ESIA REPORT *VOLUME II*

Project Oil Kenya - Upstream

Environmental and Social Impact Assessment (ESIA)

Submitted to:

Tullow Kenya BV

Submitted by:

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ACRONYMS AND UNITS OF MEASUREMENT

"	Inch
%	Percentage
~	circa
<	Less Than
>	Greater Than
≤	Less Than or Equal to
≥	Greater Than or Equal to
º	Degrees
ºC	Degrees Celsius
µg	Microgram
AADT	Annual Average Daily Traffic
AAH	Action Against Hunger
ABA	Athi Basin Area
AD	Anaerobic digestion
A.D.	Anno Domini
ADCP	Acoustic Doppler Current Profiler
ADM	Air Dispersion Model
ADP	Annual Development Plan
AEWA	African-Eurasian Water-bird Agreement
AFDB	Africa Development Bank
AGI	Above Ground Installation
AIDS	Acquired Immune Deficiency Syndrome
Al	Aluminium
ANC	Antenatal care
AOC	Africa Oil Corporation
AoI	Area of Influence
AoO	Area of Occupancy

APAD	Agency for Pastoralist Advocacy & Development
APC	Air Pollution Control
APEI	Alemun Pastoralist Empowerment Initiative
AQS	Air Quality Standard
AR	Archaeology
ARI	Acute respitory infections
ASAL	Arid and Semi-Arid Lands
ASL	Above Sea Level
Ba	Barium
BAT	Best Available Technology
bbls	Barrels
BBOP	Business and Biodiversity Offsets
BC	Before Christ
BCE	Before Common Era
BCF	billion cubic feet
BCoW	Biodiversity Clerk of Works
BES	Biodiversity and Ecosystem Services
bgl	Below Ground Level
bilharzia	Schistosomiasis
BMP	Biodiversity Management Plan
BOP	Blow Out Preventor
BP	Before Present
BrO_3	Bromate
BSI PAS	British Standards Institution Publicly Available Specification
BTEX	Benzene, toluene, ethylbenzene and xylene
bwpd	barrels of water per day
Ca	Calcium
CadnaA	Computer Aided Noise Attenuation
CAPEX	Capital Expenditure
CBD	Convention on Biological Diversity
CC	County Commissioner

CDP	Community Development Plan
CEC	County Environmental Committees
CEMP	Construction Environmental Management Plan
CEMS	Continuous Environmental Monitoring System
CFA	Central Facilities Area
CFP	Chance finds procedure
CGMW	Commission for the Geological Map of the World
CH	Living Cultural heritage
CHIS	Community Health Information System
CHMP	Cultural Heritage Management Plan
CHMT	County Health Management Team
CHSSMP	Community Health, Safety and Security Management Plan
CIA	Cumulative Impact Assessment
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CLTS	Community Led Total Sanitation
cm	Centimetre
cm/min	Centimetres per Minute
CMS	Convention on Migratory Species
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO2e	Carbon dioxide equivalent
COVID-19	Coronavirus Disease 2019
CPF	Central Processing Facility
CR	Critically Endangered
CRC	Community resource centres
CS	Carbon Steel
CSM	Corrugated Sheet Metal
CSOs	Civil Society Organisations
CWP	Community Water Points
CWRUA	Community Water Resource Users Associations
DALYs	Disability Adjusted Life Years

d	Day
dB	Decibels
dBA	A-weighted decibels
dBL	Decibels Linear
DCCs	Deputy County Commissioners
DD	Data Deficient
DDP	Delivery duty paid
DEFRA	Department for Environment, Food and Rural Affairs
DEM	Digital Elevation Model
DHIS	District Health Information System
DHIS2	District Health Information Software 2
DICL	Ductile Iron Cement Lined
DMRB	Design Manual for Roads and Bridges
DNA	Deoxyribonucleic Acid
DOSHS	Directorate of Occupational Safety and Health Services
dS/m	deci siemens per meter
DSM	Digital Surface Model
DTM	Digital terrain model
E&A	Exploration and Appraisal
EA	Environment Agency
EAC	East African Community
EARS	East African Rift System
EBA	Endemic Bird Area
EBRD	European Bank for Reconstruction and Development
ECD	Early Childhood Development
ECoW	Environmental Clerk of Works
EDC	Enterprise Development Centres
EHA	Environmental Health Areas
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EIAAR	Impact Assessment and Audit Regulations

EITI	Extractive Industry Transparency Initiative
ELC	Environment and Land Court
EMCA	Environmental Management and Co-ordination Act
EN	Endangered
ENNBA	Ewaso Ng'iro North Catchment Area
ENSO	El Niño-Southern Oscillation
EoO	Extent of Occurrence
EOPS	Early Oil Pilot Scheme
EPC	Engineering, Procurement and Construction
EPF	Early Production Facility
EPRA	Energy and Petroleum Regulatory Authority
ESD	Emergency Shutdown System
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
ESP	Electrical Submersible Pumps
ERC	Energy Regulatory Commission
ETP	Effluent treatment plant
EWB	Elephants Without Borders
F&G	Fire & Gas System
FAO	Food and Agriculture Organisation
FBOs	Faith Based Organisations
FDPs	Final Distribution Points
Fe	Iron
FEED	Front End Engineering Design
FGM	Female Genital Mutilation
FGT	Flue gas treatment
FID	Final Investment Decision
FO	First Oil
FPIC	Free Prior and Informed Consent

FSEO	Field Stakeholder Engagement Officers
g	Gram
GBIF	Global Biodiversity Information Facility
GBV	Gender-based violence
GDEM	Global Digital Elevation Model
GDP	Gross Domestic Product
GIP	Good Industry Practice
GIS	Geographical Information System
GIZ	Gesellschaft für Internationale Zusammenarbeit
GHG	Greenhouse Gas
GWP	Global Warming Potential
GNI	Gross National Income
GoK	Government of Kenya
GPS	Global Positioning System
GTG	Gas Turbine Generator
GTI	GeoTerra Image
GTZ	German Agency for Technical Cooperation
H^2S	Hydrogen Sulphide
H_2SO_4	Sulphuric acid
ha	Hectare
HBV	Hepatitis B virus
HDD	Horizontal Directional Drilling
HDI	Human Development Index
HDPE	High- Density Polyethylene
HECRAS	Hydraulic Engineering Center River Analysis System'
HGV	Heavy Good Vehicles
HIV	Human Immunodeficiency Virus
HMIS	Health Management Information System
hr or h	Hour
HR	Human Resources
HV	High Voltage

HWC	Human Wildlife Conflict
IBA	Important Bird Area
IBAT	Integrated Biodiversity Assessment Tool
ICP	Informed Consultation and Participation
ICSS	Integrated Control and Safety System
IDP	internally displaced person
IEBC	Independent Electoral and Boundaries Commission
IEC	International Electrotechnical Commission
IF	Incineration facility
IFC	International Finance Corporation
IHME	Institute for Health Metrics and Evaluation
ILO	International Labour Organisation
ILRI	International Livestock Research Institute
IOGP	International Association of Oil and Gas Producers
IPCC	Intergovernmental Panel on Climate Change
IPIECA	International Petroleum Industry Environmental Conservation Association
IRPA	Individual Risk Per Annum
ISMP	Invasive Species Management Plan
ISO	International Organization for Standardization
ITCZ	inter-tropical convergence zone
IUCN	International Union for Conservation of Nature
IWMF	Integrated Waste Management Facility
K	Potassium
KBA	Key Biodiversity Area
kbd	1000 barrels per day
KEBS	Kenya Bureau of Standards
kbwpd	1000 barrels water per day
KCAA	Kenya Civil Aviation Authority
KCl	Potasium Chloride
KDHS	Kenya Demographic and Health Survey
KEMRI	Kenya Medical Research Institute

KenGen	Kenya Electricity Generating Company
KeNHA	Kenya National Highways Authority
KEPH	Kenya Essential Package for Health
KeRRA	Kenya Rural Roads Authority
KES	Kenyan Shilling
KETRACO	Kenya Electricity Transmission Company
KFS	Kenya Forest Service
kg	Kilogram
KII	Key Information Interview
KJV	Kenyan Joint Venture
KIIds	Key Investor Information Documents
km	Kilometre
KMIS	Kenya Malaria Indicator Survey
KNBS	Kenyan National Bureau of Statistics
KPC	Kenya Pipeline Company
KPHC	Kenya Population and Housing Census
KPIs	Key Performance Indicators
KPR	Kenyan Police Reserve
KPRL	Kenya Petroleum Refineries Limited
KRA	Kenya Revenue Authority
KURA	Kenya Urban Roads Authority
kV	Kilovolts
KVDA	Kerio Valley Development Authority
KWCMA	Kenyan Wildlife Conservation and Management Act
KWRUA	Kochodin Water Resources Users Association
KWS	Kenya Wildlife Services
l or ltr	Litre
L_{A90}	Ambient Noise
L_{Aeq}	A-weighted Equivalent Continuous Sound Level in Decibels
LAF	Land Access Framework
LAPSSET	Lamu Port- South Sudan- Ethiopia Transport

LARF	Land Acquisition and Resettlement Framework
LC	Least Concern
LCC	Logistics Coordination Centre
LCAA	The Landcover Assessment Area
LCAs	Landscape Character Areas
LCIDP	LAPSSET Corridor Infrastructure Development Project
LEF	Lokichar Export Facility
LGV	Light Good Vehicles
LiDAR	Light Detection and Ranging
LLCOP	Lokichar to Lamu Crude Oil Pipeline
LLINs	Long-lasting Insecticidal Nets
LoD	Limit of Detection
LOWASCO	Lodwar Water and Sewerage Company
LPG	Liquified Petroleum Gas
LV	Low Voltage
LVAA	Landscape and Visual Assessment Area
LVNBA	Lake Victoria North Basin Area
LWHIV	Living with HIV
m	Metre
m/s	Meters Per Second
m^2	Metres squared
m^3	Metres cubed
masl	Metres Above Sea Level
mbar	Millibar
MDBRT	Measured Depth Below Rotary Table
mbgl	Metres Below Ground Level
MCA	Member of County Assembly
Mg	Magnesium
mg	Milligram
MJ	Megajoules
mm	Millimetre

MMbbls	Million Barrels
MMIF	Mesoscale Model Interface Program
MMscfd	Million standard cubic feet per day
Mg	Magnesium
Mn	Manganese
MoH	Ministry of Health
MoPM	Ministry of Petroleum and Mining
MP	Member of Parliament
MSAVI	Modified Soil Adjusted Vegetation Index
MTRH	Moi Teaching and Referral Hospital
mS	Millisiemen
mV	millivolts
MW	Megawatt
MWSI	Ministry of Water, Sanitation and Irrigation
N	Nitrogen
Na	Sodium
NACC	National AIDS Control Council
NASA	National Aeronautics and Space Administration
NASCOP	National AIDS and STI Control Programme
NBI	Nile Basin Initiative
NBSAP	National Biodiversity Strategy and Action Plan
NCA	National Construction Authority
NCD	Non-Communicable Diseases
NDMA	National Drought Management Authority
NEAP	National Environmental Action Plan
NEC	National Environmental Council
NECC	National Environmental Complaints Committee
NEMA	National Environment Management Authority
NET	National Environment Tribunal
NGOs	Non-governmental Organisations
NH_3	Ammonia

NLC	National Land Commission
NMK	National Museums of Kenya
NO	Nitric oxide
NO_x	Nitrogen oxides
NO_2	Nitrogen dioxide
NORM	Naturally occurring radioactive materials
NPV	Net present value
NR	National Reserve
NRT	Northern Rangelands Trust
NT	Near Threatened
NTLD	National TB, Leprosy and Lung Disease
NTR	Non-Technical Risk
NTSA	National Transport Safety Authority
NTS	Non-Technical Summary
O_2	Oxygen
O_3	Ozone
O&M	Operations and Maintenance
OEMP	Operations Environmental Management Plan
OHTL	Overhead Transmission Lines
OPEX	Operational Expenditure
ORP	Oxygen Redox Potential
OSHA	Occupational Safety and Health Act
Osiris	Optical Scattering Instantaneous Respirable Indication Sensor
OVCs	Orphans and Vulnerable Children
PaHs	Polycyclic aromatic hydrocarbons
PAP	Project Affected People
PARs	Pre- assembled racks
PAUs	Pre-assembled units
Pb	Lead
PC	Process Contribution
PCP	Progressing Cavity Pump

PCS	Process control system
PEC	Predicted Environmental Concentrations
PGA	Peak Ground Acceleration
pH	Acidity or Basicity of a Water-Based Solution
PIIM	Project induced in-migration
PLL	Potential Loss of Life
PM_1	Particulate matter less than or equal to 1 microgram
PM_{10}	Particulate matter less than or equal to 10 micrograms
$PM_{2.5}$	Particulate matter less than or equal to 2.5 micrograms
PMC	Project Management Company
ppm	Parts Per Million
POK	Project Oil Kenya
PoI	Points of Interest
polio	Poliomyelitis
PPP	Purchasing Power Parity
PPV	Peak Particle Velocity
PS	Performance Standard
PSC	Production Sharing Contracts
PSD	Particle Size Distribution
PSPL	Peak Sound Pressure Level
QA	Quality Assurance
QRA	Quantitative Risk Assessment
RAP	Resettlement Action Plan
RCP	Representative Concentration Pathway
RF	Recycling facility
RLRP	Resettlement and Livelihood Restoration Plan
RoW	Right of Way
RPB	Radiation Protection Board
RUSLE	Revised Universal Soil Loss Equation
RVBA	Rift Valley Basin Area
RWs	Reformed Warriors

s	Second
SAPCONE	St. Peter Community Network
SBM	Synthetic-Based Mud
SCDSCs	Sub-County Disease Surveillance Coordinators
SCR	Selective Catalytic Reduction
SD	Scaled Distance
SEA	Strategic Environmental Assessment
SEP	Stakeholder Engagement Plan
SGR	Standard Gauge Railway
Si	Silicon
SL	Standard Length
SLMs	Sound Level Metres
SMART	Standardised Monitoring Assessment on Relief and Transition
SNCR	Selective Non-Catalytic Reduction
SO_2	Sulphur dioxide
SoCC	Species of Conservation Concern
SPT	Social Performance Team
sq km	Square Kilometre
SRES	Special Report on Emissions Scenarios
SRTM	Shuttle Radar Topography Mission
SSAs	Specific Site Assessments
STIs	Sexually Transmitted Infections
STP	Sewage treatment plant
TAP	Turkwel Agro-Pastoral
TB	Tuberculosis
TBA	Tana Basin Area
TBP	Turkana border pastoral
TCFD	Task Force on Climate- related Financial Disclosures
TCG	Turkana County Government
TCP	Turkana central pastoral
TDS	Total dissolved solids

TKBV	Tullow Kenya Business Venture
TMP	Transport Management Plan
ToR	Terms of Reference
ToT	Terms of Trade
TPH	Total Petroleum Hydrocarbons
TSP	Total Suspended Particles
TUCODA	Turkana County Drivers Association
TUDOF	Turkana Development Organization Forum
TUPADO	Turkana Pastoralists Development Organisation
TWADO	Turkana Women Advocacy Development Organization
UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNHCR	United Nations High Commission for Refugees
UNICEF	United Nations International Children's Emergency Fund
UPS	Uninterruptible Power Supply
US	United States
USEPA	United States Environmental Protection Agency
USD or $	United States Dollar
UTM	Universal Trans Mercator
V	Volts
VDS	Vision 2030 Delivery Secretariat
VECs	Valued Environmental and Social Components
VIP	ventilated improved pit
VOCs	Volatile Organic Compounds
VPSHR	Voluntary Principles for Security and Human Rights
VU	Vulnerable
W/m^2	Watts per metre squared
w/w	Weight by Weight
w/w %	percent by weight

WaSH	Water-Sanitation-Hygiene
WAT	Wax Appearance Temperature
WBG	World Bank Group
WBG EHS	World Bank Group Environmental, Health and Safety General Guidelines
WBM	Water-Based Mud
WCRP CMIP3	World Climate Research Programme Coupled Model Intercomparison Experiment, Phase 3
WHO	World Health Organisation
WHRU	Waste Heat Recovery Units
WRA	Water Resources Authority
WRF	Weather Research and Forecasting
WRI	World Resources Institute
WWF	World Wildlife Fund
yr	Year
ZTV	Zone of Theoretic Visibility

ESIA REPORT

1.0 INTRODUCTION

This report presents the Environmental and Social Impact Assessment (ESIA) for Project Oil Kenya – Upstream ("the Project") in South Lokichar, Turkana County in Kenya. This ESIA has been prepared by Golder Associates (UK) Ltd and Ecoscience and Engineering Ltd (National Environment Management Authority (NEMA) Expert Registration No: 11492), based on the Terms of Reference (144936.517.A0[1], March 2016, presented in Annex I), which were approved by NEMA in a letter dated 16 March 2016, also in Annex I[2].

