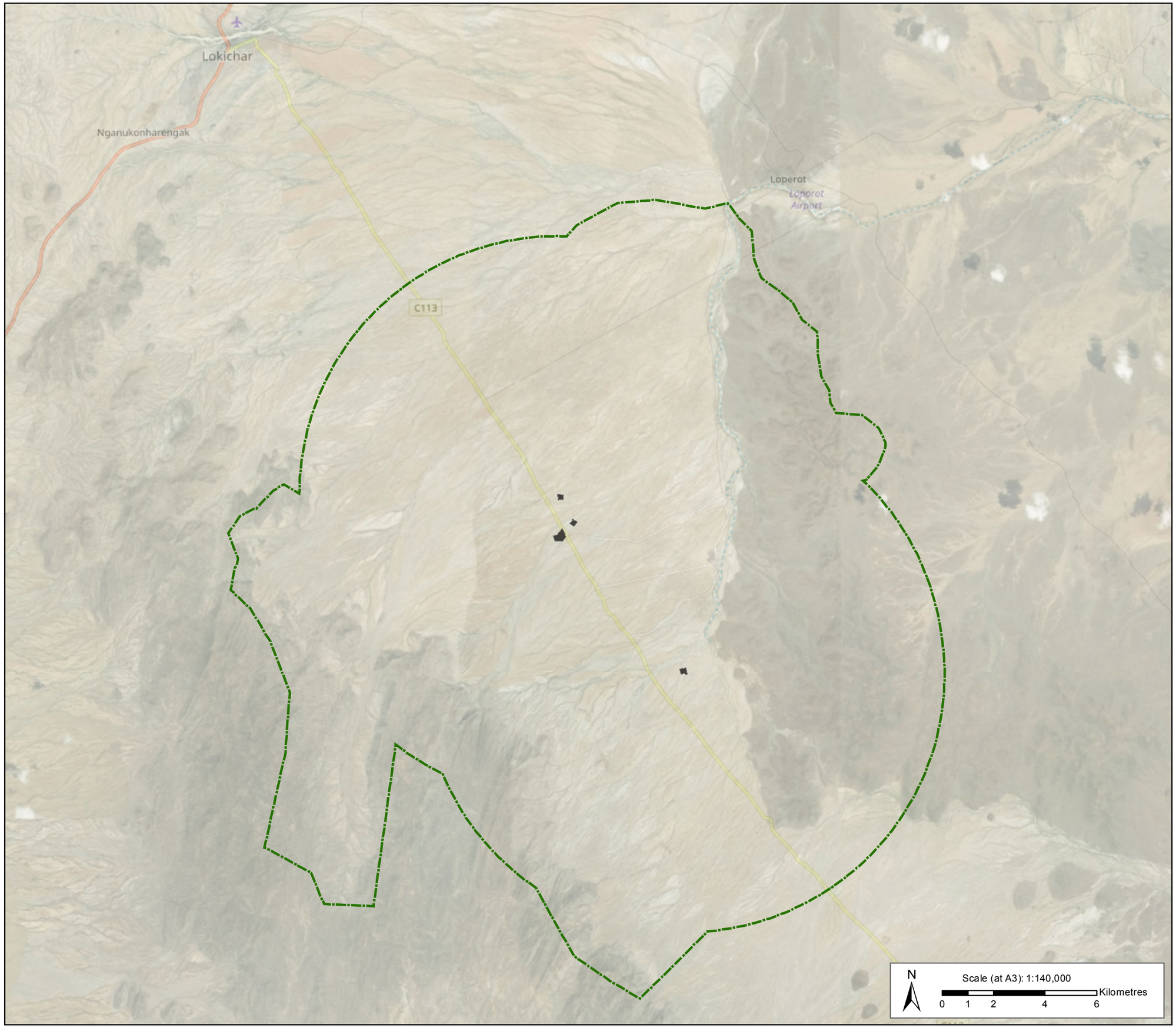
Project Ref:	Prepared by:	Reviewed by:	Approved by:
1654017	LD 05/06/2018	CR 04/08/2017	AM 04/08/2017

TULLOW OIL plc

GOLDER

Cavandish House, Bourne End, SL8 5AS, UK.

Map path: Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_701\02_PRODUCTION\MXD\1654017-701-OG-291-F1.5-2-Upstream-Biophy-Study-Area.mxd



Drawing 1.5-3: Upstream Physical Impact Assessment Regional Study Area

Early Oil Pilot Scheme

Key

- Upstream Physical Impact Assessment Regional Study Area
- Well Pad
- Watercourse

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared by:	Reviewed by:	Approved by:
1654017	LD 05/06/2018	CR 04/08/2017	AM 04/08/2017

TULLOW OIL plc

GOLDER

Cavandish House, Bourne End, SL8 5AS, UK.

Map path: Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_701\02_PRODUCTION\MXD\1654017-701-OG-292-F1.5-3-Upstream-Phy-Study-Area.mxd

Drawing 1.5-4: Upstream Biological Impact Assessment Regional Study Area

Early Oil Pilot Scheme

Key

- Upstream Biological Impact Assessment Regional Study Area
- Well Pad
- Watercourse

770000

340000

140000

Kapedo
Kaabong
Kaabong
Kotido
Akademothy
Moroto
Moroto
Napak
Napak
Katakwi
Nakapiripirit
Amudat
Amudat
West Pokot
Kapir
Koloin
Ngora
Kumi
Kabarwa Trading Centre
Kwen
Bukedea
Bulambuli
Koliri
Mukongoro
Bukwo
Sironko
Sironko
Nakaloke
Kapenguria
Kibuku
Budaka
Mbale
Budaka
Mbale
Bukalasi
Bubulo
Butaleja
Manafwa
Trans Nzoia
Mors Bridge
Lwakhakha
Elegeyo-Marakwet
Kapsowar
Maralal
Lokichar
Kalabata
Kerio
Turkwel
Lodwar
Kalokol
Lake Turkana
Loiyangalani

N

Scale (at A3): 1:1,150,000

0 5 10 20 30 40 Kilometres

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared by:	Reviewed by:	Approved by:
1654017	LD 05/06/2018	CR 04/08/2017	AM 04/08/2017

TULLOW OIL plc

GOLDER

Cavandish House, Bourne End, SL8 5AS, UK.

Map path: Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_701\02_PRODUCTION\MXD\1654017-701-OG-293-F1.5-4-Upstream-Biological-Study-Area.mxd

Drawing 1.5-5: Upstream Social Impact Assessment Study Area

Early Oil Pilot Scheme

Key

- Upstream Social Impact Assessment Study Area
- Administrative Division
- Country Boundary
- Watercourse
- Well Pad

Nakwehe
Lodwar
Turkwell
Turkana Central
Loima
Loiyangalani
Lake Turkana
Turkana South
Lokichar
Kalabata
Endo
Amudat
Uganda
Kenya
Amudat
West Pokot
Turkana East
Suam
Kapenguria
Mbere
Koitobos
Trans Nzoia
Kapsowar
Nzoia
Mora Bridge
Maralal

770000
970000
340000
140000

N

Scale (at A3): 1:900,000

0 5 10 20 30 Kilometres

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared by:	Reviewed by:	Approved by:
1654017	LD 01/09/2017	CR 04/08/2017	AM 04/08/2017

TULLOW OIL plc

GOLDER

Cavandish House, Bourne End, SL8 5AS, UK.

Map path: Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_701\02_PRODUCTION\MXD\1654017-701-OG-294-F1.5-5-Social-IA-Study-Area.mxd

Drawing 1.5-6: Midstream Impact Assessment Study Area

Early Oil Pilot Scheme

Key

- Midstream Impact Assesssment Study Area
- Well Pad Location

770000 970000 1170000 1370000

140000 -60000 -260000 -460000

Napak Amudat Nakapiripirit West Pokot Bukwo Trans Nzoia Elegeyo-Marakwet Mbale Bungoma Baringo Uasin Gishu Busia Kakamega Nandi Siaya Kisumu Kericho Nakuru Homa Bay Kisii Bomet Migori Narok Nairobi Machakos Kajiado Makueni Kitui Meru Tharaka-Nithi Embu Kirinyaga Nyeri Murang'a Thika Laikipia Samburu Isiolo Wajir Marsabit National Park Mount Kenya National Park Tana River Garissa Dadaab Jubbada Hoose جوبا السفلى Lamu Kilifi Malindi Mombasa Kwale Kilimanjaro Taita-Taveta Kilimanjaro National Park Moshi Arusha Tsavo East National Park Kibwezi Ngorongoro Conservation Area Serengeti National Park Simiyu Tarangire National Park Manyara Lake Eyasi

N

Scale (at A3): 1:2,800,000

0 22,500 45,000 90,000 135,000 Metres

Coordinate System: WGS 1984 UTM Zone 36N

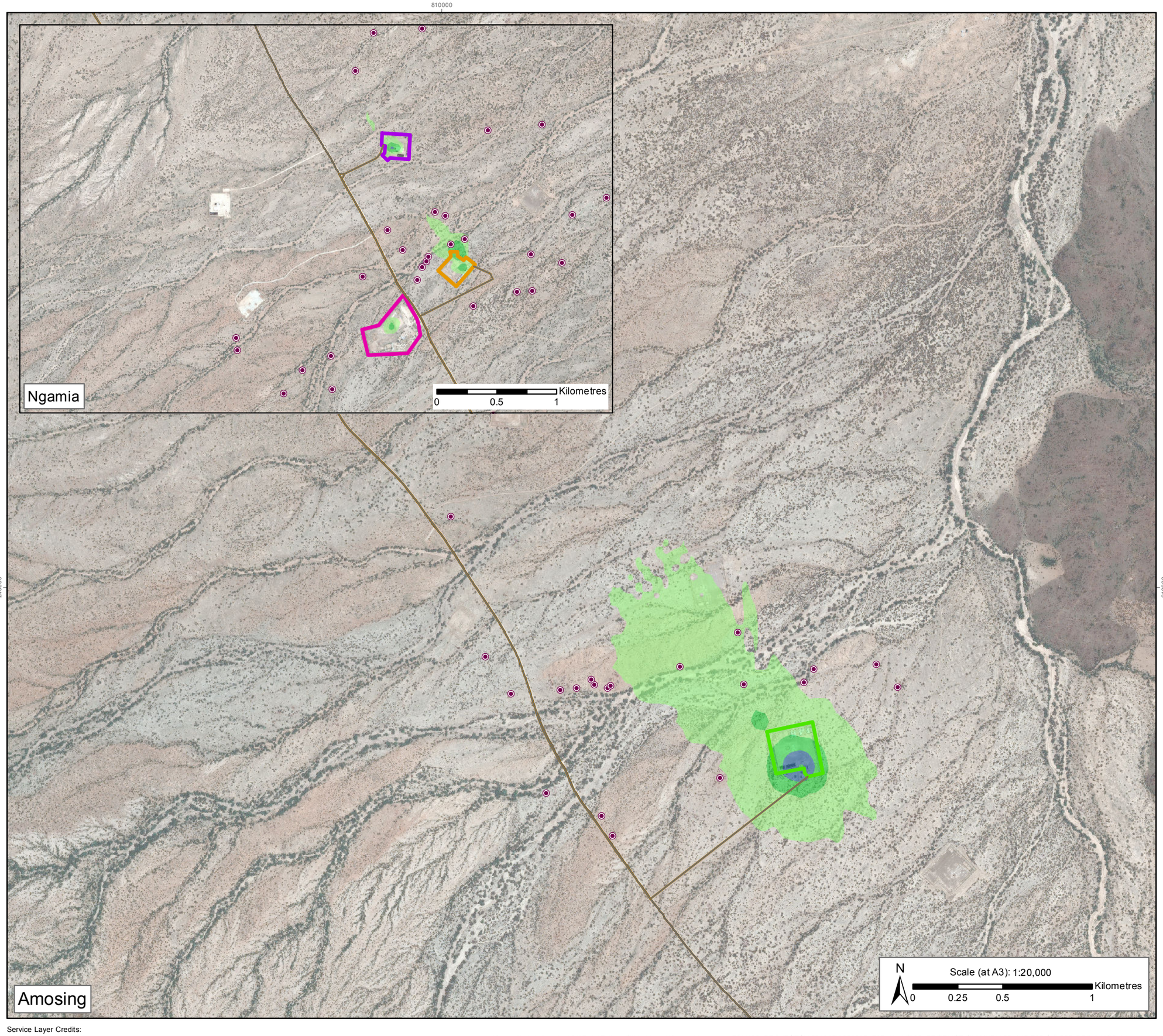
Project Ref:	Prepared by:	Reviewed by:	Approved by:
1654017	LD 27/11/2018	CR 27/11/2018	AM 27/11/2018

TULLOW OIL plc

GOLDER

Cavandish House, Bourne End, SL8 5AS, UK.