The ESIA assesses potential impacts of the Project based on the Project description presented in Section 5 and covers all activities and infrastructure associated with the construction, operation and decommissioning of the Project.

The objective of the ESIA is to identify and quantify impacts that the Project may have on the biophysical and socio-economic environments by comparison to the ESIA baseline and Project standards. Where identified as necessary, the ESIA defines potential mitigation and management processes to prevent unacceptable deterioration of environmental and social conditions, minimise negative impacts and enhance benefits to Kenya, local communities and other stakeholders.

1.1 Project Proponent

In 2010, Tullow Kenya BV (TKBV) signed agreements with Africa Oil Corporation (AOC) and Centric Energy to gain a 50% operated interest in five Kenyan licences; Blocks 10BA, 10BB, 10A, 12A and 13T covering over 67,000 km^2 (square kilometre).

In 2011 AOC and TKBV agreed a farm-in deal whereby TKBV acquired a 50% interest and Operatorship in block 10BB and 13T, which is where the Project is located. At the end of 2015 AOC entered into a farmout agreement with Maersk Oil & Gas A/S ("Maersk"), whereby Maersk acquired 50% of AOC's interests in block 10BB. Thereafter in 2017, Maersk was acquired by TotalEnergies. At the time of writing, AOC and TotalEnergies each have a 25% and TKBV a 50% working interest in the block. These three companies form the Kenyan Joint Venture (KJV) partners that will execute the Project.

Project Oil Kenya is the term used to describe the Government of Kenya (GoK) led program to deliver Kenyan oil production of which the Upstream Oil Project is an integral component. The KJV partners are the joint licensees of Blocks 10BB and 13T and are represented by TKBV as the Operator. The KJV partners are the Government's Contractor to implement the Upstream Oil Project under the terms of the Production Sharing Contract.

[1] Initially developed with the Kenyan-based consultancy firm EMC in March 2016. See Annex I for reference.
[2] Although Kenyan legislation defines the environmental assessment process as an "Environmental Impact Assessment" or "EIA", the term "ESIA" has been used for this assessment process from the outset, to align with international best practice and stakeholder concerns. This terminology was set out in the terms of reference agreed with NEMA (See Annex I).

1.2 Project Location and Setting

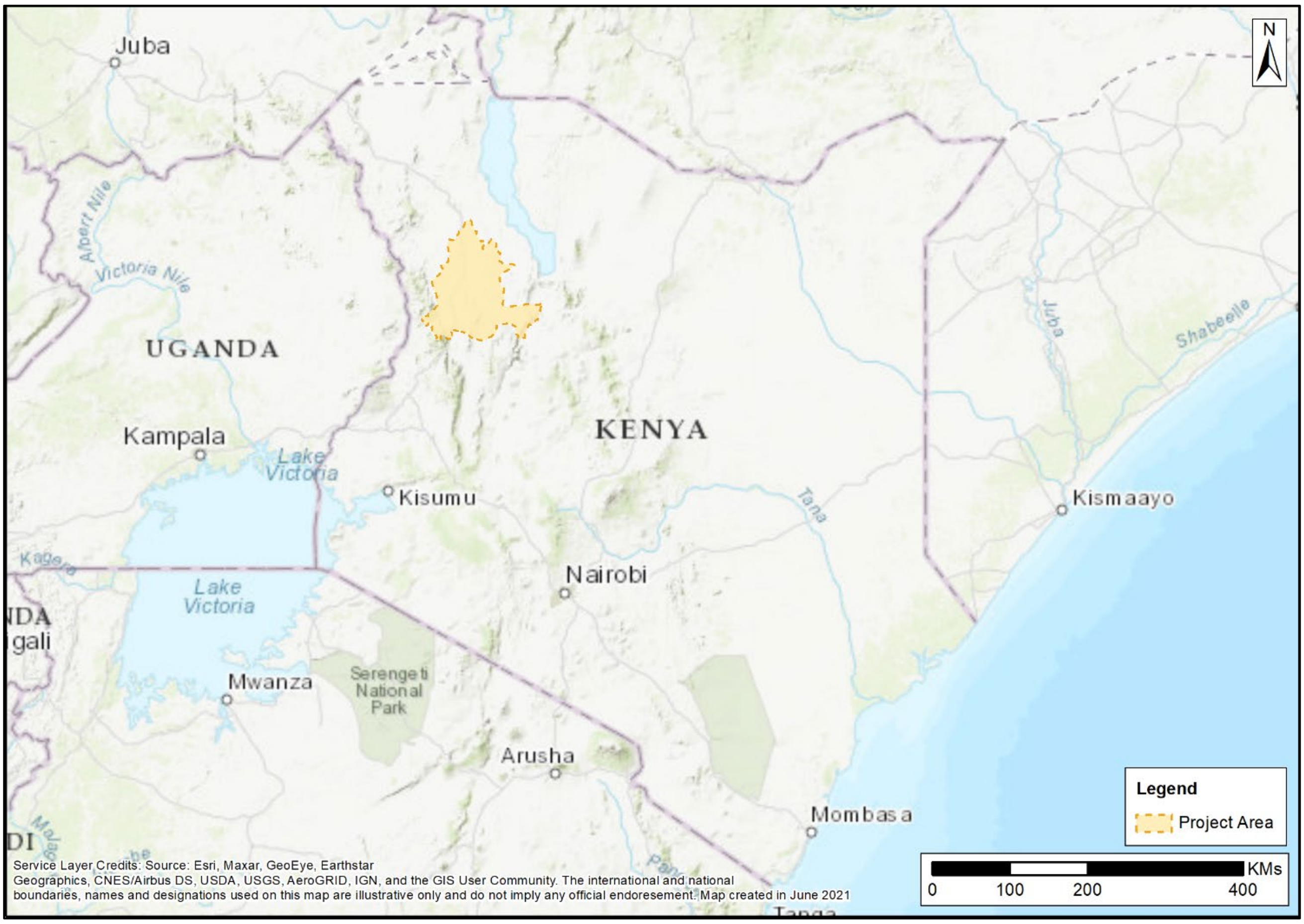

Figure 1.2-1: Project Area of Influence Location

The Project is located between Lake Turkana and the Turkwel River valley approximately 100 kilometres (km) to the south and west of Lake Turkana, in north-west Kenya, approximately 450 km north of Nairobi.

Figure 1.2-1 shows the location of the Project Area of Influence (see Section 3.12 for definition). The location of the Project's facilities in a regional setting are shown in Figure 1.2-2. The nearest town is Lokichar.

The oilfields and Project's facilities are located in Turkana South and Turkana East sub-counties in Turkana County. Water will be sourced from the Turkwel Gorge Reservoir, located approximately 70 km to the southwest of the Project, in West Pokot County.

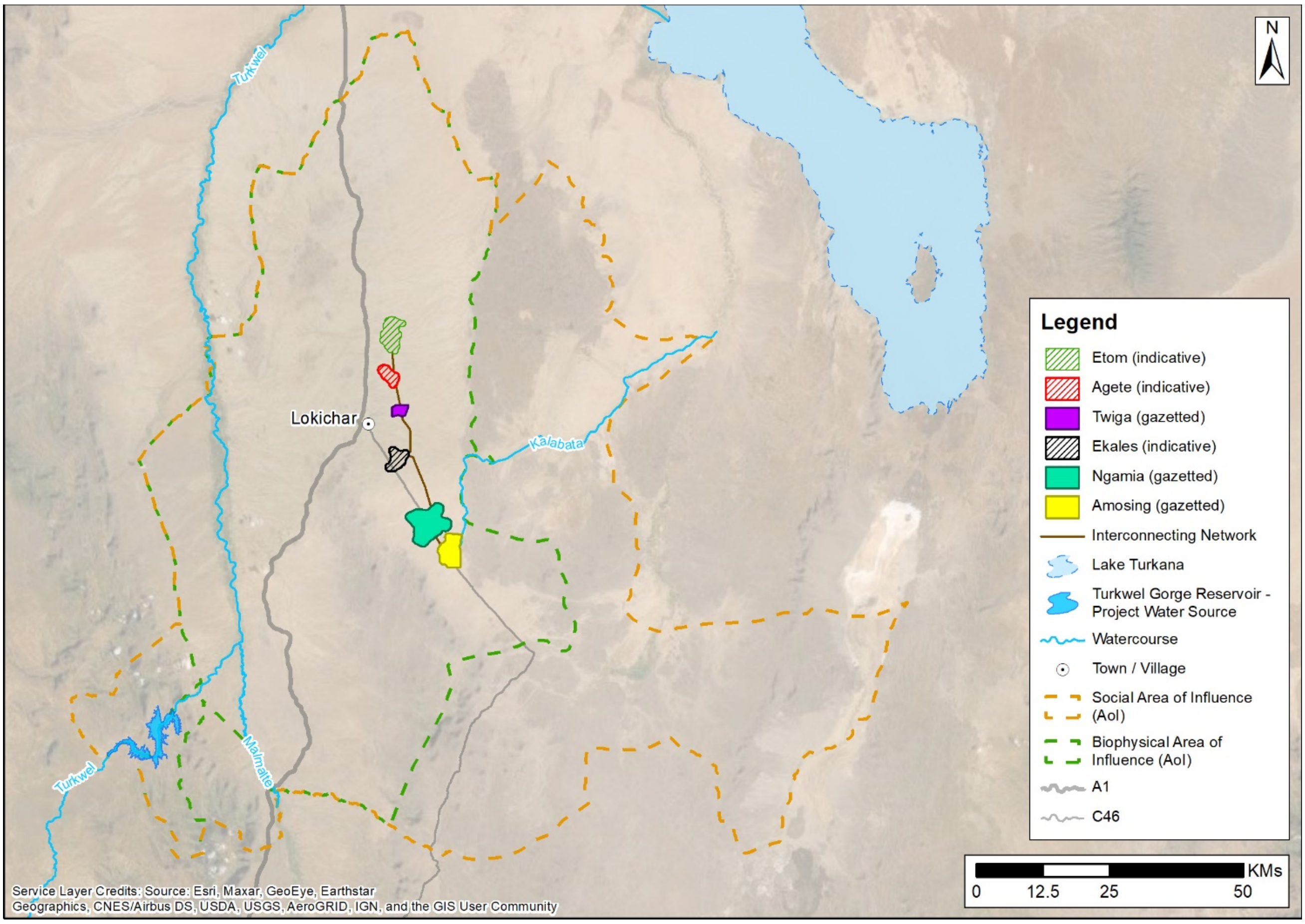

Figure 1.2-2: Project Regional Setting

The Project is located in a semi-arid environment. There are two wet seasons, between April and June (long rains), and between October and December (short rains), but rainfall can be sporadic. The landscape around Lokichar comprises flat featureless outwash plains with an extensive network of wide, shallow, ephemeral stream beds ('luggas'). The infield area is at an altitude of 720 m above sea level.

The population in the area surrounding the oilfields is characterised by pastoralists. The Project is located within the Rift Valley zone, known for its archaeological and anthropological importance with respect to early hominid fossils and artefacts.

1.3 Project Background

The first onshore well in the South Lokichar Basin, Ngamia-1, in Block 10BB, commenced drilling in January 2012 and since then several discoveries have been made in the South Lokichar Basin during the exploration phase.

The Project has been preceded by the Early Oil Pilot Scheme (EOPS) Phase II, for which a separate ESIA was produced in 2018 (Golder, 2018, ref. 1654017.718). Existing facilities used during EOPS Phase II, including the Kapese airstrip, Kapese Base (camp), wellpads, wells, water supply boreholes and production facilities will be adopted by the Project.

1.4 Project Overview

Full details of the Project are provided in the Project description presented in Section 5.

For the Project (Figure 1.4-1), oil will be produced from production wells located on multiple wellpads across six oilfields: Etom, Agete, Ekales, Twiga, Amosing and Ngamia. The wellpads will be connected to the Central Processing Facility (CPF) via a buried gathering network. The Project will use water injection to maintain reservoir pressure. Water will be sourced from the Turkwel Gorge Reservoir located to the southwest of the facility. The water pipeline route, design and construction is outside the scope of this ESIA: it will be subject to a separate ESIA to meet NEMA requirements and Project standards and will be separately permitted.

The CPF will be located within a central hub, the Central Facilities Area (CFA), which will be located adjacent to the Ngamia oil field. The CFA will contain accommodation, waste management facilities, offices, laydown areas and warehouses as well as facilities required for production, and to support construction and operating activities. An engineered landfill facility will be located 1 km from the CFA.

Oil export facilities for the Lokichar to Lamu Crude Oil Pipeline (LLCOP) project are also located within the CFA. However, a separate ESIA has been prepared for this component (Golder, 2019, ref. 1772867.554).

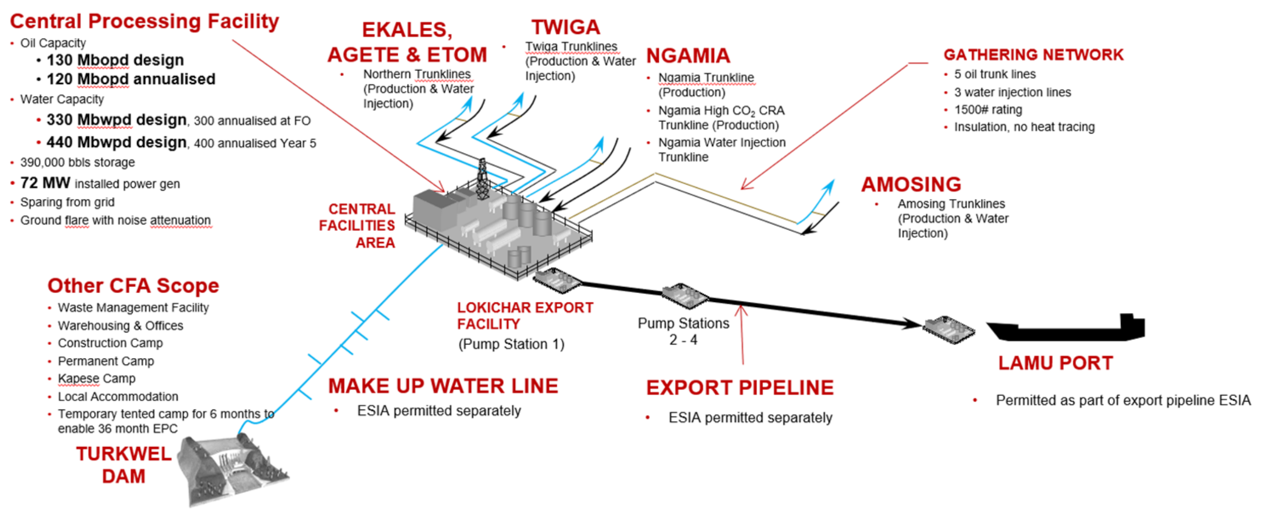

Figure 1.4-1: Project Overview

1.5 This Report

The structure of this ESIA is as follows:

- ESIA Report:
  - Non-Technical Summary (NTS);
  - 1.0 Introduction (this section);
  - 2.0 Policy, Legal and Administrative Framework;
  - 3.0 Impact Assessment Methodology;
  - 4.0 Stakeholder Engagement;
  - 5.0 Project Description and Analysis of Alternatives (including zero project option);
  - 6.0 Baseline Reports;
  - 7.0 Potential Impacts and Mitigation;

  - 8.0 Cumulative Impacts;
  - 9.0 Environmental and Social Management Plan;
  - 10.0 Conclusions; and
  - 11.0 References.
- Annex I – Supplementary Information:
  - Terms of Reference and Scoping Report (as approved by NEMA);
  - Project Standards;
  - Baseline supporting information; and
  - ESIA supporting information.
- Annex II – Stakeholder Engagement:
  - Stakeholder Engagement Plan;
  - Stakeholder Engagement Consultation Report (including consultation materials and meeting minutes); and
  - Upstream Resettlement and Livelihood Restoration Framework.

1.6 ESIA Project Team – Statement of Qualifications

The ESIA Project Team comprises Golder Associates (UK) Ltd and Ecoscience and Engineering Ltd (NEMA Expert Registration No: 11492; see Figure 1.6-1).

FORM 5 (r.14(4))

nema

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)
THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT
CERTIFICATE OF REGISTRATION AS AN ENVIRONMENTAL IMPACT ASSESSMENT/ AUDIT EXPERT

Certificate No: NEMA/EIA/RC/5083
Application Reference No: NEMA/EIA/ER/10546

This is to certify M/s ECOSCIENCE & ENGINEERING LIMITED of P.O. Box 55533-00200, Nairobi (Address) has been registered as an Environmental Impact Assessment Expert in accordance with the provisions of the Environmental Management and Coordination Act Cap 387 and is authorized to practice in the capacity of a Lead Expert/Associate Expert/Firm of Experts (Type) Firm of Experts

Expert Registration No: 11492

Issued Date : 6/9/2020

Signature

(Seal)

Director-General
The National Environmental Management Authority

P.T.O.

ISO 9001: 2008 Certified

Figure 1.6-1: Ecoscience and Engineering Ltd NEMA Expert Registration Certificate.

The Lead Authors of the ESIA are Andrew Morsley (Project Director) and Rachel Lansley (Project Manager). Table 1.6-1 provides the statement of qualifications for the ESIA Project Team.

Table 1.6-1: Statement of Qualifications for the ESIA Project Team

ESIA Chapter	Discipline	Lead Specialist	Qualifications	Accreditations	Years of professional Experience
All	ESIA & Water	Andrew Morsley (Project Director)	M.Sc. Sustainable Management of the Water Environment BSc Mathematics	CIWEM Chartered Scientist, 2007	20+
All	ESIA & Air Quality	Rachel Lansley (Project Manager)	M.Sc. Environmental Monitoring and Analysis, BSc Physical Geography	Chartered Scientist (CSci), Member of the Institution of Environmental Sciences (IES) Member of the Institute of Air Quality Management (IAQM)	15+
All	ESIA	Philip Abuor (Assistant Project Manager)	M.Sc. Environmental Management and Legislation BSc, Chemistry	NEMA EIA Lead Expert, Industrial Hygiene (DOSHS), Local Assessor of Climate Change Programs (CDM-GS), ISO 14001- Lead Assessor	20+
2.0	Policy, Legal and Administrative Framework	Angeline Abuor	Bachelor of Law	Diploma in Law	4 (legal practice)
6.7	Water Quality	Dan Odero	MSc Hydrogeology, BSc Geology	Panel II Licensed Water Engineer, Geological Society of Kenya	30+
6.6 & 7.2	Noise and Vibration	Joe Tomaselli	M.Eng. Mechanical Engineering B.A.Sc. Mechanical Engineering	Professional Engineers of Ontario (P.Eng)	20+
6.1 & 6.6	Noise and Air Quality	Sam Obiya	BSc. Chemistry MSc. In Environmental Legislation and Management,	Ecological Society of East Africa, NEMA Registered Lead Expert	20+

ESIA Chapter	Discipline	Lead Specialist	Qualifications	Accreditations	Years of professional Experience
			JKUAT (on-going)		
6.2, 6.3, & 7.5	Soils, Terrain and Seismicity	Claire McFee	B.Sc. Environmental and Conservation Science – Land Reclamation	Professional Agrologist, 2018	8+
6.11 & 7.6	Landscape and Visual and Information Management	Christopher Boyd	M.Sc. Geographical Information Systems B.Sc. Geography	Fellow of the Royal Geographical Society (FRGS)	10+
6.9 & 7.7	Biodiversity, Ecology and Protected Areas	Freddy Brookes	MSc Aquatic Ecosystem Management	Member of the Chartered Institute of Ecology and Environmental Management (MCIEEM) Member of the Institute of Fisheries Management (MIFM)	15+
6.9	Biodiversity and protected areas & mammals	Bernard Agwanda	MSc. Animal Ecology and Taxonomy	Head Mammalogy Department, Curator of Mammals and Head of Great Hall of Mammal Gallery	20+
6.9	Biodiversity and protected areas & flora	John Kimeu	MSc Plant Ecology	National Museums of Kenya	15+
6.9	Biodiversity and protected areas & avifauna	Philista Malakai	MSc Dryland Biodiversity	Society for Conservation Biology, Ecological Society for Eastern Africa	15+
6.9	Biodiversity and protected areas & aquatics	Dickens O'Deny	MSc. Water and Coastal Management	Certificate in Spatial Data Handling	15+
6.9	Biodiversity and protected areas & herptofauna	Victor Wasonga	Msc in Dryland Biodiversity	Scientific Advisory Council of the Tropical Biology Alumni Group of Africa, Herpetological Association of Africa	20+

ESIA Chapter	Discipline	Lead Specialist	Qualifications	Accreditations	Years of professional Experience
6.9	Biodiversity and protected areas & invertebrates	Morris Mutua	Ph.D in Natural Resource Policy and Management, MSc in Natural Resource Policy and Management	Member of the Kenya Institute of Planners	15+
6.10 & 7.8	Ecosystem Services	Aisling Dower	Master of Science (Hons) Applied Environmental Science Bachelor of Science (Hons) Zoology	Professional Natural Scientist (Pr. Sc. Nat. 114477/15) Member of South African Bat Assessment Association Member of South African Wetland Society	15+
4.0, 6.12 & 7.9	Stakeholder Engagement & Social	Linda Havers	M.A. Anthropology B.A. Anthropology	International Association of Impact Assessment (IAIA)	20+
4.0	Stakeholder Engagement	Muthoni Koinange	BA in International Relations	Kenya Private Sector Alliance, Expert member with National Environment Management Authority	15+
6.12	Social (Health)	Milka Abuor	MSc in Infectious Biology and Epidemiology	MBchB of Surgery	10+
6.13 & 7.10	Cultural Heritage	Conor Ryan	BA (Joint Hons.) Archaeology and Geography	Associate of the Chartered Institute for Archaeologists (ACIfA)	7+
6.13	Cultural Heritage	Christine Ogola	Ph.D University of the Wintwatersrand	East African Association for Palaeontology and Palaeo-anthropology, Society for Africanist Archaeologists	15+
7.11	Environmental Risks & Accidents	Tim Flower	MSc Ecology BSc (Hons) Environmental Science	Chartered Water and Environmental Manager (C.WEM) Registered Environmental Auditor (IEMA)	30+

ESIA Chapter	Discipline	Lead Specialist	Qualifications	Accreditations	Years of professional Experience
				General Certificate in Occupational Safety and Health (NEBOSH) Lead Social Systems Auditor/SA8000 (SGS)	

2.0 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 Background and Context

The Project ESIA has been prepared to comply with Kenyan legislative, regulatory and policy requirements. Throughout this document, reference is made to relevant international standards as part of Good Industry Practice (GIP) (i.e., International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability (2012) and IFC World Bank Group (WBG) Environmental, Health and Safety (EHS) Guidelines (2007a, 2007b)). This subsection of the ESIA provides an overview of the relevant policy, legal and institutional framework governing the Project ESIA. Other relevant regulatory and legal framework specific to each Physical, Biodiversity or Social discipline is provided within each section of the ESIA.

2.1.1 Devolution in Kenya

The Constitution of Kenya 2010 has given mandate to devolve certain powers from the National Government to the 47 County Governments, including responsibility for the agriculture sector, health services, early childhood development, public amenities, County trade development and regulations, and County planning and development. The National Government continue managing issues related to security, education, and other national interests.

Under the devolved governance system, each County is responsible for managing certain aspects of environmental management, including issuing noise permits and non-hazardous waste permits.

2.1.2 Governance and Administrative Structure

The following table presents a list of administrative agencies and government institutions that regulate the development of the oil and gas sector in Kenya which have a key role in the Project ESIA authorisation process.

Table 2.1-1: Administrative Regulation Agencies

Institution	Description	Project Relationship
County Environmental Committees (CEC)	CEC are responsible for the proper management of the environment within the County for which it is appointed. The Committee also develops the county Strategic Environmental Action Plan for five years.	Key stakeholder at County level that monitors project activities.
Directorate of Occupational Safety and Health Services (DOSHS)	DOSHS draws its functions from the Occupational Safety and Health Act (OSHA), 2007 and the Work Injury Benefit Act, 2007. It promotes the development of a safe and healthy workplace by implementing effective systems for the prevention of occupational diseases. As part of its responsibilities, it inspects internal and external working environments and ensures the prevailing environmental conditions are favourable to human health.	Issues workspace permits for any premises used as workplace areas. Receives reports of Occupational Health and Safety audits, which are undertaken every 12 months in relation to each workplace.
Energy and Petroleum Regulatory Authority (EPRA)	EPRA was established under the Energy Act, 2019 and is also the selected regulator under the Petroleum Act, 2019 (regulation of upstream petroleum and coal). All responsibilities relating to Energy Regulatory Commission (ERC; established under the now repealed Energy Act of 2006) now fall under the remit of EPRA. EPRA's functions in relation to the Environment include: ▪ Regulate, monitor, and supervise upstream petroleum operations in Kenya in accordance with the law relating to petroleum.	EPRA is mandated by law to take such action as is necessary to enforce the requirements in a petroleum agreement or any regulations and to protect the environment, the health and safety of workers and the public. It is also required to investigate complaints or disputes arising from petroleum operations as well as enforce local content

Institution	Description	Project Relationship
	■ Inform the Cabinet Secretary regarding Upstream petroleum operations in Kenya. ■ Collect, maintain and manage Upstream Petroleum data.	requirements. The Project contractor is required to take all reasonable actions to secure the safety, health and welfare of all persons engaged in its operations, furnish EPRA with details of petroleum reservoirs and water sources discovered and seek approval for flaring and venting.
Environment and Land Court (ELC)	ELC is established under Section 4 of the Environment and Land Court Act No. 19 of 2011. It has original and appellate jurisdiction to hear and determine all disputes in accordance with Article 162(2)(b) of the Constitution and with the provisions of the Act or any other written law relating to environment and land.	ELC would adjudicate any disputes on environment and land matters that may arise as a result of the Project.
Kenya Forest Service (KFS)	KFS is established under the Forest Conservation and Management Act (2016) to conserve, protect and manage all public forests and also to manage water catchment areas in relation to soil and water conservation, carbon sequestration and other environmental services in collaboration with the relevant stakeholders. According to the Environmental Management and Co-ordination Act (EMCA), the Cabinet Secretary has the authority to (in consultation with the relevant lead agencies and national and international treaties) declare any area of land, sea, lake, forests, or river to be a protected natural environment.	Issues conservation (orders) and ensures enforcement.
Kenya Pipeline Company (KPC) Limited	KPC is a state corporation established in September 1973 under the Companies Act Cap 486 (now repealed). It is 100% owned by the government and is responsible for providing an effective, reliable, safe and cost-effective means of transporting and storing petroleum products.	KPC is integral to the transportation and storage of petroleum products and is therefore a key stakeholder to the Project.
Kenya Wildlife Services (KWS)	KWS is responsible for the conservation and management of Kenya's Wildlife and its habitats.	KWS has a mandate to promote wildlife conservation and to manage human – wildlife conflicts. KWS is therefore a key stakeholder with regards to the potential biodiversity impacts of the Project.
Kerio Valley Development Authority (KVDA)	KVDA is responsible for the planning, monitoring and implementation of transboundary programmes and projects making use of the best technical, financial, human and natural resources.	Key stakeholder to the ESIA process regarding the proposed abstraction of groundwater from the Kerio catchment and water from the Turkwel Gorge Reservoir. KDVA's mandate covers the Turkwel river.
Lamu Port-South Sudan-Ethiopia	LAPSSET LCDA was established in March 2013 (Presidential Order Kenya Gazette Supplement No. 51, Legal Notice No. 58). It is mandated to plan, coordinate	The LLCOP crude oil pipeline (which will transport oil from the facility to Lamu) will be

Institution	Description	Project Relationship
Transport (LAPSSET) Corridor Development Authority (LCDA)	and manage the implementation of the LAPSSET Corridor. It is tasked with establishing an integrated implementation plan and oversee the implementation of the proposed projects, especially the LLCOP, railway and highways.	constructed in the LAPSSET corridor. LCDA is a key stakeholder and is involved in the midstream LLCOP development.
Ministry of Agriculture, Livestock and Fisheries.	The Ministry of Agriculture, Livestock and Fisheries is responsible for the implementation and monitoring of agricultural legislations, regulations and policies, facilitating and representing agricultural state corporations in the government, and implementing programmes in the agriculture sector. It is also responsible for the management and control of pests and disease.	Mandated to the management of agriculture and livestock; and control of pests and disease, the Ministry of Agriculture will be a key stakeholder for any potential impacts of the Project relating to changes to agricultural practices, and invasive species management.
Ministry of Energy	The Ministry of Energy is responsible for facilitating the provision of clean, sustainable, affordable, reliable, and secure energy services for national development while protecting the environment. On behalf of the National Government, The Ministry of Energy is in charge of promoting energy policies and regulation of electricity and gas reticulation. Relevant departments include the EPRA (previously named Energy Regulatory Commission) and the Energy and Petroleum Tribunal (previously named the Energy Tribunal).	Key stakeholder mandated in permitting of energy generation and distribution.
Ministry of Environment and Forestry	The Ministry of Environment and Forestry mission statement and key objective is to facilitate good governance in the protection, restoration, conservation, development and management of the environment and forestry resources for equitable and sustainable development. Responsible for several administrative structures under EMCA 1999 as amended by EMCA (amendment) 2015, these include the National Environmental Council (NEC), NEMA, National Environment Tribunal (NET) and the National Environmental Complaints Committee (NECC)	Key stakeholder to the Project, mandated to undertake national environment policy and management, forestry development policy and management, development of re-afforestation and agro-forestry, among others.
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. The ministry is composed of two state departments: State Department for interior and Citizen Services; and Correctional Services. The ministry has the following responsibilities: ■ National government coordination at counties; ■ Disasters and Emergency Response Coordination;	Key stakeholder in mobilisation of communities at the County, sub-County and locational levels. Control of registration of expatriate workers at the national level and coordination of emergency responses.