Map path: Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_701\02_PRODUCTION\MXD\1654017-701-OG-295-F1.5-6-Midstream-Biological-Study-Area.mxd



Drawing 5.3-1: NO_2 1 hour Predicted Environmental Concentration

Early Oil Pilot Scheme

Key

- Homestead (identified during May 2017 land survey)

Well Pad

- Amosing-1
- Ngamia-1
- Ngamia-3
- Ngamia-8
- Access Road

NO_2 1 hour Concentration PEC ($\mu g/m^3$)

- > 200 (Exceedance of AQS)
- 100.1 - 200
- 50 - 100

NOTES

NO_2 1 hour AQS for Human Health is 200 $\mu g/m^3$
Values under 50 $\mu g/m^3$ are omitted

Data sources:
Data sourced from client.

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	LD 26-05-2017	RL 26-05-2017	AM 27-11-2018

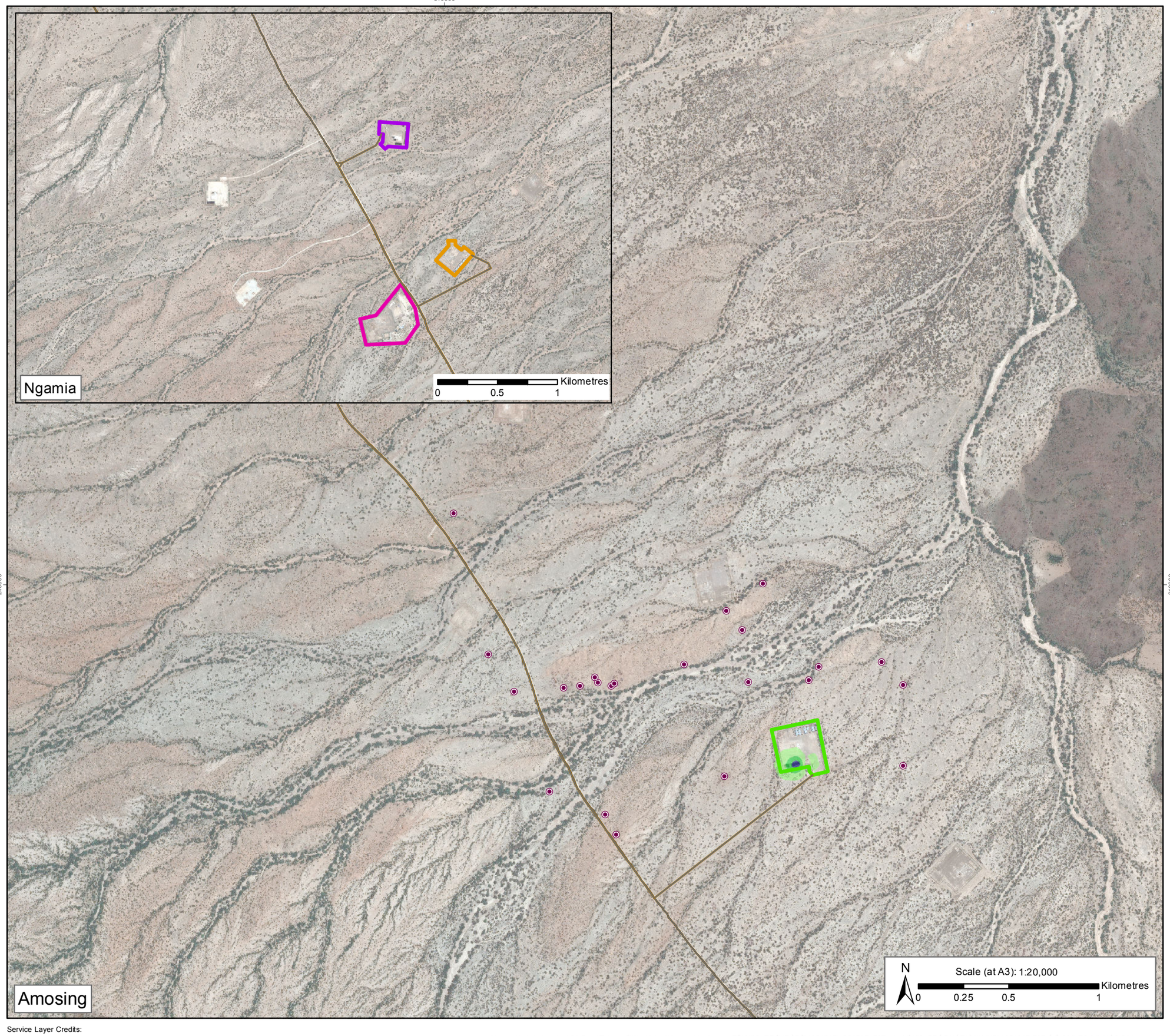
TULLOW OIL plc

GOLDER

Cavandish House, Bourne End, SL8 5AS, UK.

Service Layer Credits:

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_707_IA_AQ\02_PRODUCTION\MXD\1654017-707-OG-237-D5.3-1-NO2-1-hour.mxd



Drawing 5.3-2: NO_2 24 hour Predicted Environmental Concentration

Early Oil Pilot Scheme

Key

- Homestead (identified during May 2017 land survey)

Well Pad

- Amosing-1
- Ngamia-1
- Ngamia-3
- Ngamia-8
- Access Road

NO_2 24 hour Concentration PEC ($\mu g/m^3$)

- > 188 (Exceedance of AQS)
- 100.1 - 188
- 50 - 100

NOTES

NO_2 24 hour AQS for Human Health is 188 $\mu g/m^3$
Values under 50 $\mu g/m^3$ are omitted

Data sources:
Data sourced from client.

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	LD 26-05-2017	RL 26-05-2017	AM 27-11-2018

TULLOW OIL plc

GOLDER

Cavandish House, Bourne End, SL8 5AS, UK.

Service Layer Credits:

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_707_IA_AQ\02_PRODUCTION\MXD\1654017-707-OG-236-D5.3-2-NO2-24-hour.mxd

Drawing 5.3-3: NO_2 Annual Predicted Environmental Concentration

Early Oil Pilot Scheme

Key

- Homestead (identified during May 2017 land survey)

Well Pad

- Amosing-1
- Ngamia-1
- Ngamia-3
- Ngamia-8
- Access Road

NO_2 Annual Concentration PEC ($\mu g/m^3$)

- (Exceedance of AQS)
- > 40 (Exceedance of AQS)
- 20.1 - 40
- 2 - 20

Ngamia

Kilometres
0 0.5 1

Amosing

N

Scale (at A3): 1:20,000

Kilometres
0 0.25 0.5 1

810000

240000

NOTES

NO_2 Annual AQS for Human Health is 40 $\mu g/m^3$
Values under 2 $\mu g/m^3$ are omitted

Data sources:
Data sourced from client.

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	LD 26-05-2017	RL 26-05-2017	AM 27-11-2018

TULLOW OIL plc

GOLDER

Cavandish House, Bourne End, SL8 5AS, UK.

Service Layer Credits:

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_707_IA_AQ\02_PRODUCTION\MXD\1654017-707-OG-235-D5.3-3-NO2-Annual.mxd

Drawing 5.3-4: NO_x 24 hour Process Contribution

Early Oil Pilot Scheme

Key

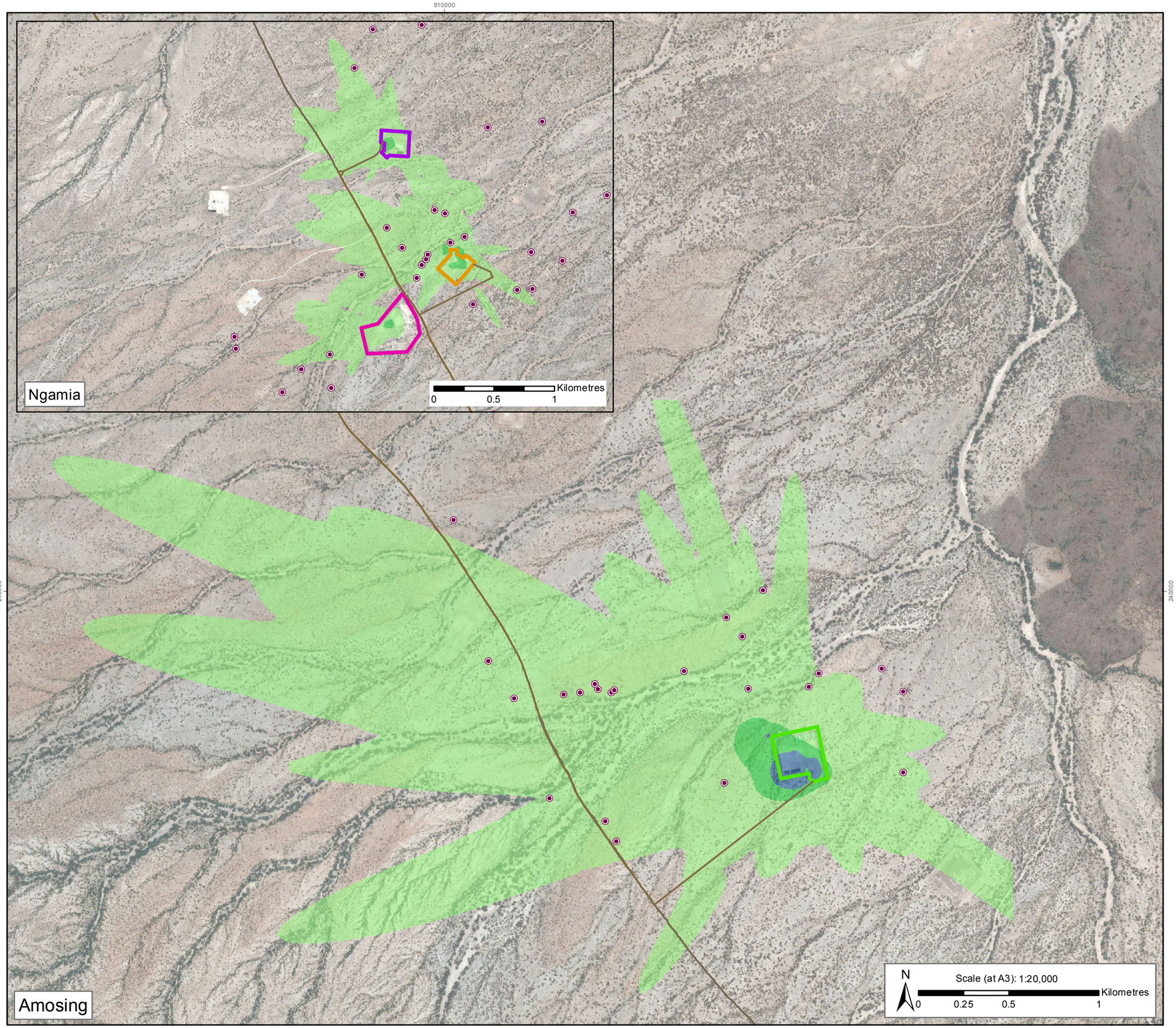
Homestead (identified during May 2017 land survey)

Well Pad

- Amosing-1
- Ngamia-1
- Ngamia-3
- Ngamia-8
- Access Road

NO_x 24 hour Concentration PC ($\mu g/m^3$)

- > 80 (Exceedance of AQS)
- 40.1 - 80
- 10 - 40



NOTES

NO_x 24 hour AQS for Human Health is 80 $\mu g/m^3$
Values under 10 $\mu g/m^3$ are omitted

Data sources:
Data sourced from client.

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	LD 26-05-2017	RL 26-05-2017	AM 27-11-2018

TULLOW OIL plc

GOLDER

Cavandish House, Bourne End, SL8 5AS, UK.

Service Layer Credits:

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_707_IA_AQ\02_PRODUCTION\MXD\1654017-707-OG-239-D5.3-4-NOx-24-hour.mxd

Drawing 5.3-5: NO_x Annual Process Contribution

Early Oil Pilot Scheme

Key

- Homestead (identified during May 2017 land survey)

Well Pad

- Amosing-1
- Ngamia-1
- Ngamia-3
- Ngamia-8
- Access Road

NO_x Annual Concentration PC ($\mu g/m^3$)

- > 60 (Exceedance of AQS)
- 30.1 - 60
- 5 - 30

Ngamia

Kilometres
0 0.5 1

Amosing

N

Scale (at A3): 1:20,000

Kilometres
0 0.25 0.5 1

810000

240000

NOTES

NO_x Annual AQS for Human Health is 60 $\mu g/m^3$
Values under 5 $\mu g/m^3$ are omitted

Data sources:
Data sourced from client.

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	LD 26-05-2017	RL 26-05-2017	AM 27-11-2018

TULLOW OIL plc

GOLDER

Cavandish House, Bourne End, SL8 5AS, UK.

Service Layer Credits:

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_707_IA_AQ\02_PRODUCTION\MXD\1654017-707-OG-238-D5.3-5-NOx-Annual.mxd

Drawing 5.3-6: SO_2 10 Minute Predicted Environmental Concentration

Early Oil Pilot Scheme

Key

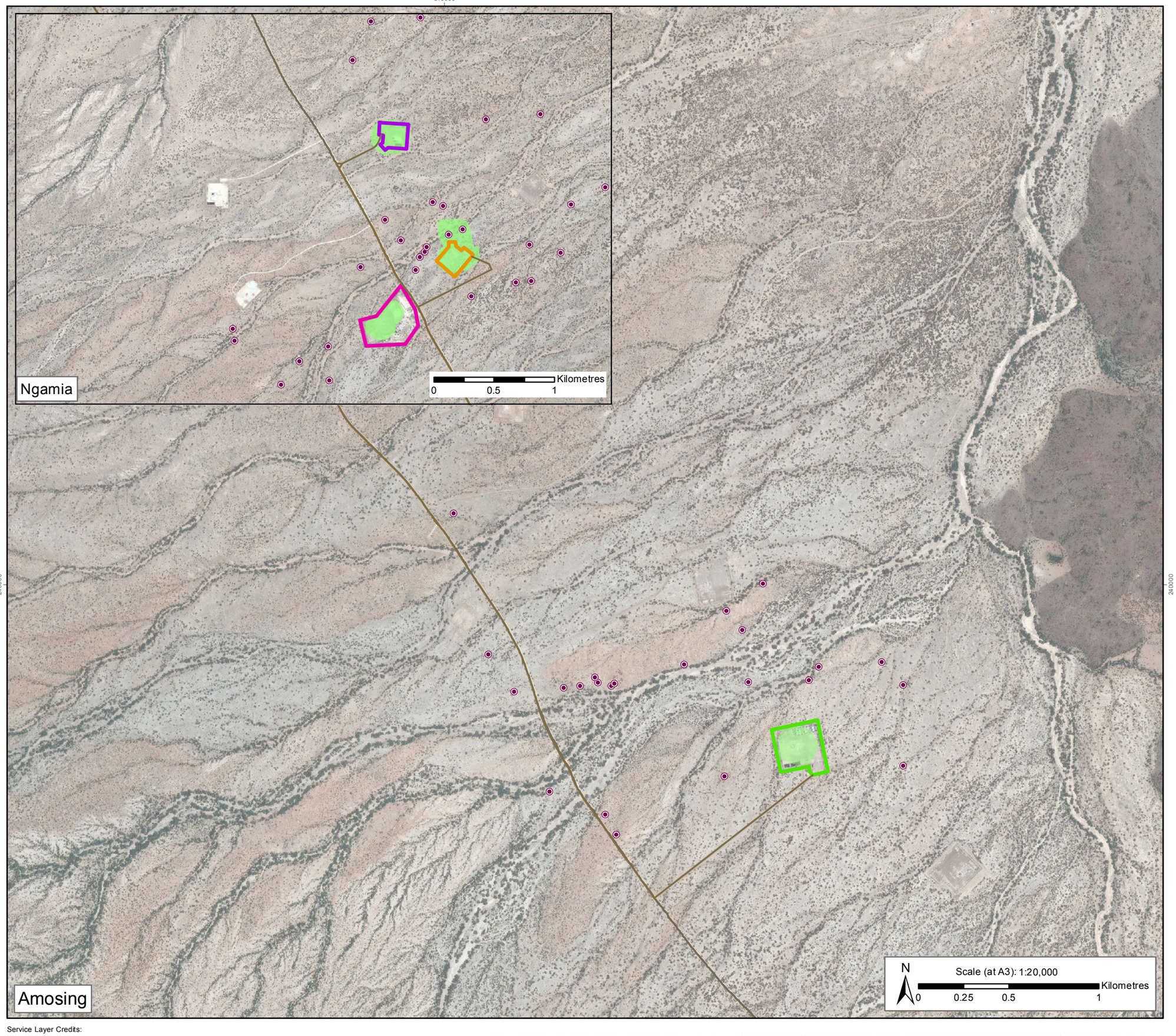
Homestead (identified during May 2017 land survey)

Well Pad

- Amosing-1
- Ngamia-1
- Ngamia-3
- Ngamia-8
- Access Road

SO_2 10 minute PEC (µg/m^3)

- < 5



NOTES

SO_2 10 minute AQS for Human Health is 500 µg/m^3
The highest SO_2 value was 4.8360 µg/m^3
Values under 3.65 µg/m^3 are omitted

Data sources:
Data sourced from client.

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref: 1654017	Prepared By: LD 26-05-2017	Reviewed by: RL 26-05-2017	Approved by: AM 27-11-2018

TULLOW OIL plc

GOLDER

Cavendish House, Bourne End, SL8 5AS, UK

Service Layer Credits:

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_707_IA_AQ\02_PRODUCTION\MXD\1654017-707-OG-234-D5.3-6-SO2-10-min.mxd

Drawing 5.3-7: SO_2 24 Hour Predicted Environmental Concentration

Early Oil Pilot Scheme

Key

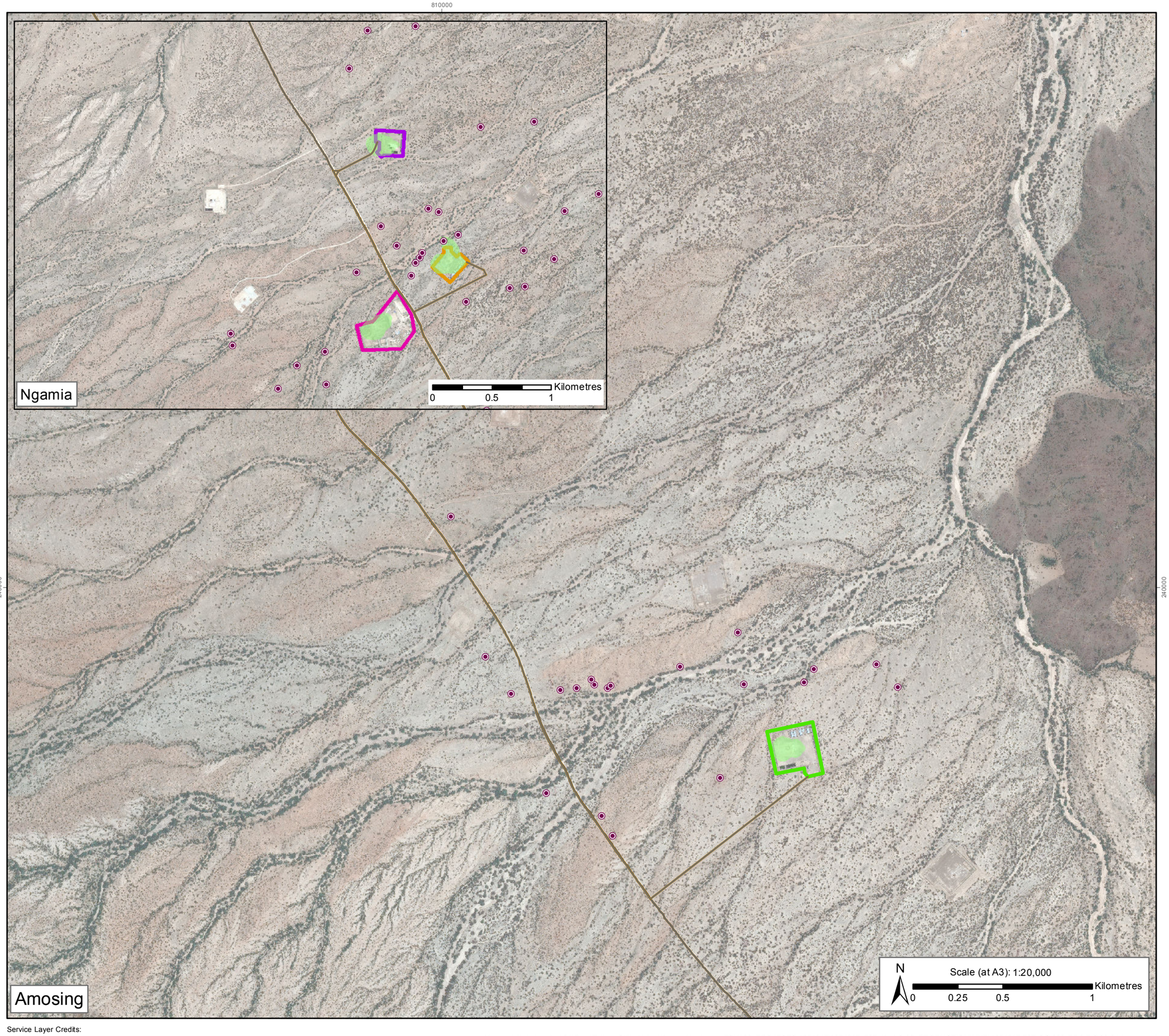
- Homestead (identified during May 2017 land survey)

Well Pad

- Amosing-1
- Ngamia-1
- Ngamia-3
- Ngamia-8
- Access Road

SO_2 24 Hour PEC (µg/m^3

- < 2



NOTES

SO_2 24 hour AQS for Human Health is 20 µg/m^3
The highest SO_2 value was 1.4480 µg/m^3
Values under 1.31 µg/m^3 are omitted

Data sources:
Data sourced from client.