Institution	Description	Project Relationship
	■ Internal Security Affairs; and ■ Citizenship and Immigration Policy and Service.	
Ministry of Petroleum and Mining (MoPM)	MoPM oversees the management of the extractive sector in Kenya by developing Petroleum and Mining policies and creating and overseeing a favourable legal and regulatory framework. It is responsible for managing programs and projects within the Petroleum and Mining sector.	MoPM is the entity responsible for the issuance and management of production sharing agreements. Land required for the Project will be acquired on behalf of MoPM by NLC.
Ministry of Sports, Culture and Heritage	The mission of the Ministry of Sports, Culture and Heritage is to develop, promote, preserve and disseminate Kenya's diverse cultural, artistic and sports heritage, through formulation and implementation of policies on sports, culture and the arts industry that enhance national pride and improve the livelihood of the Kenyan people. Of 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.	The NMK is the key stakeholder that permits the movement of heritage items.
Ministry of Transport, Infrastructure, Housing, Urban Development and Public Works	The Ministry of Transport, Infrastructure, Housing, Urban Development and Public Works is responsible for granting permits for the transportation of wide loads, bulk carriers and abnormal loads as described under Traffic Act Cap 403 part (V) and (VI); Kenya Roads Act No.2 of 2007. It is composed of the following state departments: ■ State Department of Transport; ■ State Department of Infrastructure; ■ State Department for Maritime and Shipping Affairs; ■ State Department for Public Works; and ■ State Department for Housing & Urban Development. The Ministry is mandated to perform several functions, including (amongst others): ■ National Roads Development Policy Management;	Key stakeholder responsible for permit approvals within the transport sector as well as safety management on classified roads.

Institution	Description	Project Relationship
	■ Transport Policy Management; ■ National Road Safety Management; ■ Development and Maintenance of Airstrips; and ■ National Transport and Safety Policy.	
Ministry of Water, Sanitation and Irrigation (MWSI)	MWSI mission statement is to contribute to national development by promoting and supporting integrated water resource management to enhance water availability and accessibility. The MWSI has the following subsectors: Water Supply Services; Sewer & Non-Sewer Sanitation Services; Water Harvesting & Storage; Water Resource Management; Water Sector Investment Planning; and Transboundary Waters.	Key stakeholder responsible for water management and catchment conservation.
National Land Commission (NLC)	NLC is the main government institution responsible for managing public land on behalf of the National and County governments. It is responsible for advising the national government on a comprehensive program for the registration of title in and throughout Kenya and recommends National Land Policy to the National government. The NLC also initiates investigations into present or historical land injustices and have oversight responsibilities over land use planning throughout the country.	Responsible for Land acquisition process and compensation to persons affected by the Project.
NEMA	NEMA was established under the Environmental Management and Co-ordination Act (EMCA) 1999 (CAP387, Laws of Kenya). NEMA is the main institution of the Government responsible for the coordination and supervision of the various environmental management activities in Kenya and implementation of policies relating to the environment in country development projects. As part of its mandate in the regulation and management of the petroleum sector, NEMA is responsible for granting ESIAs, Environmental Audit reports, licensing under different Environmental Management and coordination regulations.	Main institution responsible for granting of ESIA approvals in Kenya and monitoring and assessing project activities according to relevant environmental regulations and laws in the country. The Project ESIA document will be submitted to NEMA for approval and permitting.
National Environment Council	The National Environment Council was established under the EMCA 1999 (Section 4(1), Act no 8). Its key function is to formulate and set national policy and direction for the protection of the environment as prescribed in the EMCA.	Stakeholder responsible for formulation of environmental policies.
National Environmental Complaints Committee	The National Environmental Complaints Committee is responsible for investigating complaints and allegations related to the condition of the environment and suspected cases of environmental degradation.	Key stakeholder in environmental complaints and dispute resolution
NET	NET has several 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	Key stakeholder in environmental dispute resolution

Institution	Description	Project Relationship
	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.	
National Oil Corporation of Kenya	The National Oil Corporation of Kenya is a fully integrated State Corporation involved in all aspects of the petroleum supply chain covering the upstream oil and gas exploration, midstream petroleum infrastructure development and downstream marketing of petroleum products. It was incorporated in April 1981 with a mandate to participate in all aspects of the petroleum industry and it became operational in 1984. The Corporation is wholly owned by the Government of Kenya through a joint ownership by the Ministry of Petroleum and Mining and the National Treasury. The Corporation, through its National Data Centre (NDC) project, has an inventory on all petroleum explorations since 1960.	The National Oil Corporation of Kenya holds key information on all petroleum exploration work that has been conducted in Kenya since 1960 and so is a key source of information for the Project.
Turkana County Government	The Turkana County Government was formed as part of the devolved government provided by the 2010 Constitution of Kenya. The Turkana County Government consists of the County Assembly and the County Executive 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, land, energy and housing, trade, gender and youth affairs, etc. Further, planning for development of all nationally significant projects in County require participation in each of the affected counties.	The County will host the majority of Project infrastructure, with all the wellfields located within Turkana County. Turkana County Government is therefore a key stakeholder for the Project. Turkana County Government is responsible for issuing permits, such as noise and non-hazardous waste and is also a key stakeholder regarding the Government-led land acquisition process.
West Pokot County Government	The West Pokot County Government was formed as part of the devolved government provided by the 2010 Constitution of Kenya. The West Pokot County Government consists of the County Assembly and the County Executive made up of several County Ministries. The West Pokot 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, land, energy and housing, trade, gender and youth affairs etc. Further, planning for development of all nationally significant projects in County require participation in each of the affected counties.	Water for the Project is proposed to be abstracted from the Turkwel Gorge Reservoir in West Pokot, making the West Pokot County Government a key stakeholder for the Project.

Institution	Description	Project Relationship
Vision 2030 Delivery Secretariat (VDS)	VDS is the leading institution to implement the Vision 2030 as the country's blueprint and strategy towards making Kenya a newly industrialising middle-income country. The LAPSSET and its constituent projects, including the LLCOP, form a key pillar to the Vision 2030.	Exploration and Development of Oil and Other Mineral Resources is one of the Vision 2030 flagship projects. VDS is therefore a key stakeholder in the Project, which is a fundamental step in meeting VDS's responsibility to implement a key component of Vision 2030.
Water Resources Authority (WRA)	WRA is a state corporation established under the Water Act 2016 (Section 11) (formerly called Water Resource Management Authority - WRMA, established under Water Act 2002). The WRA is the lead agency in water resources management and use of water sources. Its responsible for granting permits of water use.	Key stakeholder as the national authority responsible for granting water permits for water abstraction from surface and ground sources. Any application for water permits will be conducted in accordance with the requirement of the EMCA 2015 and Water Act, 2016.
Other Government Agencies	Relevant government agencies at the national level include:	
	■ Ministry of Lands and Physical Planning;	The Ministry of Lands and Physical Planning will be a key stakeholder during the Government-led land acquisition process.
	■ Radiation Protection Board (RPB);	The Radiation Protection Board is responsible for issuing permits for any equipment with radiation source.
	■ Kenya Electricity Generating Company (KenGen);	KenGen manages hydropower generation at the Turkwel Gorge Dam and is therefore a key stakeholder with regards to proposed water abstraction from the Turkwel Gorge Reservoir.
	■ Kenya Revenue Authority (KRA);	KRA's mandate is the collection of taxes, and it has the power to inspect goods and records, to demand records from taxpayers, and to search and seize. It also has right to assess taxes owed by petroleum companies up to seven years after the year to which the income assessment relates.
	■ Kenya Bureau of Standards (KEBS);	KEBS's mandate is to promote standardisation in industry and trade through the development

Institution	Description	Project Relationship
		of standards and testing. If any industry standards are required for the Project, KEBS will be a key stakeholder.
	■ National Construction Authority (NCA);	NCA's main function is to regulate, streamline and build capacity in the construction industry. The authority registers projects and contractors, as well as provides supervisors' and workers' accreditation. All construction contractors working on the Project must have approval from the NCA.
	■ Kenya Petroleum Refineries Limited (KPRL);	KPRL is responsible for the storage of petroleum products.
	■ National Disaster Operation Centre;	The National Disaster Operation Centre is responsible for disaster preparedness and response.
	■ National Drought Management Authority (NDMA);	NDMA coordinates all matters relating to drought risk management and establishes mechanisms, either on its own or with stakeholders, that will end drought emergencies in Kenya. Turkana and West Pokot are both prone to drought, making the NDMA a key stakeholder for the ESIA.
	■ Kenya National Highways Authority (KeNHA);	KeNHA is responsible for the management, development, rehabilitation and maintenance of international trunk roads linking centres of international importance and crossing international boundaries or terminating at international ports (Class A road); national trunk roads linking internationally important centres (Class B roads); and roads linking provincially important centres to each other or to higher-class roads (Class C roads). They are a key stakeholder with regards to the Project's use of the existing road network.
	■ Kenya Rural Roads Authority (KeRRA);	The role of KeRRA is the development, rehabilitation, maintenance and management

Institution	Description	Project Relationship
		of rural roads in the country. They are a key stakeholder with regards to the Project's use of the existing road network.
	■ National Transport Safety Authority (NTSA);	NTSA's mandate include inspection of motor vehicles and ensuring road safety. Project vehicles would be regularly inspected by the institution.
	■ Kenya Civil Aviation Authority (KCAA); and	KCAA's mandate is to plan, develop, manage, regulate and operate a safe, economically sustainable and efficient civil aviation system in Kenya. The KCAA will be a key stakeholder with regards to the use of Kapese airstrip. If there are any structures of certain heights (i.e., communication towers) then approvals from KCAA will have to be obtained.
	■ Ministry of Health	Public Heath under the Ministry of Health is mandated to carry out medical examination of food handlers and camp inspections to ensure hygiene is maintained within camps.

2.2 Kenyan Policy and Legislative Requirements

This section includes a list of Kenyan policy and national legislation applicable to the Project ESIA as well as draft policies, legislation and guidelines relevant to the ESIA.

Table 2.2-1: Key Kenyan National Law

Legislation	Description
The Constitution of Kenya (2010)	The Constitution of Kenya has taken on board various issues that are related to environmental management. Article 42 of the Constitution provides that every Kenyan has the right to a clean and healthy environment, which includes the right to have the environment protected for the benefit of present and future generations through legislative and other measures. In terms of land and environmental, chapter 5 (Part 1 and Part 2) of The Constitution of Kenya is dedicated to both issues; Part 1 of this chapter provides a list of principles of land policy (article 60), defines different types of land (public, community and private land) (articles 61 to 64) and describes regulation of land use and property (article 66 and 67). The constitution requires that land be used and managed in a manner that is equitable, efficient, productive and sustainable.

Legislation	Description
	Part 2 of Chapter 5 of the constitution is dedicated to Environment and Natural Resources. Article 69 in Part 2 provides that the state shall provide encourages efforts towards sustainable of natural resources, increasing of the national forest cover public participation in the management, protection and conservation of the environment, protection of genetic resources and biodiversity. This article also mandates that the State shall establish systems of environmental impact assessment, environmental audit and monitoring of the environment. It also mandates that the State should eliminate processes and activities that are likely to endanger the environment.

Table 2.2-2: Key Kenyan National Policy

Policy	Description
Environment and Development (Sessional Paper No.6) (1999)	The Kenya's policy paper on the Environment and Development was formulated in 1999. The policy defined approaches that will be pursued by the Government in mainstreaming environment into development. The policy harmonised environmental and developmental objectives with the broad goal of achieving sustainable development. The policy paper also provided guidelines and strategies for government action regarding environment and development. About wildlife, the policy reemphasised government's commitment towards involving local communities and other stakeholders in wildlife conservation and management, as well as developing mechanisms that allow them to benefit from the natural resources occurring in their areas. The policy also advocated for the establishment of zones that allow for the multiple use and management of wildlife.
The National Biodiversity Strategy and Action Plan (NBSAP) (2000)	NBSAP was formulated in order to enable Kenya address national and international commitments defined in Article 6 of the Convention on Biological Diversity (CBD). The strategy is a national framework of action for ensuring that the present rate of biodiversity loss is reversed, and present levels of biological resources are maintained at sustainable levels for posterity. The general objectives of the strategy are to conserve Kenya's biodiversity; to sustainably use its components; to fairly and equitably share the benefits arising from the utilisation of biological resources among the stakeholders; and to enhance technical and scientific cooperation nationally and internationally, including the exchange of information in support of biological conservation.
The National Environmental Action Plan (NEAP) (1994 revised in 2007).	First published in 1994 and later revised in 2009, NEAP provides a framework for the implementation of the Environment Policy and realisation of the National Millennium Sustainable Goals and Vision 2030. The NEAP proposes a series of measure to address climate change including mitigation and adaptation, improving inter-sectoral coordination, mainstreaming sustainable land management into national planning, policy and legal frameworks and undertake research on impact of climate change on environmental, social and economic sector. It is also part of NEAP scope to increase the country's forest cover and adopt economic incentives for the management of forest products and community participation in conservation strategy

Policy	Description
	The NEAP has been also responsible for the formulation of An Environmental Action Plan for Arid and Semi-Arid Lands (ASAL) and County-specific Environmental Action Plans which will form a baseline for reference during the development of the ESIA process.
National Land Policy (2009)	The National Land Policy aims to guide the country towards efficient, sustainable and equitable use of land for prosperity and provides legal, administrative, institutional and technological framework for optimal utilisation and productivity of land related resources in a sustainable and desirable manner at national, County and community levels. It addresses critical issues of land administration, access to land, land use planning, restitution of historical injustices, environmental degradation, conflicts, unplanned proliferation of informal urban settlements outdated legal framework, institutional framework and information management. This policy addresses the following topics: ■ Constitutional issues, such as compulsory acquisition and development control as well as tenure. It recognises the need for security of tenure for all Kenyans (all socioeconomic groups, women, pastoral communities, informal settlement residents and other marginalised groups); ■ This policy recognises and protects private land rights and provides for derivative rights from all categories of land rights holding; ■ Through the Policy the government will ensure that all land is put into productive use on a sustainable basis by facilitating the implementation of key principles on land use, productivity targets and guidelines as well as conservation; and ■ Policy promotes Environmental Management and Audit as land management tools and encourages public participation in the process. It will encourage a multi-sectoral approach to land use, provide social, economic and other incentives and put in place an enabling environment for investment, agriculture, livestock development and the exploitation of natural resources.
Kenya Vision 2030 (2010)	Kenya Vision 2030 involved the participation of a wide range of stakeholders for its preparation and with the process carried out between 2006 and 2007. Kenya Vision 2030 is a national long-term development blueprint to create a globally competitive and prosperous nation with a high quality of life by 2030. The vision is anchored on three key pillars; economic, social and political governance. It aims to transform Kenya into a newly industrialising, middle high-income country and to provide a high quality of life to all its citizens by 2030 in a clean and secure 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 National Wildlife Conservation and Management 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.

Policy	Description
The National Environment Policy (2013)	The goal of The National Environment Policy is to provide a better quality of life for present and future generations through the sustainable management and use of the environment and natural resources. The National Environment Policy has the following objectives: ■ Provide a framework for an integrated approach to planning and sustainable management of the environment and natural resources; ■ Strengthen the legal and institutional framework for effective coordination and management of the environment and natural resources; ■ Promote sustainable management of the environment and natural resources; and ■ Promote collaboration and cooperation in the protection, conservation and sustainable management of the environment.
National Wetlands Conservation and Management Policy (2015)	The Wetland Policy aims to provide an effective and efficient institutional and legal framework for the management and conservation of wetlands and mitigating the diverse challenges that affect wetlands conservation and use in Kenya. This policy also fulfils Kenya's obligations under the Ramsar Convention.
National Water Masterplan 2030 (2014)	The National Water Master Plan 2030 was launched in 2014 and includes information about Kenya's water resources and meteorological conditions to facilitate planning for development and management of the same. The objectives of this plan are: ■ Assess the availability, reliability, quality, and vulnerability of Kenya's water resources up to 2050; ■ Include climate change into the assessment of availability of water resources in the country; ■ Improve water and sanitation access to all Kenyans by 2030; ■ Promote a clean, secure and sustainable environment by 2030; and ■ Generate more energy and increase efficiency in energy sector.
The National Land Use Policy (2017)	The Policy provides a legal, administrative, institutional and technological framework for optimal utilisation and productivity of land related resources in a sustainable and desirable manner at national, county and community levels. The Policy is premised on the philosophy of economic productivity, social responsibility, environmental sustainability and cultural conservation. Key principles informing it include efficiency, access to land use information, equity, elimination of discrimination and public benefit sharing. The Policy offers a framework to ensure efficient, productive and sustainable use of land system that provides for: ■ Land use planning, resource allocation and resource management for sustainable development to promote public good and general welfare; ■ Environmental management and sustainable production in the utilisation of land resources; ■ Equitable utilisation of land resources to meet governance, social, economic and cultural obligations of the people of Kenya; and ■ Mitigating problems associated with poor land use

Policy	Description
The National Energy Policy (2018)	The Policy provides for sustainable, adequate, affordable, competitive, secure and reliable supply of energy at the least cost geared to meet national and county needs while protecting and conserving the environment.
Strategic Environmental and Social Assessment of the Petroleum Sector in Kenya (2016)	Presents a unique opportunity for the country to systematically address environmental and socio-economic management issues pertaining to oil and gas activities in the context of sustainable development.