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref: 1654017	Prepared By: LD 26-05-2017	Reviewed by: RL 26-05-2017	Approved by: AM 27-11-2018

TULLOW OIL plc

GOLDER

Cavandish House, Bourne End, SL8 5AS, UK.

Service Layer Credits:

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_707_IA_AQ\02_PRODUCTION\MXD\1654017-707-OG-233-D5.3-7-SO2-24-hours.mxd

Drawing 5.3-8: SO_2 Annual Predicted Environmental Concentration

Early Oil Pilot Scheme

Key

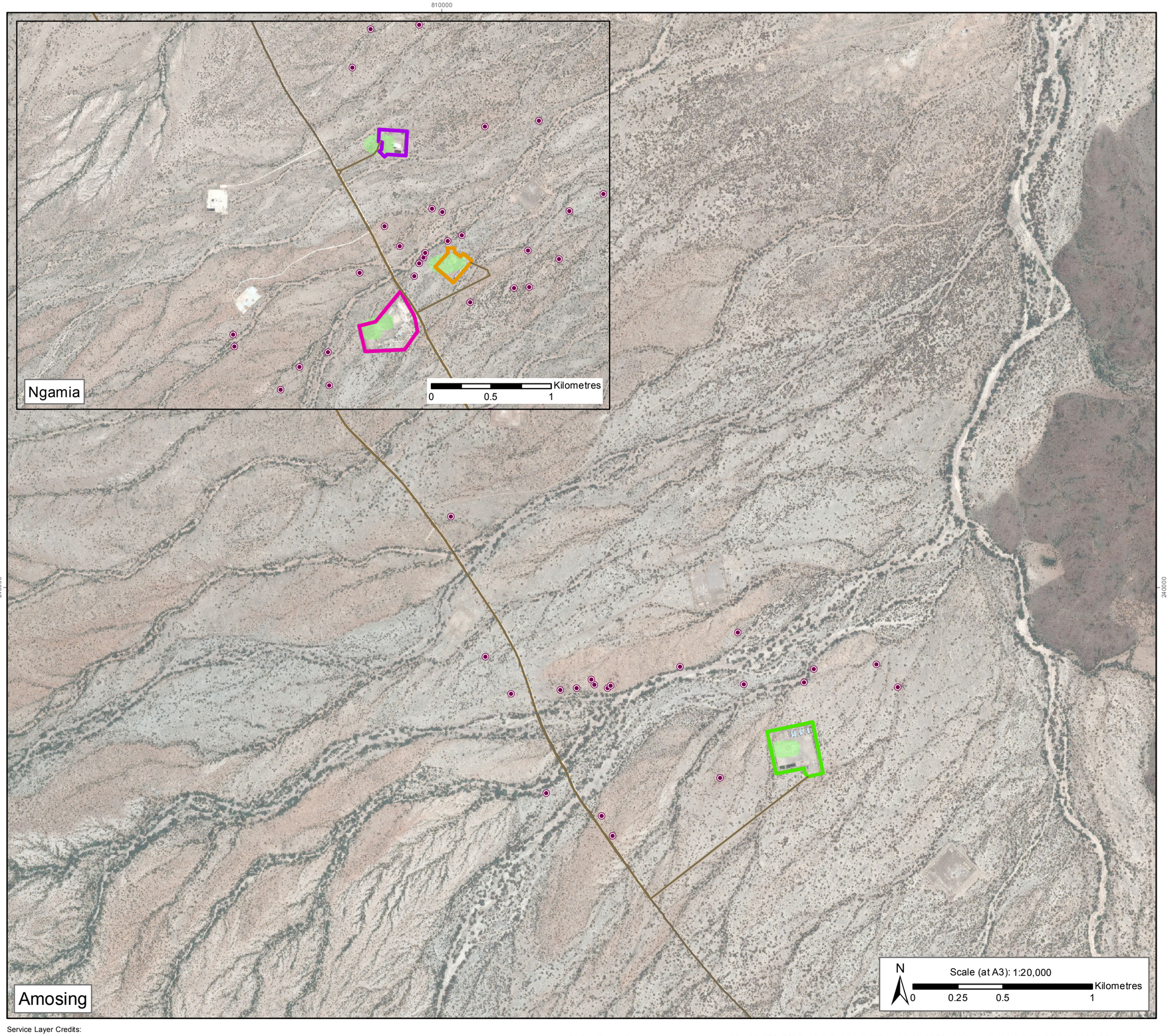
- Homestead (identified during May 2017 land survey)

Well Pad

- Amosing-1
- Ngamia-1
- Ngamia-3
- Ngamia-8
- Access Road

SO_2 Annual PEC (µg/m^3)

- < 2



NOTES

SO_2 Annual AQS for Human Health is 50 µg/m^3
The highest SO_2 value is 1.119 µg/m^3
Values under 1.1035 µg/m^3 are omitted

Data sources:
Data sourced from client.

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	LD 26-05-2017	RL 26-05-2017	AM 14-07-2017

TULLOW OIL plc

GOLDER

Cavendish House, Bourne End, SL8 5AS, UK

Service Layer Credits:

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_707_IA_AQ\02_PRODUCTION\MXD\1654017-707-OG-232-D5.3-8-SO2-Annual.mxd

Drawing 5.3-9: CO 1 Hour Process Contribution

Early Oil Pilot Scheme

Key

- Homestead (identified during May 2017 land survey)

Well Pad

- Amosing-1
- Ngamia-1
- Ngamia-3
- Ngamia-8
- Access Road

CO 1 hour PC (µg/m^3)

- 600 - 677
- 181 - 600

Ngamia

Kilometres
0 0.5 1

Amosing

N

Scale (at A3): 1:20,000

Kilometres
0 0.25 0.5 1

810000

240000

NOTES

CO 1 hour AQS for Human Health is 4000 µg/m^3
The highest CO value is 677 µg/m^3
Values under 180 µg/m^3 are omitted

Data sources:
Data sourced from client.

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	LD 26-05-2017	RL 26-05-2017	AM 27-11-2018

TULLOW OIL plc

GOLDER

Cavandish House, Bourne End, SL8 5AS, UK.

Service Layer Credits:

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_707_IA_AQ\02_PRODUCTION\MXD\1654017-707-OG-245-D5.3-9-CO-1-hour.mxd

Drawing 5.3-10: CO 8 Hour Process Contribution

Early Oil Pilot Scheme

Key

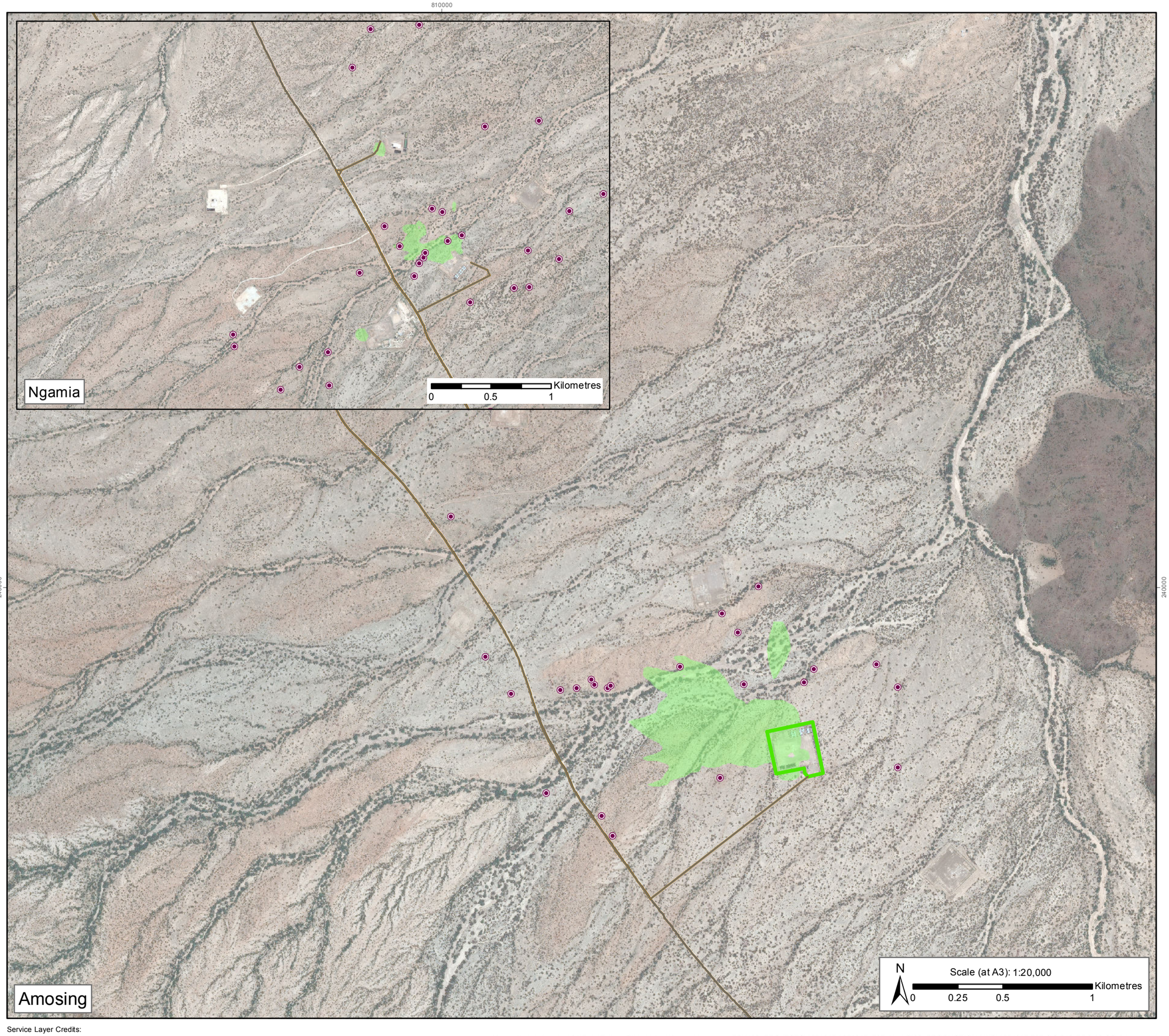
- Homestead (identified during May 2017 land survey)

Well Pad

- Amosing-1
- Ngamia-1
- Ngamia-3
- Ngamia-8
- Access Road

CO 8 hour PC (µg/m^3)

- 400 - 415
- 100- 400



NOTES

CO 8 hour AQS for Human Health is 2000 µg/m^3
The highest CO value is 415 µg/m^2
Values under 100 µg/m^3 are omitted

Data sources:
Data sourced from client.

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	LD 26-05-2017	RL 26-05-2017	AM 27-11-2018

TULLOW OIL plc

GOLDER

Cavandish House, Bourne End, SL8 5AS, UK.