Table 2.2-3: Relevant National Legislation

Name of Legislation	Description
The Petroleum Act (2019)	This Act applies in the regulation of upstream, midstream and downstream petroleum operations being developed in Kenya. It provides a framework for the contracting, exploration, development and production of petroleum and provides information on the establishment and functions of the National Upstream Petroleum Advisory Committee. Part VIII of the Petroleum Act (2019) provides for environment, health and safety, which covers environmental compliance, waste management, maintenance of property, venting and flaring of oil and natural gas, reporting of accidents and incidents, safety precautions, emergency preparedness measures, safety zones and liability of contractor for damage due to pollution.
Mining Act (2016)	Addresses the key areas that will regulate and facilitate the development of the mining and mineral industry including health, safety and environment issues related to mining, including mining of construction materials.
Energy Act (2019)	The Act provides for the establishment, functions and powers of the EPRA under Part III. The Energy Act also provides that a person engaged in any undertaking or activity pursuant to a licence under this Act shall notify the respective licensing authority and EPRA of any accident or incident causing loss of life, personal injury, explosion, oil spill, fire or any other accident or incident causing harm or damage to the environment or property which has arisen in Kenya, within 48 hours in writing, in the form and manner prescribed by EPRA.
Physical and Land Use Planning Act (2019)	An Act of Parliament to provide for the preparation and implementation of physical development plans and for connected purposes. It empowers County Governments to adopt Physical Development Plans in accordance with this Act and to control development through issuance of development plan permits, prohibition/control of land and buildings, and subdivision of land. It also provides for approval by the Cabinet Secretary of projects of strategic national importance.
The National Museums and Heritage Act (2006 Revised 2012)	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

Name of Legislation	Description
	and sets restrictions on moving objects of archaeological or palaeontological interest.
Environment and Land Court Act (2012)	The Environment and Land Court Act establishes the Environment and Land Court pursuant to Article 162 of the Kenya Constitution which provides for the creation of specialised 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.
County Government Act (2012)	The County Governments Act expounds on the functions of County Governments in Kenya and to clarify on the functions of County governments in Kenya. It also designates any other functions not assigned to the counties by the Constitution, or any other written law, as a national government function. It led to the constitution of the department of Environment, Water and natural resources responsible for environmental conservation in the County level.
Prevention, Protection and Assistance to Internal Displaced Persons and Affected Community Acts (2012)	An Act of Parliament on internal displacement in Kenya that makes provision for the prevention, protection and provision of assistance to internally displaced persons and affected communities.
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. 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.
Environmental Management and Coordination Act (1999) as amended in 2015 and the subsidiary Regulations	The EMCA as amended in 2015 and its subsidiary regulations set out requirements and procedures for conducting EIAs, auditing and environmental monitoring in Kenya. This Act addresses issues related to duties of NEMA, constitution of CEC at County level as well as its composition and functions, the National Environmental Complaints Committee, the adoption of a NEAP. The Act also establish environmental standards for water quality, noise, fossil fuel emission, and waste management and regulates activities impacting wetlands, riverbanks, lake/seashores, and the conservation of biological diversity.
The Water Act (2016) and subsidiary legislation	This is an Act of Parliament with the purpose to provide for the regulation, management and development of water resources and water and sewerage services in line with the Constitution. Part III of the Act provides for the Regulation of the Management and use of water Resources through the WRA which is in charge of implementation of the policy. Part of this act, Section 22 provides for protection of catchment areas to conserve vulnerable water resource and Section 23 provides for the conservation of ground water resource, including i) protection of public water or water supplies for different uses (industrial, agriculture and other private purposes), ii) conservation of the water resources of the aquifer of

Name of Legislation	Description
	the ground water resources, and iii) declaration of conservation areas for ecological reasons (published in Gazette). Section 36 of the Act requires that a permit is obtained for: any use of water from a water resource, except as provided by section 37; the drainage of any swamp or other land; and the discharge of a pollutant into any water resource. The policy requires that an application for such a permit shall be subject to public consultation as well as an EIA as per the EMCA, 1999. Section 63 of the Act entitles every person in Kenya the right to clean and safe water in adequate quantities and reasonable standards of sanitation as stipulated in Article 43 of the Constitution.
Land Act (2012) as amended by the Land Laws (Amendment) Act (2016)	It is the substantive law governing land in Kenya and provides the legal regime over the 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.
Community Land Act (2016)	The Act provides for the recognition, protection and registration of community land rights; management and administration of community land; to provide for the establishment of and the powers of community land management committees; and County governments in relation to unregistered community land and for connected purposes. Part V to VIII of the Act are key to Oil and Gas Operations on Community Land. These parts give provisions on guidelines on: ■ Conversion of community land for public use; ■ Special rights and entitlements in the community land; ■ Environment and natural resources management (natural resources on community land, benefit sharing, rules by-laws and regulation of community land use planning); and ■ Settlement of disputes relating to community land such as dispute resolution mechanisms, mediation and arbitration.
Land Registration Act (2012) as amended by the Land Laws (Amendment) Act (2016)	This is a procedural law and provides for revision, consolidation and rationalisation of the registration of titles to land, to give effect to the principles and objects of devolved government in land registration. It also provides for the registration of interests over land.
National Land Commission Act (2012) as amended by the Land Laws (Amendment) Act (2016)	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.
Land Value (Amendment) Act (2019)	The Act amends the Land Act, 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.
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 and connected purposes. It provides the regulatory framework for enhanced response to climate change.

Name of Legislation	Description
Access to Information Act (2016)	The Act upholds the right to information and enables citizens to access information from the state and private companies.
Health Act (2017)	Private entities shall be permitted to operate hospitals, clinics, laboratories and other institutions in the health sector, subject to licensing by the appropriate regulatory bodies.
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 (now County governments) 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). Chapter 242 makes provision for securing and maintaining public health. Section 115 of this Act prohibits causing nuisance or other condition liable to be injurious or dangerous to health. Section 118 provides a list of nuisances which includes any noxious matter or waste water, flowing or discharged from any premises, wherever situated, into any public street, or into the gutter or side channel of any watercourse, irrigation channel or bed thereof not approved for the reception of such discharge.
The Kenya Wildlife Conservation and Management Act (KWCMA) (2013)	An Act of Parliament to provide for the protection, conservation, sustainable use and management of wildlife in Kenya and for connected purposes. The Act covers wildlife resources in all public, private and community land and Kenyan territorial waters. The Act provides that wildlife should be conserved to yield optimum returns in terms of cultural, aesthetic, scientific and economic benefits. The Act requires that full account be taken of the inter-relationship between wildlife conservation and land use. The Act controls activities within the national parks, which may lead to the disturbance of wild animals. Unauthorised entry, residence, burning, damage to objects of scientific interest, introduction of plants and animals and damage to structure are prohibited under this law. 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 KWS as the implementing agency. The act lists nationally protected wildlife conservation areas, species under varying conservation threat levels as well as those nationally considered invasive. The following schedules will form key reference for the impact analysis and ESMP (Environmental and Social Management Plan) formulation: ■ Sixth Schedule- Nationally listed Critically Endangered, Vulnerable, Nearly Threatened and Protected Species; ■ Seventh schedule- National list of Invasive Species; ■ Ninth Schedule- Wildlife categories in relation to offences and penalties in sport and recreational hunting; and ■ Eleventh Schedule- National Parks, Marine Protected Areas and Sanctuaries

Name of Legislation	Description
The Forest Conservation and Management Act (2016)	An Act of Parliament to give effect to Article 69 of the Constitution about forest resources; to provide for the development and sustainable management, including conservation and rational utilisation of all forest resources for the socio-economic development of the country and for connected purpose.
Agriculture, Fisheries and Food Authority Act (2013)	The Agriculture, Fisheries and Food Authority Act consolidates 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.
The Traffic (Amendment) Act (2019)	The Traffic Act relates to traffic on all roads. This amendment makes provision for the standardisation of the use of all roads classified as superhighways.
Kenya Roads Act (2007)	An Act of Parliament to provide for the establishment of the Kenya National Highways Authority, the Kenya Urban Roads Authority (KURA) and the Kenya Rural Roads Authority, to provide for the powers and functions of the authorities and for connected purposes.
The Turkana County Water Act (2019)	Enacted by the County Assembly of Turkana, this Act provides for: the regulation and management of water and sewerage services in Turkana County; the development, regulation and management of County public works in relation to water and sewerage systems; and the implementation of National Government Policies on water conservation in Turkana County and for connected purposes.
Human Immunodeficiency Virus (HIV)/ Acquired Immune Deficiency Syndrome (AIDS) Control & Prevention Act (2006)	Provides measures for the prevention, management and control of HIV and AIDS, and for the protection and promotion of public health and for the appropriate treatment, counselling, support and care of persons infected or at risk of HIV and AIDS infection, and for connected purposes. The act requires HIV and AIDS education in the workplace for employees of private and informal sector.
The Penal Code, Cap 63 (2009)	Makes it an offence for any person or institution that voluntarily corrupts, or fouls water for public springs or reservoirs rendering it less fit for its ordinary use. Similarly, it prohibits making the atmosphere in any place noxious to health of persons/institution in dwellings or business premises in the neighbourhood or those passing along a public way. In addition, any person who makes loud noises or offensive or unwholesome smells in a place so as to annoy any considerable number of persons in the exercise of their common rights commits an offence and is liable to be punished as for a common nuisance.
Labour Relations Act (2007 Revised 2012)	Consolidates the laws relating to trade unions and trade disputes, to provide for the registration, regulation, management and democratisation of trade unions and employers organisations and to promote sound labour relations through the protection and promotion of freedom of association. It addresses employee's freedom of association, establishment and registration of trade unions and organisations, officials and members of trade unions and employers' organisations, trade union dues and agency fees, among many others.

Name of Legislation	Description
Employment Act 2007 as amended by Employment (Amendment) Act 2019	This is an Act of parliament that applies to all employees employed by any employer under a contract of service. The Act came in operation in June 2008. The Act regulates employment relations between the employer and the employee. It provides fundamental rights of employees, to provide basic conditions of employment of employees, to regulate employment of children, and to provide for matters connected with the foregoing. This law prohibits employment of children in any activity which constitutes worst form of child labour. No person shall employ a child who has not attained the age of thirteen years whether gainfully or otherwise in any undertaking. However, a child of between thirteen years of age and sixteen years of age may be employed to perform light work which is: a) Not likely to be harmful to the child's health or development; and b) Not such as to prejudice the child's attendance at school, his participation in vocational orientation or training programmes approved by Minister for labour or his capacity to benefit from the instructions received.
Children Act (2001 Revised 2012)	Protects children from economic exploitation and any work that is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral or social development.
Explosives Act, Chapter 115 (2017)	Regulates the manufacture, storage, sale, transport, importation, exportation and use of explosives, as deployed in construction materials extraction and related construction activities
The Protection of Traditional Knowledge and Cultural Expressions Act (2016)	The Act provides a unified and comprehensive framework for the protection and promotion of traditional knowledge and traditional cultural expressions.
Natural Resources (Classes of Transactions Subject to Ratification) Act (2016)	The Act provides for ratification process by parliament prior to extraction of natural resources. The extraction of underground steam within a water conservation or other water resource protected area, extraction of crude oil or natural gas and excision or change of boundaries of gazetted public forests or nature reserves are listed as transactions requiring parliamentary ratification.
Subsidiary Legislation of Petroleum (exploration and Production) Regulations (1984)	These Regulations provide for access to land. A petroleum agreement or exploration permit cannot authorise a contractor to occupy or exercise any rights in any burial ground or land near a place of worship, any area situated within 50 m of any building, any public road, any area situated within a municipality or township and any area of land declared to be a national park.
The Environmental Management and Coordination (Wetlands, River Banks, Lake Shores and Sea Shore Management Plan) Regulations (2009)	These regulations require the protection of wetlands, riverbanks, lake shore and seashore areas which provide ecological habitats.
Food, Drugs and Chemical Substances (Food Hygiene) Regulations (1978)	These regulations provide that no person shall use any premises or being the owner or occupier thereof permit or allow the premises to be used for the purposes of selling, preparing, packaging, storing, or displaying for

Name of Legislation	Description
	sale any food unless that person is in possession of a licence issued under the Regulations.
National Environmental Tribunal Procedure Rules (2003) (L.N. No. 191)	The rules provide the procedure for appeals and referrals to the tribunal for determination. The Tribunal hears appeals and complaints from the decisions of NEMA.
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. This Act, through medical examination rules, requires workers exposed to various occupational health hazards to undergo regular medical examination
Factories and Other Places of Work (Noise Prevention and Control) Rules (2005)	These rules require that where the noise level is above 90 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.
The Factories and Other Places of Work (Hazardous substances) Rules 2007	These Rules are prepared to: ■ Mitigate against workplace exposure of persons to potentially hazardous substances; ■ Put in place safety standards against hazardous exposure; and ■ Lower performance of work in hazardous conditions or circumstances.
The Factories and Other Places of Work (Fire Risk Reduction) Rules L.N. 59/2007	These Rules seek to promote fire safety measures at every workplace, process and operations by, among others: ■ Vesting some responsibilities to the occupier; ■ Recommendations on flammable substances on storage, marking and labelling, handling, monitoring (flammable substances), ventilation; ■ Housekeeping as well as removal of products and waste; ■ Machinery/equipment layout as well as Fire escape exits; ■ Control of the spread of smoke; ■ Means of evacuation; ■ Formation and functions of fighting teams; ■ Training in fire safety; ■ Fire detection system; ■ Maintenance inspection & testing of cylinders.
The Factories and other places of work (Safety and health committees) Rules L.N. 31/2004	Make provisions in support of formation of Safety and Health Committees at all factories and other workplaces which regularly employ 20 or more employees. These committees are tasked with the responsibility for

Name of Legislation	Description
	overseeing occupational safety and health implementation and performing safety audits.
The Factories (First-Aid) Order, L.N. 666/1963.	Makes provisions for first aid boxes/cupboards and trained first aiders in workplaces with the respective level first aid kit stocking and numbers of trained first aiders required depending on the number of workers.
Waste Management 01.Regulations (2006)	A licence is required to transport waste in a vehicle approved by the Authority upon the recommendation of the relevant lead agency.
Water Quality Regulations (2006)	A permit is required to discharge a waste/ effluent disposal into the environment in a sound manner.
The Environmental Management and Coordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations (2006)	These regulations ensure that activities do not have an adverse impact on any ecosystem.
The Environmental Management and Coordination (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 WRA and NEMA are key administering authorities. A permit is required to discharge a waste/ effluent disposal into the environment in a sound manner.
The Environmental Management and Coordination (Waste Management) Regulations (2006), Cap. 387	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 facilities, and require an EIA to be undertaken on any site disposing of or generating biomedical waste. A licence is required to transport waste in a vehicle approved by the Authority upon the recommendation of the relevant lead agency.
The Environmental Management and Coordination (Impact Assessment and Audit) Regulations (EIAAR) (2003)	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.