Service Layer Credits:

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_707_IA_AQ\02_PRODUCTION\MXD\1654017-707-OG-246-D5.3-10-CO-8-hour.mxd

Drawing 5.3-11: VOC 24 Hour Process Contribution

Early Oil Pilot Scheme

Key

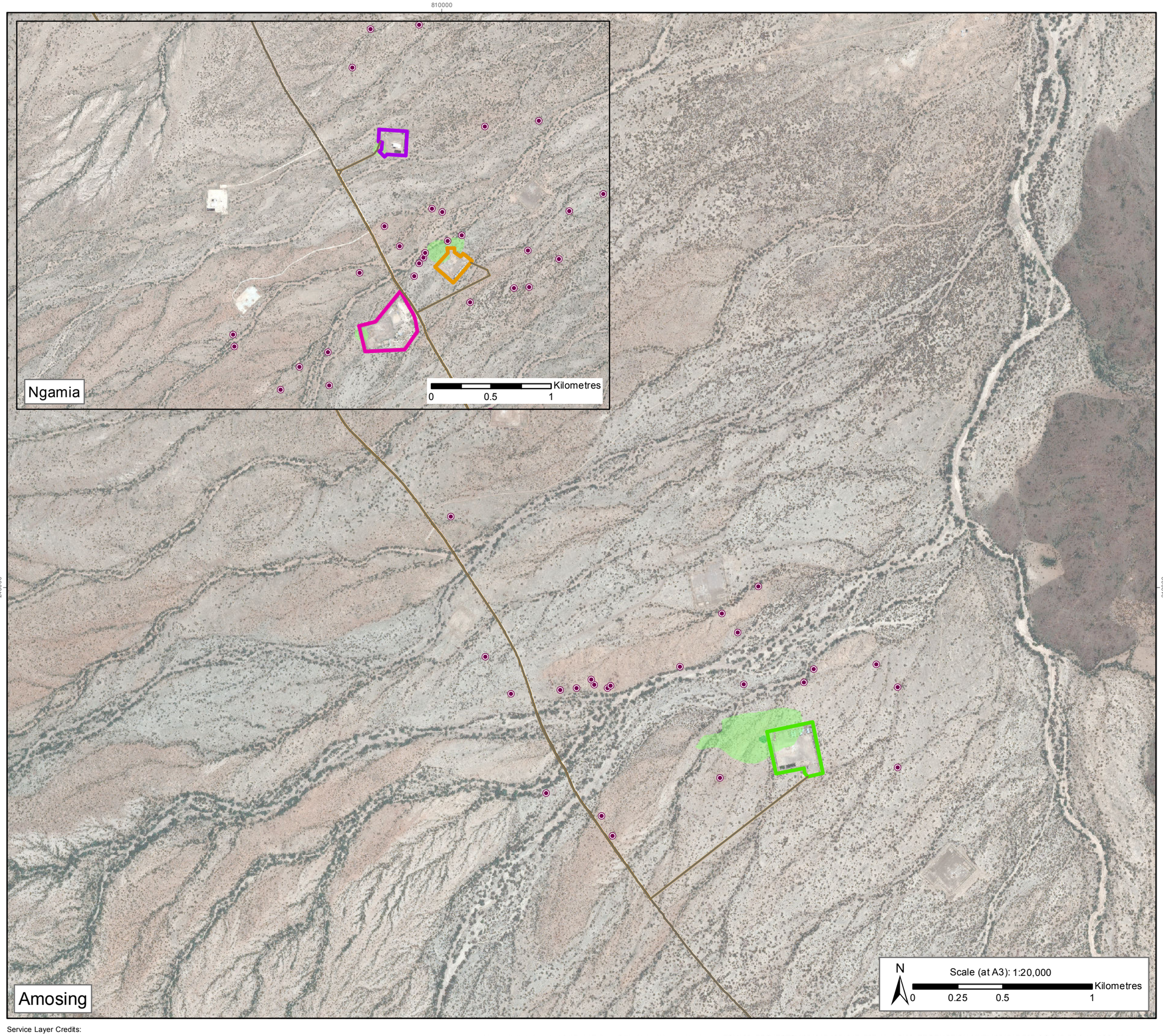
- Homestead (identified during May 2017 land survey)

Well Pad

- Amosing-1
- Ngamia-1
- Ngamia-3
- Ngamia-8
- Access Road

Total VOC 24 hour PC (µg/m^3)

- 400 - 534
- 100 - 400



NOTES

Total VOC 24 hour AQS for Human Health is 600 µg/m^3
The highest VOC value is 534 µg/m^x
Values under 100 µg/m^3 are omitted

Data sources:
Data sourced from client.

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	LD 26-05-2017	RL 26-05-2017	AM 27-11-2018

TULLOW OIL plc

GOLDER

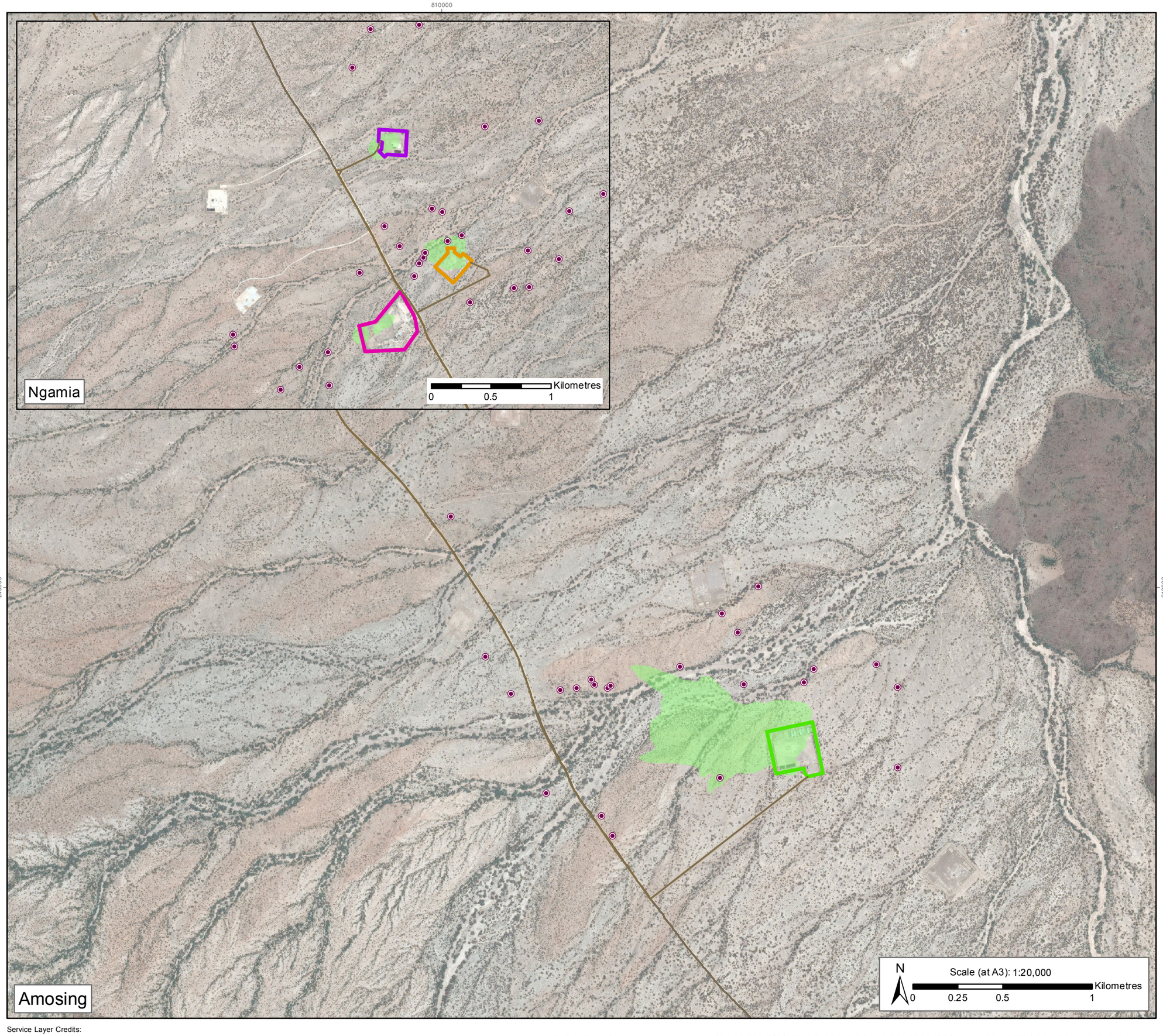
Cavandish House, Bourne End, SL8 5AS, UK.

Service Layer Credits:

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_707_IA_AQ\02_PRODUCTION\MXD\1654017-707-OG-247-D5.3-11-VOC-24-hour.mxd

Drawing 5.3-12: $PM_{2.5}$ 24 Hour Predicted Environmental Concentration

Early Oil Pilot Scheme



Key

- Homestead (identified during May 2017 land survey)

Well Pad

- Amosing-1
- Ngamia-1
- Ngamia-3
- Ngamia-8
- Access Road

$PM_{2.5}$ 24 hour Concentration PEC ($\mu g/m^3$)

- 7 - 14

NOTES

$PM_{2.5}$ 24 hour AQS for Human Health is 25 $\mu g/m^3$
The highest $PM_{2.5}$ value is 14 $\mu g/m^2$
Values under 7 $\mu g/m^3$ are omitted

Data sources:
Data sourced from client.

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	LD 26-05-2017	RL 26-05-2017	AM 27-11-2018

TULLOW OIL plc

GOLDER

Cavandish House, Bourne End, SL8 5AS, UK.

Service Layer Credits:

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_707_IA_AQ\02_PRODUCTION\MXD\1654017-707-OG-244-D5.3-12-PM2_5-24-hour.mxd