Name of Legislation	Description
The Environmental Management and Coordination (Impact Assessment and Audit) Regulations (EIAAR) (Amendment) (2016) The Environmental Management and Coordination (Impact Assessment and Audit) Regulations (EIAAR) (Amendment) (2019)	A holder of an EIA licence may, on payment of the prescribed fee, transfer the licence to another person only in respect of the project to which such licence was issued. The EIA/EA (Environment Agency) amendments revise and replace the second schedule of projects required to undergo EIA by categorising projects into low, medium and high risk. Petroleum exploration, development and production are categorised as high risk. The draft ESIA and EA Guidelines for the Downstream Petroleum Sub-sector (2012) issued by ERC (now the responsibility of EPRA) provide advice on their interpretation to that sector.
Environmental Management and Co-ordination (Controlled Substances) Regulations (2007), Cap. 387	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, and also for packing and labelling control. A valid license is required to import controlled substances into Kenya.
The Environmental Management and Coordination (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. For an activity that will exceed the noise and/ or vibration limits stipulated in the Regulations ensure that a licence is secured before the undertaking of such activity (fireworks, demolitions, firing ranges or specific heavy industry).
The Environmental Management and Coordination (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 sources (e.g., industries). The regulations provide the procedure for designating controlled areas, and the objectives of air quality management plans for these areas.

Name of Legislation	Description
	Schedules 1 to 3 of the regulations prescribe the ambient air quality tolerance limits, priority air pollutants and emission limits. These will be relevant in monitoring any project impacts on the air environment.
The Public Health (Drainage and Latrine) Rules	This subsidiary legislation, to Public Health Act, regulates drainage and sewerage provisions and provides technical standards that have to be met in the construction, laying or maintenance of any sewerage system. Provides that every owner or occupier of every workshop, workplace or other premises where persons are employed shall provide proper and sufficient latrines for use by employees. Also requires every contractor, builder or other person employing workmen for the demolition, construction, reconstruction or alteration of any building or other work in any way connected with building to provide in approved position sufficient and convenient temporary latrines for use by such workmen.

Table 2.2-4: Draft Policies, Legislation and Guidelines

Name of Legislation	Description
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 Kenya National Petroleum Master Plan (2015)	Purpose of this is to integrate all elements of the oil and gas value chain, from exploration, production, transportation, processing, storage and distribution, and usage in domestic and export markets.
Draft Petroleum (Local Content) Regulations (2019)	These regulations are made pursuant to the Petroleum Act, 2019. The regulations will apply to local content with respect to the upstream, midstream and downstream petroleum activities. The purpose of these regulations includes: a) To maximise value addition through local content development and local participation in the petroleum industry operations; c) To promote participation of Kenyan people and indigenous Kenyan companies in provision of goods and services in the petroleum industry value chain; d) To provide for a robust, transparent monitoring and reporting for local content obligations, among others
Public Participation Bill (2019)	This Bill seeks to provide a framework for effective public participation, The Constitution of Kenya 2010, introduced a new system of governance that places the people at the centre of governance.
Strategic Environmental and Social Assessment of the Petroleum Sector in Kenya (2016)	Presents a unique opportunity for the country to systematically address environmental and socio-economic management issues pertaining to oil and gas activities in the context of sustainable development.
The Draft Sovereign Wealth Fund Bill (2019)	The Bill establishes Kenya's Sovereign Wealth Fund to undertake diversified portfolio of medium and long-term local and foreign investment to build a savings base for purposes of national development, stabilisation the economy at all times, enhance intergenerational equity in Kenya. It provides institutional arrangements for effective administration and efficient management of minerals and petroleum revenues.
The Preservation of Human Dignity and Enforcement of Economic and Social Rights Bill (2018)	The Bill gives effect to Article 43 of the Constitution in order to ensure the preservation of human dignity as set out under Article 19 of the Constitution. Article 43 of the Constitution guarantees economic and social rights for all persons.
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.

Name of Legislation	Description
Draft Environmental Management and Coordination (Waste Tyre Management) Regulations (2013)	The regulations stipulate that no person shall be engaged in the collection, transportation, storage or disposal of waste tyres without a valid licence from the Authority.
The Environment Management and Co-ordination (Deposit Bonds) Regulations (2015)	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 and Coordination (Conservation and Management of Wetlands) Amendment 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 Environmental Management and Coordination (Strategic Assessment, Integrated Impact Assessment and Audit) Regulations (2018)	The draft regulations provide for the need to register environmental assessment experts and the requirement for an environmental assessment expert licence. The regulation spells out requirements for a project report as well as the submission comment and authorisation process. The regulations define the requirements for the integrated environmental impact assessment, environmental audit and monitoring, and strategic environmental assessment processes in some detail.
Draft Plastic Bags Control and Management Regulations (2018)	The Authority may authorise the manufacture, import, export or use of plastic flat bags for industrial packaging. An application for authorisation to manufacture, import, export or use plastic flat bags shall be made in accordance with the first schedule.
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, restrictions and banning, incidents, liabilities, waste disposal and offences of toxic and hazardous chemicals and materials.

2.3 International Guidance and Standards

The Project ESIA is focused on compliance with Kenyan regulatory requirements. In addition, the following international standards and guidelines will be referenced, as appropriate, throughout the Project ESIA:

Table 2.3-1: List of International Standards Referenced in the Project ESIA

Source	International Standard
IFC (2007a)	▪ WBG EHS General Guidelines including key sections on the following: ▪ WBG EHS Guidelines: Wastewater and Ambient Water Quality; ▪ WBG EHS Guideline: Air Emissions and Ambient Air Quality; ▪ WBG EHS Guideline: Occupational Health and Safety; ▪ WBG EHS Guideline: Noise; and ▪ WBG EHS Guidelines: Water and Sanitation.
IFC (2007b)	▪ WBG EHS Guidelines for Onshore Oil and Gas Development.
IFC (2007d)	▪ WBG EHS Guidelines for Electric Power Transmission and Distribution
IFC (2012)	▪ Performance Standards for Environmental and Social Sustainability and accompanying Guidance Notes.

Good Practice guidelines referred to in this document include:

Table 2.3-2: List of Good Practice Guidelines Referenced in the Project ESIA

Source	International Guideline
Business and Biodiversity Offsets Programme (BBOP) (2012).	▪ BBOP Standard on Biodiversity Offsets Guidance.
IFC (1998)	▪ Doing Better Business Through Effective Public Consultation and Disclosure.
IFC (2007e)	▪ Stakeholder Engagement: A Good Practice Guide for Companies Doing Business in Emerging Markets.
IFC GPN 7 (2009)	▪ Good Practice Note 7: Addressing Grievances from Project-Affected Communities: Guidance for Projects and Companies on Designing Grievance Mechanisms.
IFC and European Bank for Reconstruction and Development (EBRD) (2009)	▪ Workers' Accommodation: Processes and Standards.
IFC (2013)	▪ Good Practice Handbook: Cumulative Impact Assessment and Management – Guidance for the Private Sector in Emerging Markets.
IFC (2014)	▪ Environmental and Social Management System Implementation Handbook.

Source	International Guideline
IFC (2017)	■ Good Practice Note: Managing Contractors' Environmental and Social Performance.
International Petroleum Industry Environmental Conservation Association (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 et al., 2013)	■ Weaving ecosystem services into impact assessment: A Step-By-Step Method.
World Health Organisation (WHO) (1999)	■ Guidelines for Community Noise.
WHO (2005)	■ Air Quality Guidelines Global. Guidelines on the standards that should be achieved for air, in the absence of national guidelines.
WHO (2011)	■ Drinking Water Quality Guidelines – 4th edition.

2.4 International Conventions

This subsection presents a list of relevant international treaties, conventions and agreements to which Kenya is a signatory or has acceded to/ratified and that are related to the social and/or environmental aspects of the Project ESIA.

Table 2.4-1: Relevant International Conventions

Convention	Date Ratified/ Acceded to
African Convention on The Conservation of Nature and Natural Resources (Revised Edition) 2003	Ratified 1969
International Convention Relating to Intervention on the High Seas in Case of Oil Pollution Casualties (1969)	N/A
International Oil Pollution Compensation Supplementary Fund (2003)	N/A
International Covenant on Economic, Social and Cultural Rights	Ratified 1972
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1973)	Acceded 1978
The African (Banjul) Charter on Human and Peoples" Rights (African Charter)	Ratified 1992
Vienna Convention for the Protection of the Ozone Layer (1985)	Acceded 1988
Montreal Protocol on Substances that Deplete the Ozone Layer (1987)	Accepted 1988
International Convention on Oil Pollution Preparedness, Response and Co-operation (1990)	Acceded 1999
Convention on Wetlands of International Importance (the Ramsar Convention) (1971)	Ratified 1990
United Nations Educational, Scientific and Cultural Organisation (UNESCO) Convention for the Protection of the World Cultural and Natural Heritage	Acceded 1991
United Nations Framework Convention on Climate Change (1992)	Acceded 1994
Convention on Biological Diversity (1992)	Acceded 1994
Lusaka Agreement on the Cooperative Enforcement Operations Directed against Illegal trade in Fauna (1994)	Ratified 1997
Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) (1979): ■ The African-Eurasian Water-bird Agreement (AEWA); and ■ The Agreement on the Conservation of African-Eurasian Migratory Water birds (AEWA).	Acceded 1999
Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal (Basel Convention) (1989)	Acceded 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)	Signed 2003
Convention on Persistent Organic Pollutants (2001)	Ratified 2004

Convention	Date Ratified/ Acceded to
Convention on Climatic Change and the Kyoto Protocol (1997)	Ratified 2005
UNESCO Convention on Intangible Cultural Heritage	Ratified 2007
Framework Convention for Climate Change (The Paris Agreement)	Ratified 2016
United Nations Convention to Combat Desertification	Ratified 1997
International Convention on Establishment of an International Fund for Compensation for Oil Pollution Damage, 1992	Acceded 2000
International Convention on Civil Liability for Oil Pollution Damage for Oil Pollution Damage, 1992	Acceded 2000

2.5 Project Standards

The Project Standards that were used for the preparation of baseline reports and that form the basis of the impact assessment criteria for certain topics are presented in Annex I.

The ESIA project standards were selected by reviewing international and Kenyan national guideline values, particularly for water quality, air quality, vibration and noise. Where Kenyan national standards are absent or are not appropriate, the approach used for the ESIA has been to refer to other internationally recognised guidelines for reference, such as IFC, WBG, WHO, USEPA (United States Environmental Protection Agency), and UK EA guidelines.

3.0 IMPACT ASSESSMENT METHODOLOGY

3.1 Overview

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. The ESIA sets out potential mitigation and management processes to prevent unacceptable deterioration of environmental and social conditions, minimise negative impacts and enhance benefits for stakeholders, affected communities and the environment. The ESIA methodology uses a staged approach presented in Table 3.1-1.

A stakeholder engagement process is incorporated in the ESIA methodology to ensure that legislative requirements are met; sources of information and expertise are identified; and stakeholder concerns and expectations are registered and addressed in the ESIA. Through stakeholder engagement, Project Affected People (PAP) have the opportunity to discuss the Project risks, impacts, proposed mitigation and monitoring. The stakeholder engagement process is detailed in Chapter 4.0 of this ESIA. The Stakeholder Engagement Plan (SEP), which details the specific approach to undertaken stakeholder engagement, and consultation materials are presented in Annex II.

Table 3.1-1: Approach to Impact Assessment

Stage	Activity
1	Establish baseline conditions – determine baseline conditions through review of existing published and available site-specific information.
2	Establish the key receptors, their importance and sensitivity.
3	Characterise the magnitude of the impact to the receptor. Bio-physical: determine the potential changes to receptors brought about by the Project (including incorporated environmental measures) and assign a magnitude of impact. Social: determine the potential changes to PAP brought about by the Project (including incorporated environmental measures) and assign a consequence.
4	Assess the impact significance Bio-physical: determined by the nature and magnitude of impact, combined with the importance and sensitivity of the receptor. Social: Evaluation of social significance impacts through a narrative evaluating direction, consequence, geographic extent and duration of impact.
5	Consider the need for monitoring and management – used where there is a need to support the implementation of or monitor the success of any mitigation.

The ESIA has been undertaken in accordance with the applicable requirements of:

- Kenyan EIA legislation and policy[1];
- IFC Performance Standards (the ESIA is an approvals document prepared to meet Kenya requirements and, where relevant, is aligned with IFC requirements – compliance with which will be documented in a separate Supplemental Assessment document);
- The Operator's internal policies and standards; and

[1] Although Kenyan legislation defines the environmental assessment process as an "Environmental Impact Assessment" or "EIA", the term "ESIA" has been used for this assessment process from the outset, to align with international best practice and stakeholder concerns. This terminology was agreed in the terms of reference agreed with NEMA (See Annex I).

- GIP.

3.2 Scoping Stage

The aim of scoping is to identify potential impacts, in conjunction with Project stakeholders, on environmental and social receptors arising 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 scoping stage was the Terms of Reference (ToR) and the Scoping Report. Both documents were developed based on what was at that time known as the "*Full Field Development*" Project. The name and format of the Project has subsequently changed, but the ToR (1433956.517_A.0) and Scoping Report (1433956.516_A.2) remain valid and are presented in Annex I of this ESIA.

3.3 Establishment of Baseline Conditions

Baseline data collection is undertaken to characterise the existing environmental and social receptors and conditions in the Area of Influence (AoI), and to identify any trends in such conditions. 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;
- Site reconnaissance visits and field surveys; and
- The subsequent analysis and interpretation of data.

Baseline data is presented in detail in Chapter 6.0 of this ESIA. A summary of all baseline studies that have been undertaken by Golder to gather primary data in the field is presented in Table 3.3-1.

Baseline data collection was undertaken both prior to and during the operation of EOPS. Although EOPS is outside of the scope of this ESIA, the impact and inclusion of EOPS on the current baseline has been considered in this assessment.

Table 3.3-1: Summary of all baseline fieldwork completed to date

Year	Summary of fieldwork
2014	■ Scoping visits to inform Scoping Report and ToR.
2015	■ Air Quality surveys; ■ Meteorology data collection; ■ Noise and Vibration surveys; ■ Water Quality and Water Quantity surveys; ■ Biodiversity – aquatic and wetland ecosystems, terrestrial invertebrates, large mammals, small mammals, birds, vegetation surveys; and ■ Social – land surveys.
2016	■ Air Quality surveys; ■ Meteorology data collection;

Year	Summary of fieldwork
	■ Noise and Vibration surveys; ■ Water Quality and Water Quantity surveys; ■ Biodiversity – mammals, birds, reptiles, invertebrates, vegetation surveys; ■ Social – socioeconomic and health, land surveys; ■ Cultural Heritage surveys; and ■ Traffic surveys.
2017	■ Air Quality surveys, including odour; ■ Meteorology data collection; ■ Water Quality and Water Quantity surveys/monitoring; ■ Biodiversity – mammals, birds; ■ Soils surveys; and ■ Landscape and Visual.
2018	■ Air Quality surveys; ■ Meteorology data collection; ■ Noise and Vibration surveys; ■ Biodiversity – birds, aquatics, mammals surveys; and ■ Social – stakeholder mapping, health surveys.
2019	■ Air Quality surveys; ■ Noise and Vibration surveys; ■ Water Quality surveys; ■ Biodiversity surveys; ■ Cultural Heritage surveys; ■ Social – health surveys; and ■ Landscape and Visual surveys.
2020	■ Air Quality surveys; ■ Noise and Vibration surveys; and ■ Biodiversity – terrestrial invertebrates, herpetofauna, birds, vegetation surveys.

Year	Summary of fieldwork
2021	■ Air Quality surveys; ■ Water Quality and Water Quantity surveys; ■ Biodiversity surveys; ■ Cultural Heritage surveys; and ■ Social surveys.