Drawing 5.3-13: $PM_{2.5}$ Annual Predicted Environmental Concentration

Early Oil Pilot Scheme

Key

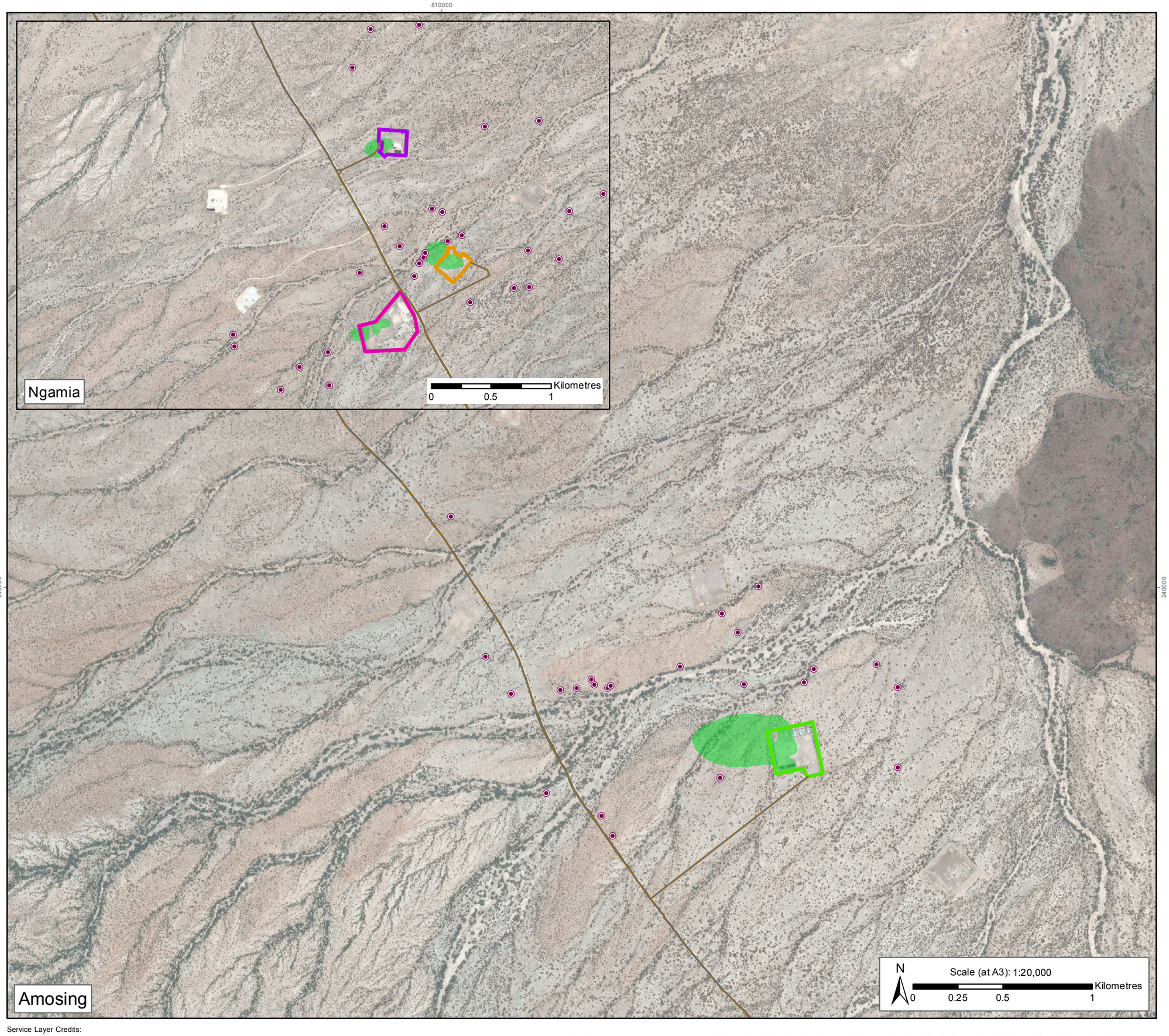
- Homestead (identified during May 2017 land survey)

Well Pad

- Amosing-1
- Ngamia-1
- Ngamia-3
- Ngamia-8
- Access Road

$PM_{2.5}$ Annual Concentration PEC (µg/m³)

- 5.5- 10



NOTES

$PM_{2.5}$ Annual AQS for Human Health is 10 µg/m³
The highest PM_{10} value is 8.3 µg/m^{x}
Values under 5.5 µg/m³ are omitted

Data sources:
Data sourced from client.

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	LD 26-05-2017	RL 26-05-2017	AM 27-11-2018

TULLOW OIL plc

GOLDER

Cavandish House, Bourne End, SL8 5AS, UK.

Service Layer Credits:

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_707_IA_AQ\02_PRODUCTION\MXD\1654017-707-OG-243-D5.3-13-PM2_5-Annual.mxd

Drawing 5.3-14: PM_{10} 24 Hour Predicted Environmental Concentration

Early Oil Pilot Scheme

Key

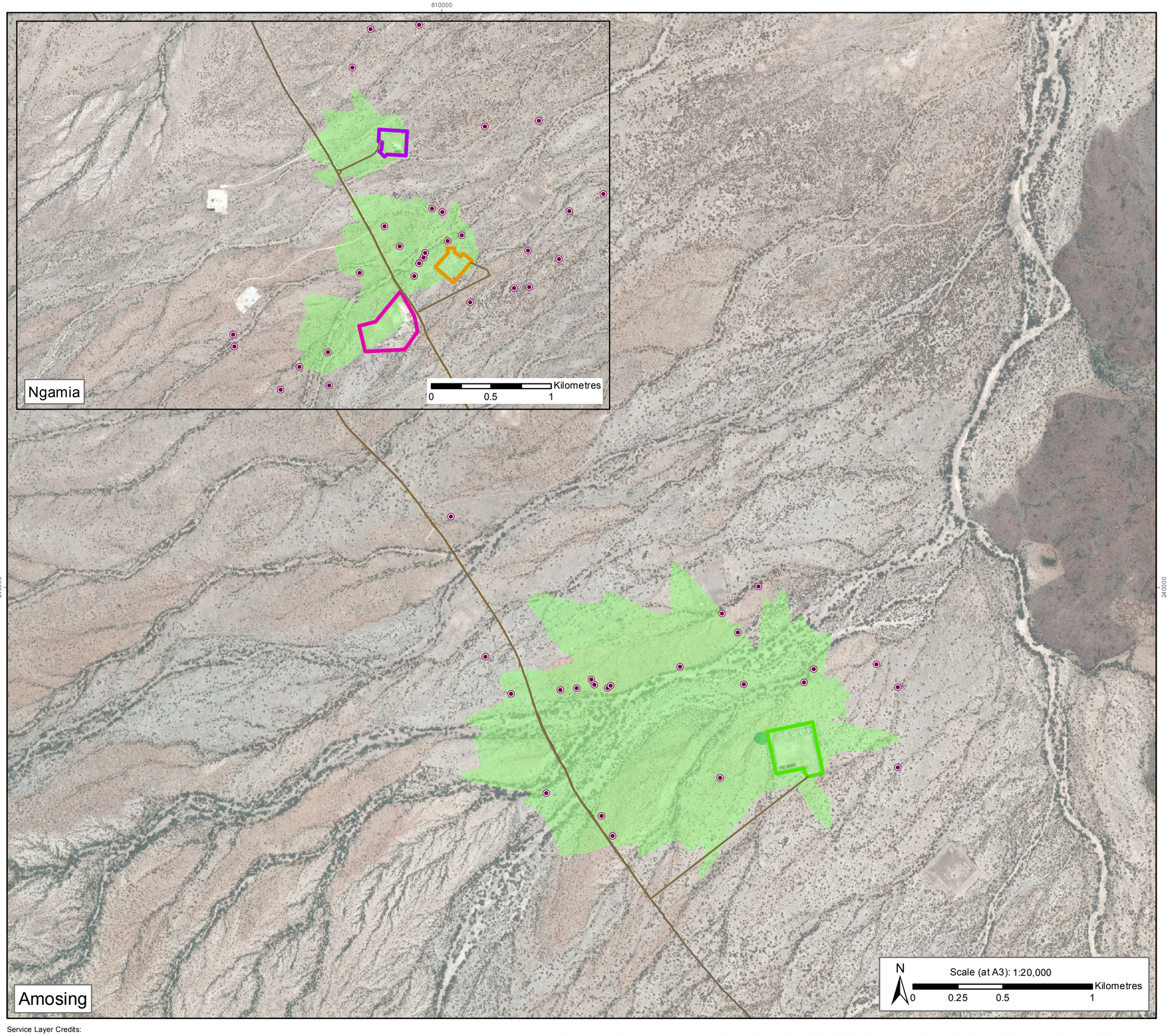
- Homestead (identified during May 2017 land survey)

Well Pad

- Amosing-1
- Ngamia-1
- Ngamia-3
- Ngamia-8
- Access Road

PM_{10} 24 hour Concentration PEC ($\mu g/m^3$)

- 30 - 32
- 26 - 30



NOTES

PM_{10} 24 hour AQS for Human Health is 50 $\mu g/m^3$
The highest PM_{10} value is 32 $\mu g/m^3$
Values under 25 $\mu g/m^3$ are omitted

Data sources:
Data sourced from client.

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref: 1654017	Prepared By: LD 26-05-2017	Reviewed by: RL 26-05-2017	Approved by: AM 27-11-2018

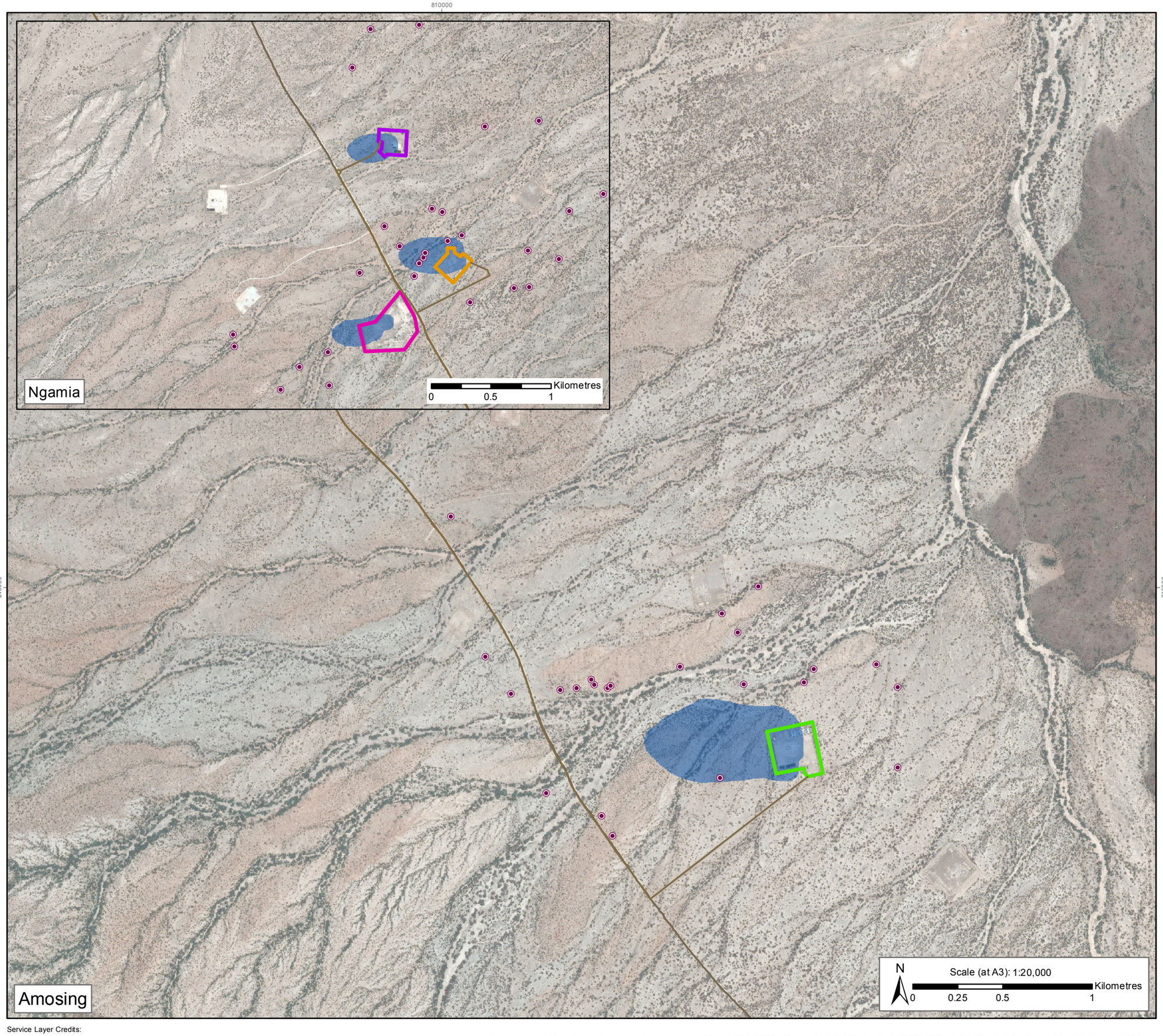
TULLOW OIL plc

GOLDER

Cavandish House, Bourne End, SL8 5AS, UK.