3.4 Impact Assessment

There are no specific methods provided in the Kenyan EIA guidelines other than stating that the environmental impacts analysis of a project should include direct, indirect, cumulative, irreversible, short-term and long-term impacts. The impact assessment process in this ESIA is therefore largely based on a standard methodology (as defined in IFC Performance Standard 1), widely used nationally and internationally.

The term 'impact' is used to describe a change to the receiving physical, biological or social environment, which may require mitigation or management to be considered. The types of impacts considered in the ESIA include:

- Direct – an impact that arises directly from activities that form an integral part of the Project (e.g. new infrastructure) and is within the control of the Project proponent;
- Indirect – an impact that arises from activities not explicitly forming part of the Project but as a "*knock on effect*" of it, that may not be within the control of the Project proponent (e.g. changes to water availability due to increased influx of people); and
- Combined – the combination of other direct or indirect impacts of the Project on any one or group of receptors.

The impact assessment process comprises the following main steps:

- Identification of the impacts of the Project on receptors taking into account incorporated environmental measures (see Section 3.9);
- Evaluation of the significance of the impact;
- Development of mitigation measures; and
- Where necessary, prediction of the significance of residual impacts.

The details of the impact assessment and classification of impacts were developed for each topic 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 is accompanied with an assessment of emergency, accidental and non-routine events, which are reported in a separate chapter (Chapter 7.11) and will feed into a Project emergency preparedness and response plan.

3.5 Receptor Importance

The term 'receptors' is used to describe features of the environment such as water resources, habitats and species which are valued by society for their intrinsic worth and/or their social or economic contribution; and social groups or PAP such as individuals and communities that may be impacted by the Project.

The importance of a receptor is determined by the consideration of a range of criteria depending on the topic under consideration, including: the economic, social and cultural value of the receptor, locally, nationally and internationally; any local, national or international designations; the rarity and sensitivity of the receiving environment; and the benefits or services provided.

Receptor importance is determined by the consideration of a receptors' ability to resist or adapt to changes and its resilience to change. The category of the importance of a receptor is determined based on professional judgement of technical topic leads and is presented in each technical sub section of Chapter 7. Table 3.5-1 provides an example of categories of importance.

Table 3.5-1: Example for Determining Receptor Importance

Importance of Receptor	Example of importance of receptors
Very high	An attribute with a high quality and/ or rarity on an international, regional or national scale with little or no potential for substitution. Sensitive receiving environment or receptor with little resilience or adaptability to imposed stresses.
High	An attribute with a high quality and/ or rarity on a local scale with little or no potential for local substitution, or with a medium quality or rarity on an international, regional or national scale with limited potential for substitution. Sensitive receiving environment or receptor with little resilience or adaptability to imposed stresses.
Medium	An attribute with a medium quality and/ or rarity on a local scale with limited potential for substitution, or an attribute of low quality and rarity on an international, regional or national scale. Receiving environment or receptor with moderate resilience or adaptability to imposed stresses.
Low	An attribute of low quality and/ or rarity on a local scale with potential for substitution locally. Receiving environment or receptor with high resilience or adaptability to imposed stresses.

3.6 Identifying the Magnitude and Significance of Environmental Impacts

The magnitude of the impact is determined by taking into account several factors. This varies per topic and includes one or several of the following:

- Intensity of change;
- Geographic extent of change (e.g., local, regional, national, transboundary);
- Duration of change; and

- Frequency.

Impact significance is determined by considering the importance of the receptor in combination with the magnitude of the impact. Receptor importance and magnitude are specific to each environmental topic and are defined in the impact assessment using a combination of environmental standards, guidance and professional judgement. Table 3.6-1 demonstrates how these parameters are considered in the assessment of significance.

Table 3.6-1: Determination of Significance of Environmental Impact

		Magnitude of Impact			
		Negligible	**Low**	**Medium**	**High**
Receptor importance	**Very High**	Negligible	Moderate	Major	Major
	High	Negligible	Minor	Moderate	Major
	Medium	Negligible	Minor	Minor	Moderate
	Low	Negligible	Negligible	Minor	Minor

The descriptions of the different significance of an impact are given in Table 3.6-2:

Table 3.6-2: Descriptions of Different Impact Significance

Significance of Impact	Typical Description of Significance
Major	Effects at this level are material in the decision-making process and require mitigation.
Moderate	Effects at this level are likely to be material in the decision-making process and require mitigation.
Minor	Effects at this level can be considered to be material decision-making factors and may require mitigation.
Negligible	Effects at this level are not material in the decision-making process.

Potential impacts are also assigned descriptors to identify whether the impact is direct or indirect. For the purposes of this assessment, a direct impact is one that occurs as a direct result of the Project and is likely to occur at the Project itself. Indirect impacts (or secondary/tertiary impacts) are those where a direct impact on one receptor has another knock-on impact on one or more other related receptor(s). Indirect impacts are likely to occur away from the Project.

3.7 Evaluating the Significance of Social Impacts

The evaluation of social impacts differs from the evaluation of environmental impacts. Evaluation of social impacts relies on a narrative, which brings together the evaluation of the following four criteria to reach an impact significance for the overall social impact:

- Direction, i.e.:

- Positive direction – impact provides a net benefit to the affected person(s);
- Negative direction – impact results in a net loss to the affected persons(s); and
- Mixed direction – mixed directions or no net benefit or loss to the affect person(s).

- Consequence, i.e.:
  - Negligible consequence – no noticeable change anticipated;
  - Low consequence – predicted to be different from baseline conditions, but not to change quality of life of the affected person(s);
  - Moderate consequence – predicted to change the quality of life of the affected person(s); and
  - High consequence – predicted to seriously change quality of life.
- Geographic extent of change (e.g. local, regional, national, transboundary); and
- Duration.

Each impact was 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. The above criteria are then used to define impact significance using the matrix in Table 3.6-1 and the descriptions in Table 3.6-2.

For impact topics on Community Health and Safety only, the following additional criterion of Likelihood has also been stated in the narrative of the assessment:

- Unlikely: likelihood is slight;
- Possible: likelihood is possible, i.e. less than 50% during the evaluated activity/period;
- Probable: likelihood is probable, i.e. more than 50% during the evaluated activity/period; and
- Definite: likelihood is certain.

3.8 Duration of Impact

Each potential impact can be either adverse or beneficial to the receptor of interest and will vary in its duration (i.e. can be long-term, medium or short-term and either permanent or temporary). For the purposes of this ESIA, the following durations apply:

- A short-term impact is defined as up to 66 months (the maximum anticipated construction period). The CFA/CPF will be constructed within the first 36 months;
- A medium-term impact is defined as between 66 months and 25 years (anticipated duration of operations); and
- A long-term impact is defined as one that is predicted to last beyond the end of the operational life of the project (>25 years).

A permanent impact is defined as a change to the baseline that would not reverse itself naturally. A temporary impact is defined as a change to the baseline conditions that would reverse naturally once the source of the impact is exhausted or has stopped.

3.9 Incorporated Environmental and Social Measures

Incorporated environmental and social measures are those measures that have already been factored into the design of the Project and are therefore not considered to be mitigation in terms of the ESIA process.

The impact assessment was undertaken assuming that the above incorporated design measures are applied alongside GIP as an integral element of the Project design.

3.10 Mitigation of Impacts

Additional measures are committed to if, as a result of the ESIA, mitigation is required to reduce the magnitude and significance of impact. Mitigation is identified in accordance with a hierarchy of options in accordance with international good practice (as defined in IFC Performance Standard 1).

- 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.

3.11 Identification of Residual Impacts

Residual impacts are those that remain following the implementation of the proposed mitigation. These are identified for each of the specialist topics by reviewing the predicted impacts against the mitigation measure proposed and then identifying any residual impacts. Residual impacts are defined based on the same process applied to the evaluation of impacts.

3.12 Area of Influence

The Area of Influence (AoI) is defined[2] as "*the area likely to be affected by:*

i) the Project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the Project;

ii) impacts from unplanned but predictable developments caused by the Project that may occur later or at a different location; or

iii) *indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent*."

For the Project, the AoI is defined incorporating the Biophysical AoI and the Social AoI. The Biophysical AoI is constrained to the administrative unit boundaries (locations) in which project infrastructure is located. It is more constrained than the Social AoI, so the land use and habitat analysis is not overly conservative.

The Social AoI remains constrained by administrative boundaries but extends further than the Biophysical AoI into surrounding locations that could be indirectly affected by the Project. The larger Social AoI reflects the dynamic of pastoralism in which people move across administrative boundaries in search of natural resources. In this context, the Project and any associate movement of people and influence on their livelihoods extends

[2] As defined in IFC Performance Standard 1.

beyond the administrative units which contain the Project's physical infrastructure. The Social AoI includes locations where movement of PAP is understood to occur based on baseline data collection.

The Social AoI includes West Pokot in so far as impacts relating to abstraction of water from the Turkwel Gorge Reservoir. All other impacts relating to West Pokot are scoped out and the water pipeline from the reservoir to the Central Processing Facility will be subject to a separate ESIA and separate permitting.

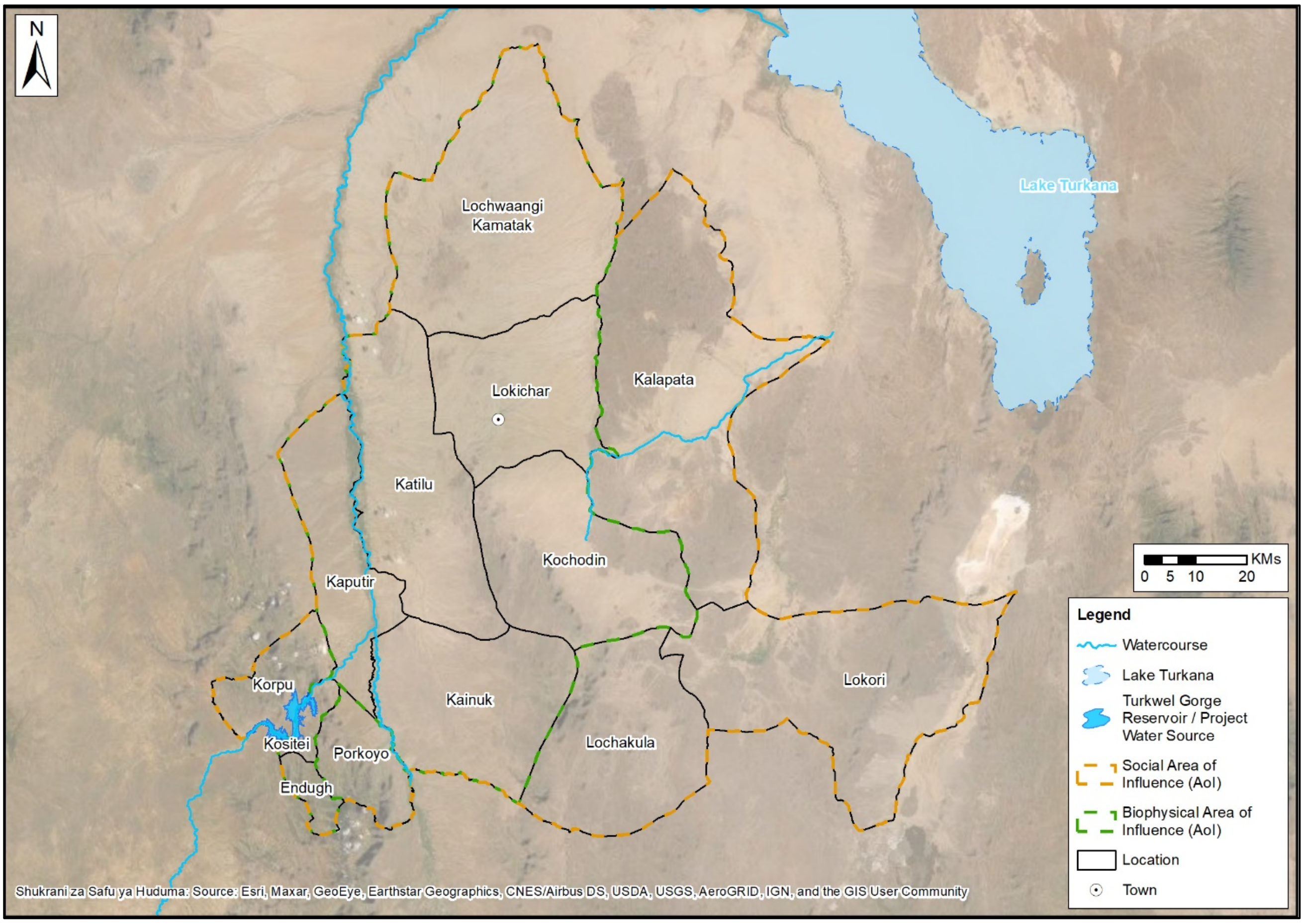

Figure 3.12-1: Project Area of Influence

3.13 Consideration of Climate Change Impacts on the Project

According to the Task Force on Climate-related Financial Disclosures (TCFD) it is increasingly essential to understand the risks posed by a changing climate on business and to realise that climate has a material impact on operations. As recommended by the TCFD, the first step in increasing sustainability and climate resilience is to assess the risks posed by climate change, and to account for its physical impacts.

The Project will have an operational life of 25 years, during which time the Project will need to be resilient to the risks of climate change. The Project will be designed taking into account the physical impacts of climate change over this timeframe, as well as during construction. The weather and climate baseline (Section 6.4) presents the results of a desktop study of Kenyan specific climate change indicators.

To understand the potential impacts on the Project posed by future climate change, prior to construction a risk assessment will be undertaken to identify how climate change should be accounted for in the Project design. In accordance with the TCFD recommendations, this assessment will allow for climate change resilience to be integrated into the Project. Likely physical climate risks are identified in each relevant technical section of the

ESIA and where a risk associated to climate change is identified, e.g. temperature change, water scarcity, extreme events, there will be a commitment to mitigation or management relating to climate change resilience.

3.14 Consideration of Impacts to Climate Change by the Project

An assessment and quantification of the greenhouse gas (GHG) impact from a collection of different gases which will potentially be produced by the Project has been carried out and is presented in Chapter 7.1 and Annex I. The collective impact has been presented as carbon dioxide equivalent (CO_2e) units to facilitate comparison. The term 'CO_2e' is a measure used to compare the emissions from various GHGs based on their Global Warming Potential (GWP). The scope of the assessment includes an estimation of the annual CO_2e emissions associated with the Project and provides recommendations for mitigation where applicable.

The calculation of GHG emissions used in the assessment has been generated by a combination of information from Xodus Group (undertaking FEED (Front End Engineering Design) review) and the KJV. Golder has not independently verified the data used in the assessment however Golder has adopted the outputs of the assessment with the assumption that appropriate Quality Assurance (QA) checks were completed by both Xodus Group and the KJV.

4.0 ESIA STAKEHOLDER ENGAGEMENT

The objective of stakeholder engagement is to ensure that Project Affected People have the opportunity to discuss Project risks and impacts, and proposed mitigation and monitoring measures; legislative requirements are met; sources of information and expertise are identified; stakeholder concerns and expectations are registered and addressed. Stakeholders including individuals, groups, local communities, businesses, local, national and county government, civil society organisations, NGOs, faith- based organisations and other institutions are invited to participate in consultation on the ESIA.

4.1 Stakeholder Groups

Table 4.1-1 provides a summary description of the main stakeholder groups linked to Project activity.