Service Layer Credits:

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_707_IA_AQ\02_PRODUCTION\MXD\1654017-707-OG-242-D5.3-14-PM10-24-hour.mxd



Drawing 5.3-15: PM_{10} Annual PEC Process Contribution

Early Oil Pilot Scheme

Key

- Homestead (identified by May 2017 land survey)

Well Pad

- Amosing-1
- Ngamia-1
- Ngamia-3
- Ngamia-8
- Access Road

PM_{10} Annual Concentration PEC (µg/m^3)

- 22 - 25 (Exceedance of AQS)

NOTES

PM_{10} Annual PC AQS for Human Health is 20 µg/m^3
Values under 22 µg/m^3 are omitted

Data sources:
Data sourced from client.

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	LD 26-05-2017	RL 26-05-2017	AM 27-11-2018

TULLOW OIL plc

GOLDER

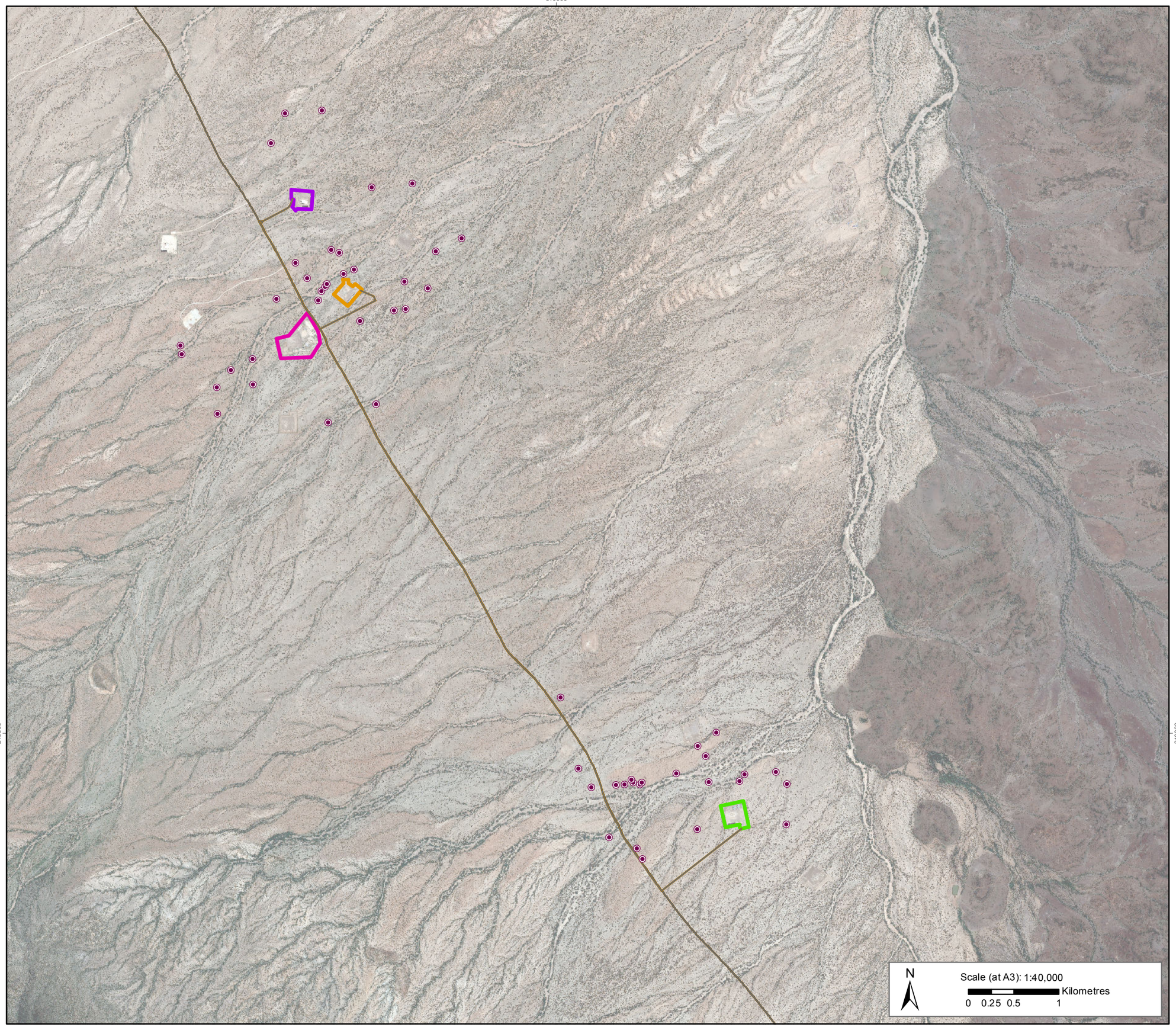
Cavandish House, Bourne End, SL8 5AS, UK.

Service Layer Credits:

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_707_IA_AQ\02_PRODUCTION\MXD\1654017-707-OG-240-D5.3-15-PM10-Annual-PEC.mxd

810000

240000



Drawing 5.4-1: Indicative Noise Receptors (May 2017 Land Baseline)

Early Oil Pilot Scheme

Key

- Potential Receptor (May 2017 Land Baseline)

Well Pad

- Amosing-1
- Ngamia-1
- Ngamia-3
- Ngamia-8
- Access Road

Data sources:
Data sourced from client.

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	LD 19-07-2017	SD 19-07-2017	AM 14-07-2017

TULLOW OIL plc

GOLDER

Cavendish House, Bourne End, SL8 5AS, UK

Service Layer Credits:

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_708_IA_Noise\02_PRODUCTION\MXD\1654017-708-OG-273-D5.4-1-Noise-Receptors.mxd

Drawing 5.4-2: Predictable Worst Case Hour Noise Contour Results

Early Oil Pilot Scheme

Key

Potential Receptor (May 2017 Land Baseline)

Predictable Worst Case (Hour) (dBA)

- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70
- 70 - 75
- 75 - 80
- 80 - 85

Well Pad

- Amosing-1
- Ngamia-1
- Ngamia-3
- Ngamia-8
- Access Road

240000

240000

Ngamia

Kilometres
0 0.5 1

Amosing

N

Scale (at A3): 1:8,000
Metres
0 50 100 200

Data sources:
Data sourced from client.

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	LD 19-07-2017	SD 19-07-2017	AM 14-07-2017

TULLOW OIL plc

GOLDER

Cavendish House, Bourne End, SL8 5AS, UK

Service Layer Credits:

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_708_IA_Noise\02_PRODUCTION\MXD\1654017-708-OG-274-D5.4-2-Worst-Case-Hour.mxd

Drawing 5.4-3: Daytime Period Noise Contour Results

Early Oil Pilot Scheme

Key

- Potential Receptor (May 2017 Land Baseline)
- Daytime Noise Limit (55dBa)

Daytime Period Noise Contour Results (dBA)

- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70
- 70 - 75
- 75 - 80

Well Pad

- Amosing-1
- Ngamia-1
- Ngamia-3
- Ngamia-8
- Access Road

Ngamia

Kilometres
0 0.5 1

Amosing

N

Scale (at A3): 1:8,000
Metres
0 50 100 200

240000

Data sources:
Data sourced from client.

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	LD 19-07-2017	SD 19-07-2017	AM 14-07-2017

TULLOW OIL plc

GOLDER

Cavendish House, Bourne End, SL8 5AS, UK

Service Layer Credits:

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_708_IA_Noise\02_PRODUCTION\MXD\1654017-708-OG-275-D5.4-3-Daytime-Period.mxd

Drawing 5.4-4: Nighttime Period Noise Contour Results

Early Oil Pilot Scheme

Key

- Potential Receptor (May 2017 Land Baseline)
- Nighttime Noise Limit (45dBa)

Nighttime Period Noise Contour Results (dBA)

- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70
- 70 - 75
- 75 - 80
- 80 - 85

Well Pad

- Amosing-1
- Ngamia-1
- Ngamia-3
- Ngamia-8
- Access Road

Ngamia

Kilometres
0 0.5 1

Amosing

N

Scale (at A3): 1:8,000
Metres
0 50 100 200

240000

Data sources:
Data sourced from client.

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	LD 19-07-2017	SD 19-07-2017	AM 14-07-2017

TULLOW OIL plc

GOLDER

Cavendish House, Bourne End, SL8 5AS, UK

Service Layer Credits:

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_708_IA_Noise\02_PRODUCTION\MXD\1654017-708-OG-276-D5.4-4-Nightime-Period.mxd

Drawing 5.7-1: Landscape Character Areas

795000 810000

255000 240000

Semi-desert

Rocky Habitat / Stunted Bushland

Dense bushland

Alluvial woodland

Dense bushland

Kalabala

N

Scale (at A3): 1:100,000

0 0.5 1 2 3 4 Kilometres

Early Oil Pilot Scheme

Key

Landscape Character Areas*

- LCA 1
- LCA 2
- LCA 3
- LCA 4

Well Pad

- Amosing-1
- Ngamia-1
- Ngamia-3
- Ngamia-8
- Watercourse
- Existing Road

*LCAs are made up of recognisable patternsor elements (physical and perceptual) that occur consistently in aparticular area and define its character, or ‘sense of place’

Data sources:
Data sourced from client. Contours generated from Plesiades data (as supplied by client)

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	LD 20-01-2017	AM 30-06-2017	AM 27-11-2018

TULLOW OIL plc

GOLDER

Cavendish House, Bourne End, SL8 5AS, UK

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_714_IA_LVIA\02_PRODUCTION\MXD\1654017-714-OG--260-F5.7-1_LCAs.mxd

Drawing 5.7-2: Ngamia Well Pads - Zone of Theoretical Visibility (ZTV)

Early Oil Pilot Scheme

Key

Ngamia Well Pads - Zone of Theoretical Visibility (ZTV)

- Not Visible
- Visible
- Unoccupied Visible Location
- Flare
- Tank
- Well Pad
- Watercourse
- Existing Road

Ngamia-3
N-1
Ngamia-8
N-6
Ngamia-1

805000 806000 807000 808000 809000
246000 245000 244000 243000

N

Scale (at A3): 1:15,000

0 0.075 0.15 0.3 0.45 0.6 Kilometres

Data sources:
Data sourced from client. Contours generated from Plesiades data (as supplied by client)

Coordinate System: WGS 1984 UTM Zone 36N

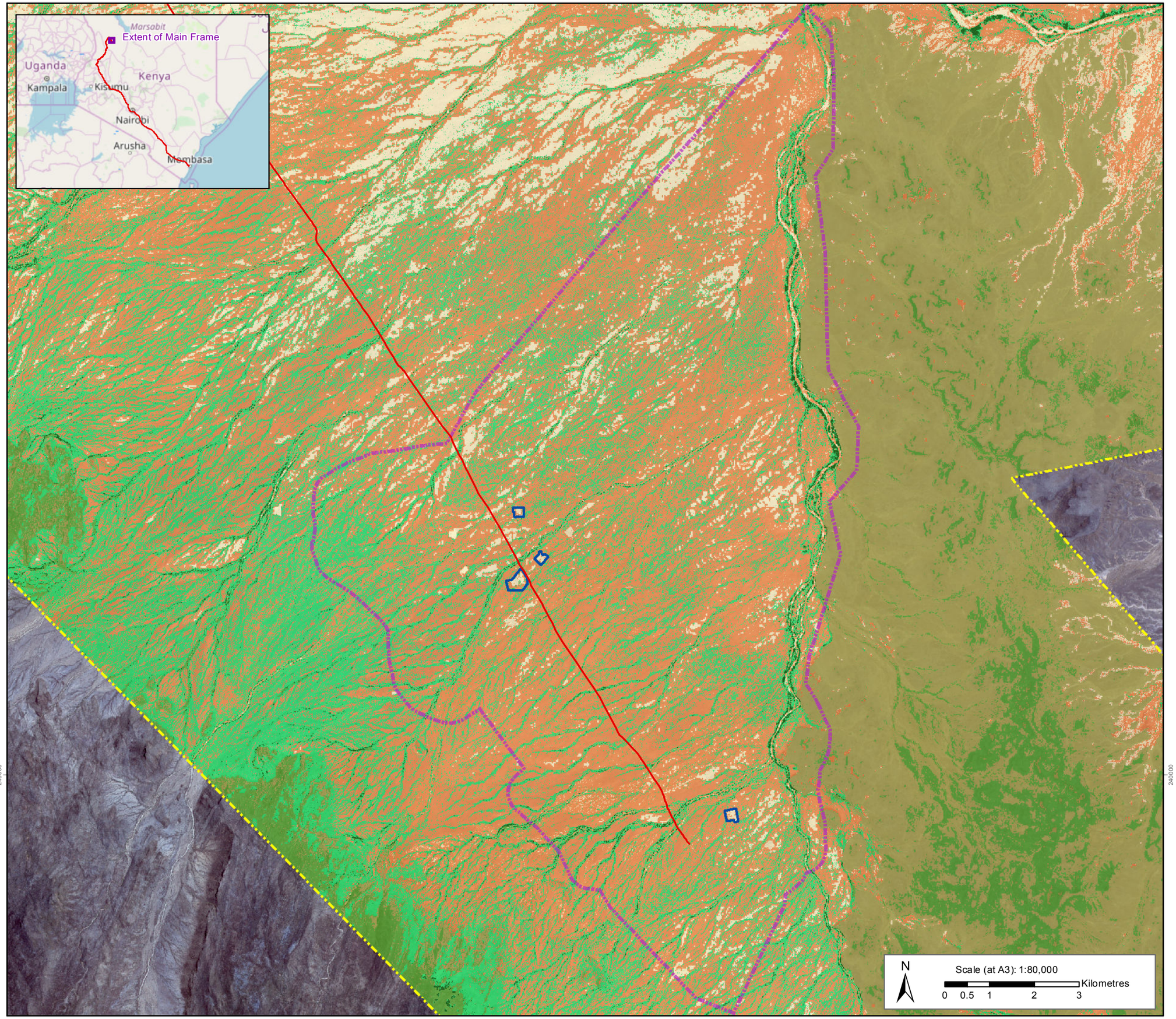
Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	LD 20-01-2017	JM 23-02-2017	AM 27-11-2018

TULLOW OIL plc

GOLDER

Cavendish House, Bourne End, SL8 5AS, UK

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_714_IA_LVIA\02_PRODUCTION\MXD\1654017-714-OG--265-F5.7-2_Combined_ZTV.mxd



Drawing 5.8-1: Vegetation Communities in Upstream Biophysical Impact Assessment Study Area

Early Oil Pilot Scheme

Key

Vegetation Communities

- *Acacia/Commiphora* Deciduous Bushland and Thicket
- Riparian Forest
- *Acacia/Commiphora/Euphorbia* Stunted Bushland/Thicket
- *Acacia/Commiphora/Indigofera* Stunted Bushland
- Semi-Desert Shrubland
- Wooded Ephemeral Stream
- Upstream Biophysical Impact Assessment Study Area
- Field Study Area
- Well Pad
- Proposed Road Route

Data sources:
Land cover data sourced from GeoTerra Image (GTI)

Coordinate System: GCS WGS 1984

Project Ref:	Prepared by:	Reviewed by:	Approved by:
1654017	TS 27/11/2018	AD 21/04/2017	AM 27/11/2018

TULLOW OIL plc

GOLDER

Cavandish House, Bourne End, SL8 5AS, UK.

Map path: Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_712_Bio\02_PRODUCTION\MXD\1654017-712-OG-283-F5.8-1_Vegetation_EOPS.mxd

Drawing 5.8-2: Ecosystems of Concern in Upstream Biological Impact Assessment Regional Study Area

Early Oil Pilot Scheme

Key

- Upstream Biological Impact Assessment Regional Study Area

VECEA (2015)

- Fb, Afromontane undifferentiated forest
- R, Riverine wooded vegetation
- WdK, Acacia tortilis wooded grassland and woodland
- Watercourse
- Proposed Road Route

Field

- Amosing
- Ngamia

Data sources:
VECEA data sourced from vegetationmap4africa.org

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared by:	Reviewed by:	Approved by:
1654017	TS 05/06/2018	AD 21/04/2017	AM 27/11/2018

TULLOW OIL plc

GOLDER

Cavandish House, Bourne End, SL8 5AS, UK.

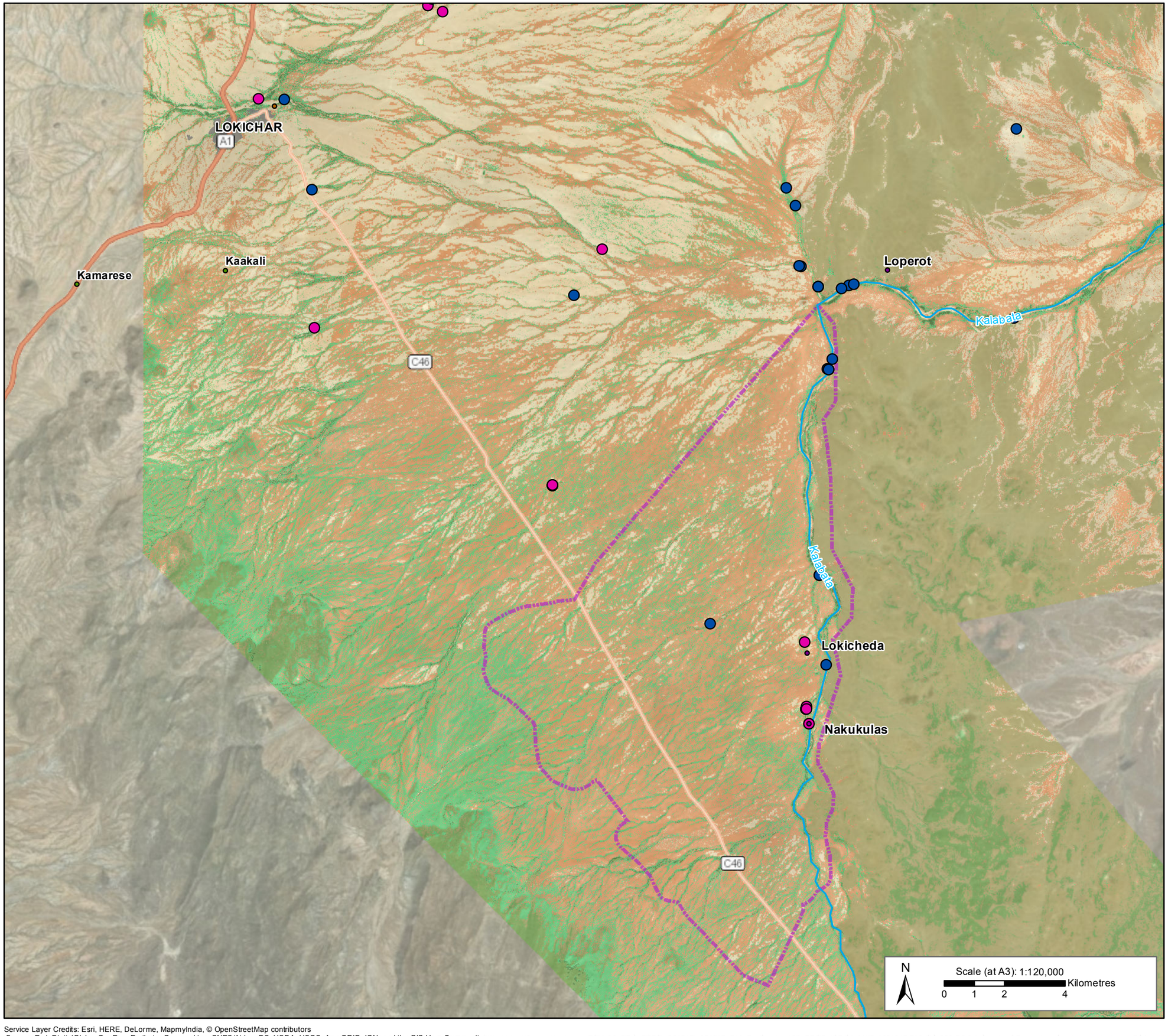
N

Scale (at A3): 1:1,150,000

0 5 10 20 30 40 Kilometres

Map path: Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_712_Bio\02_PRODUCTION\MXD\1654017-712-OG-284-F5.8-2_Habitats_Upstream_RSA_Conservation.mxd

Drawing 5.9-1: Ecosystem Services Supply in Upstream Study Area



Early Oil Pilot Scheme

Key

- Settlement

Ecosystem Services

- Cultural Tree
- Hand-dug Well

Vegetation Communities and Condition

- *Acacia/Commiphora* Deciduous Bushland and Thicket (Good - Fair)
- Riparian Forest (Fair - Poor)
- *Acacia/Commiphora/Euphorbia* Stunted Bushland/Thicket (Fair - Poor)
- *Acacia/Commiphora/Indigofera* Stunted Bushland (Poor)
- Semi-Desert Shrubland (Fair)
- Settlement
- Wooded Ephemeral Stream (Fair)
- Watercourse
- Upstream Biophysical Impact Assessment Study Area

Data sources:
Land cover data sourced from GeoTerra Image (GTI)

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	GS 13-06-2017	AD 27-11-2018	AM 27-11-2018

TULLOW OIL plc

GOLDER

Cavandish House, Bourne End, SL8 5AS, UK.

Service Layer Credits: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Map path: \\ad1-golder\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_713_EcoServices\02_PRODUCTION\MXD\1654017-713-OG-289-D5.9-1-Supply-of-Ecosystem-Services-in-Upstream-RSA.mxd

Drawing 5.11-1: EOPS - Impact Assessment - Tangible Cultural Heritage Receptors

South Lokichar Development

Key

- Cultural Heritage Receptor
- Midstream Biophysical Study Area
- Upstream Biophysical Study Area

Lokichar

N

Scale (at A3): 1:2,600,000

Kilometres

0 12.5 25 50 75 100

TR-001

TR-002

TR-006

TR-007

TR-011

TR-013

Mombasa

Data sources:
Data sourced from client and National Museums of Kenya (NMK).

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	CR 23-06-2017	PW 23-06-2017	AM 18-07-2017

TULLOW OIL plc

GOLDER

Cavendish House, Bourne End, SL8 5AS, UK

Map path:\\rdc1-v-gisuk01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1654017\1654017_716_IA_CH\02_PRODUCTION\MXD\1654017-716-259-CHeritage-EOPSImpactAssessmentReceptors_v2.mxd

golder.com