Table 4.1-1: Summary of main stakeholder groups linked to Project activity

Category	Stakeholder Group
Community Stakeholders	Traditional leadership, including: ■ Council of Elders (Turkana only); ■ Traditional governance leaders, such as seers and elders in permanent settlements (*adakar*) and mobile/pastoral administrative units (*arumrum*); and ■ Chief's Elders. Project-affected settlements, including: ■ Women; ■ Vulnerable persons; ■ Youth; and ■ Disabled persons.
National Government Elected Positions	■ Members of Parliament for all Constituencies in the Upstream Project Area of Influence (AoI) ■ Senators ■ Women representatives
National Government Appointed Positions	■ National Administration – County Commissioner, Deputy County Commissioners, Assistant County Commissioners, Chiefs and Assistant chiefs ■ National Police services – County Commander, Sub-county Commanders, Officers Commanding Station ■ MoPM – Petroleum Development Community Engagement officers at Sub-County Level
County Government Elected Positions	Members of the County Assembly (MCAs)
County Government Appointed Positions	■ Sub-county Administrators ■ Ward Administrators

Category	Stakeholder Group
	▪ National Land Commission – County Land Management Board

County Executive	▪ County Governor
	▪ County Deputy Governor
	▪ County Secretary County Executive Committee (“Ministries” in Turkana County / “Departments” in West Pokot County):
	  ▪ Health Services and Sanitation;
	  ▪ Finance and Planning;
	  ▪ Tourism, Culture and Natural Resources / Tourism, Culture, Youth, Sports, Gender and Social;
	  ▪ Water, Irrigation and Agriculture / Water, Environment and Natural Resources;
	  ▪ Public Service and Disaster Management / Public Service, ICT and Devolved Units;
	  ▪ Agriculture, Pastoral Economy and Fisheries / Pastoral Economy, Agriculture and Irrigation;
	  ▪ Education, Social Services and Culture / Education and Technical Training;
	  ▪ Land, Survey, Housing, Physical Planning and Urban Area Management / Lands, Housing, Physical Planning and Urban Development;
	  ▪ Roads, Transport and Public Works / Roads, Publics Works, Transport and Infrastructure; and
	  ▪ Trade, Gender and Youth Affairs (Turkana only).

Business Community	▪ Current and potential suppliers for the Upstream Project ▪ Turkana Chamber of Commerce ▪ Business Consortium ▪ Business Women Group
Water Institutions	Water User Associations and Water Service Providers
Media Organisations	Radio Stations: Sayare Radio, Akicha, Jambo, Maata
Faith-based Organisations	▪ Diocese of Lodwar ▪ Turkana Pastor’s Association
NGOs, Community-based Organisations, Other Institutions and Donors	▪ SIKOM Peace for Development ▪ Friends of Lake Turkana ▪ CordAid ▪ Turkana Basin Institute ▪ REACH ▪ World Vision

Category	Stakeholder Group
	■ Oxfam ■ Kenya Extractive Industries Development Program ■ Kenya Red Cross ■ Kenya Wildlife Service ■ Kenya Electricity Generating Company ■ Kerio Valley Development Authority ■ Human Rights Watch ■ Danish Demining Group ■ National Museums of Kenya ■ Northern Rangelands Trust ■ Let Us Talk ■ Turkana Empowerment Advocacy Group ■ Turkana Pastoralists Development Organisation (TUPADO) ■ St. Peter Community Network (SAPCONE) ■ Turkana Civil Society Platform (coalition of 12 local CBOs) ■ Turkana Natural Resource Hub ■ Agency for Pastoralist Advocacy & Development (APAD) ■ Alemun Pastoralist Empowerment Initiative (APEI) ■ Turkana Women Advocacy Development Organization (TWADO) ■ Turkana Development Organization Forum (TUDOF) ■ NEMA ■ WRA ■ Turkana County Drivers Association (TUCODA) ■ Health Organisations ■ British Council ■ United Nations Development Programme ■ West Pokot Youth Bunge County Forum

4.2 Administrative Divisions and Governance

Turkana and West Pokot Counties are two of 47 Counties in Kenya. Each Sub- County is further divided into Divisions, Locations and Sub-locations. Within the County, Sub-counties are also divided into electoral Wards, each being represented by a MCA in the County Assembly. These administrative units represent two strands of governance. Divisions, Locations and Sub-locations are part of a National Government administrative structure. This overlaps with the Sub-county structure, however a Ward is part of the newly instituted devolution process. Sub-county Administrators and Ward Administrators are part of the County Government administration structure. The Constitution of Kenya (2010) set up these two levels of government, making a shared mandate between the national government and counties.

4.3 ESIA Consultation

ESIA Consultation was planned in line with the SEP included in Annex II of this ESIA. Consultation materials prepared included presentations, banners, the Non-Technical Summary (in Swahili and English) and summary of key commitments (in English, Swahili, Turkana and Pokot). Consultation materials are provided in Annex **II**.

Disclosure on the final Project design (Project Disclosure) was undertaken by the Operator and MoPM during June and July 2021. Stakeholder consultation on the final ESIA was undertaken during July and August 2021. ESIA consultation followed a similar sequence to the meetings held for Project Disclosure. The meeting schedule for ESIA consultation is provided below in Table 4.3-1 and the full consultation report including list of meeting attendance numbers and relevant issues identified during the ESIA consultations are provided in Annex II.

Table 4.3-1: ESIA Consultation Schedule

Date	Consultation Location (plus target stakeholders)
28/07/21	Lodwar (Turkana County Government and Civil Society)
29/07/21	Lokichar (Local administration, Civil Society & community)
30/07/21	Lomokamar (Local Administration & Community Meeting)
31/07/21	Karoge (Local Administration & Community Meeting)
02/08/21	Nakukulas (Local Administration & Community Meeting)
03/08/21	Kalapata (Local Administration & Community Meeting)
04/08/21	Lokori (Local Administration & Community Meeting)
05/08/21	Kaputir (Local Administration & Community Meeting)
06/08/21	Kalemngorok (Local Administration & Community Meeting)
09/08/21	Lodwar (Turkana County Government and Civil Society)
10/08/21	Lorogon (Local Administration & Community Meeting)
11/08/21	Riting (Local Administration & Community Meeting)
12/08/21	Turkwel (Local Administration & Community Meeting)
13/08/21	Kapenguria (West Pokot County Government and Civil Society)
16/08/21	Nairobi (National Government Institutions & Civil Society)

4.3.1 COVID-19 Compliance

All engagement activities were undertaken in compliance with COVID-19 (Coronavirus Disease 19) restrictions, including restricting participants to permitted numbers and the holding of meetings outside, where possible. To ensure that a wide range of stakeholder interests were represented at meetings, representatives of different interest groups were invited to attend meetings on behalf of their constituents.

4.3.2 Grievance Resolution

A grievance resolution process is set out in the Project's Stakeholder Engagement Plan (Annex II) and access to this is open to all stakeholders.

4.3.3 Traditional Governance and Vulnerable & Marginalised Groups

The Operator seeks to achieve the principles of Informed Consultation and Participation (ICP) by developing robust, open and transparent channels of communication with all Project-affected communities. Achieving communication with Vulnerable & Marginalised communities requires developing direct lines of engagement with different categories of stakeholders that each represent different interests among that group of people.

These multiple lines of engagement must provide a reasonable and equal opportunity to participate, receive information in advance and to receive information in a culturally appropriate format that allows them to understand how the Project and proposed mitigation and benefit enhancement will affect their lives. With this in mind, engagement must be freely open to multiple entities. These entities are divided into categories described in the table above. The priorities among these categories are those stakeholders that are from regional administrative units affected by the Project or that represent the Project-affected people, with a priority to engage and pursue agreement from Traditional and pastoralist groups, but also considering:

- County Government Elected and Appointed officials who represent traditional and pastoralist groups; and
- National Government Elected and Appointed officials who represent traditional and pastoralist groups.

For these formal government structures, it has been relatively simple to identify specific stakeholders that represent Project-affected people, including vulnerable groups (including womens' groups, youth and other disadvantaged groups).

However, additional work has been conducted to identify and prioritise traditional leadership. Specifically, this work has involved the identification of traditional pastoralist units (*Adakar*, *Arumrum*[1] *or Mongots*[2]) within a given administrative unit. While the County Government and National Government officials are key representatives of pastoralists, there are other traditional structures that exist and need to receive an opportunity to receive information and give feedback.

Experience has shown that while County and National officials have direct lines of contact with traditional leaders, some traditional leaders may have felt excluded. This is partially linked to the mobile nature of the traditional groups and their challenges in convening in centrally located settlements.

4.3.3.1 Engagement with Traditional Leadership

The Operator's approach for engagement of traditional leadership in Turkana follows the approach adopted in Turkana by the Office of the County Commissioner (CC) National Government Administrative Officers and NEMA for previous public consultation on the LLCOP ESIA.

The approach used for ESIA consultation and Project disclosure was as follows:

- Engagements were planned well in advance;

[1] These are terms for clusters of homesteads. Adakar are sometimes referred to as "cattle camps" even if the herd does not contain cattle. This term is used interchangeable with the term kraal, a term more commonly used in South Africa. Arumrum is a relatively new form of social organisation that started in the mid-1990s. It is a large encampment of multiple heard owners that seek to build barriers to fend off attacks from outsiders. Such clusters can be up to 100 households.

[2] This refers to a traditional pastoralist grouping of homesteads in West Pokot.

- Once dates and proposed locations were agreed, the Operator discussed with respective Deputy County Commissioners (DCCs) and provided a list of the proposed groups to be engaged to be added to the DCCs knowledge of Traditional Leaders and convened at centralised locations;
- The Operator requested via the respective DCCs that traditional Leadership representatives from sub locations within the AoI were offered the opportunity to participate in engagement meetings:
  - Representatives for the following sub locations were invited to meetings in Lokichar:
    - Lokichar
    - Kapese
  - Representatives for the following sub locations were invited to meetings in Lomokamar:
    - Lokichar (Kasuroi,Lomokamar and Nayana Ereng villages)
  - Representatives for the following sub locations were invited to meetings in Karoge:
    - Lochwaangamatak
    - Napusmoru
  - Representatives for the following sub locations were invited to meetings in Nakukulas:
    - Kochodin
    - Lopii
    - Lokwamosing
  - Representatives for the following sub locations were invited to meetings in Kalapata:
    - Loperot
    - Nakalale
    - Kangakipur
  - Representatives for the following sub locations were invited to meetings in Lokori:
    - Lokori
    - Kangitit
    - Lotubae
  - Representatives for the following sub locations were invited to meetings in Kaputir:
    - Kalomwae
    - Nakwamoru
    - Lorogon
    - Juluk
  - Representatives for the following sub locations were invited to meetings in Kalemngorok:
    - Katilu

- Lokapel
- Kalemngorok
- Kanaodon

- Representatives for the following sub locations were invited to meetings in Turkwel:
  - Kositei (WP)

- Once the invitee list was agreed, DCCs and Chiefs advised on those to be invited to represent different interest groups;

This process ensured that the formal representative structures are respected, and the range of interest groups are invited to participate.

4.3.4 Summary of Results

The full results of the ESIA consultation are presented in Annex II and a summary of the findings are presented below.

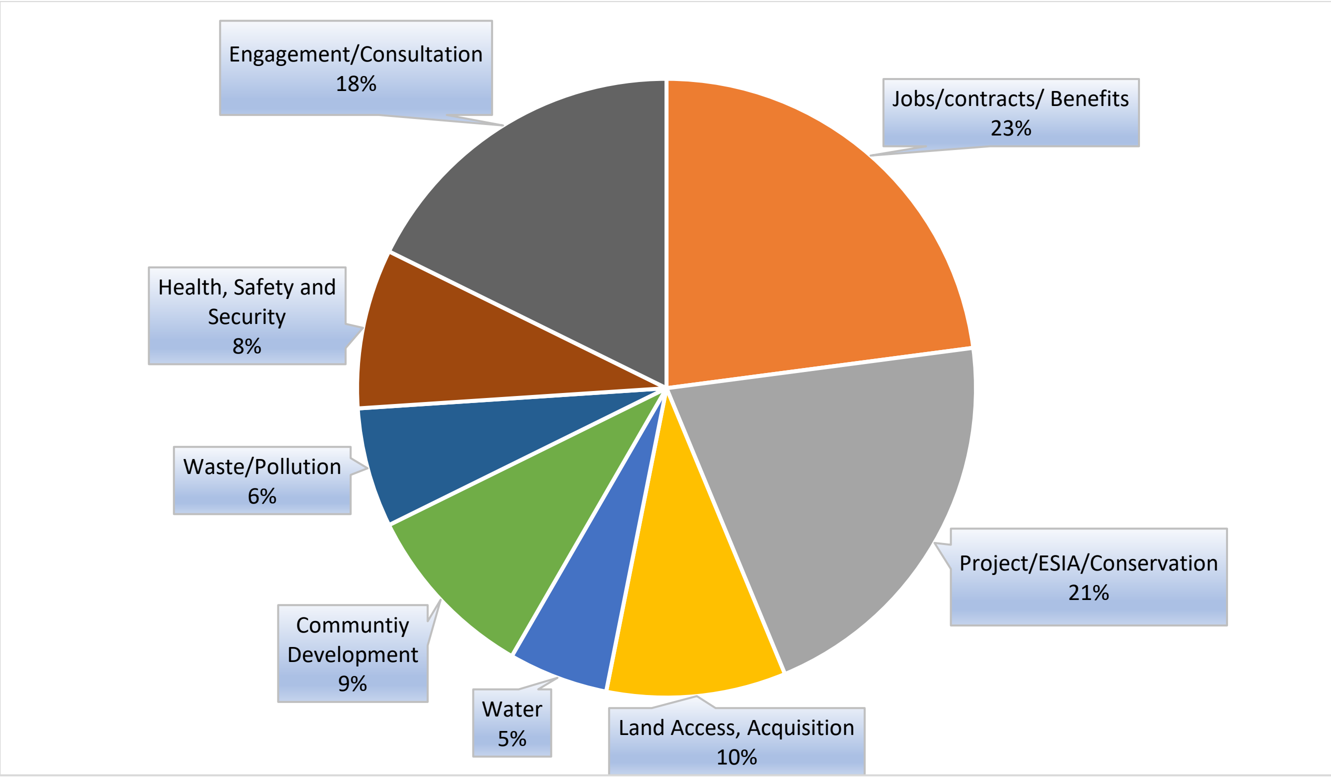

Figure 4.3-1: Summary of Issues from ESIA Consultation

Issues arising from the ESIA consultation focused primarily on employment and economic benefits (21% of all issues), followed by questions about the Project, the ESIA, and wildlife conservation (20%), and engagement/consultation concerns (17%). People in communities most often raised issues about employment (including noting that employment practices should be equitable, transparent and gender sensitive). Several people noted that there are low literacy rates and the Project should also provide employment for unskilled workers. Questions about the Project and ESIA related to requests for protection for vegetation and biodiversity, concerns about dust, noise, and light, and if the Project accounted for population influx and climate change. The National Museums of Kenya raised questions about plans to safeguard heritage resources near or under all project facilities including a pipeline from the Turkwel Gorge Reservoir. Some doubt was expressed about the proposed mitigation measures for various impacts and if they will be properly implemented, with some reference to the perception that mitigation for EOPS was not implemented. In relation to consultation, attendees asked for details about the grievance mechanisms and argued for inclusion of more stakeholders during consultation. Minutes of ESIA consultation meetings are included in Annex II.

Overall, there is support for the Project both within governments at all levels and on the part of people of Turkana. At the national level, it is recognized that the Project is comparatively large, and as such would significantly contribute to economic and oil and gas sector growth, add to government revenues and result in infrastructure improvements of value to the national economy. There is confidence in the results of the ESIA and that the Operator will follow through with monitoring and management of environmental and social impacts. However, dialogue will need to continue on the more challenging issues, such as those related to land acquisition, and on the distribution of jobs. Security and ethnic conflict in the region are also a challenge and will need continuous monitoring.

District and local governments and people recognize that the Project would bring a measure of economic development to the area. Communities are, however, somewhat wary, as there has been activity for more than a decade and a project has not yet been developed, and people feel they have experienced little benefit from all this interest. The engagement team has worked hard to explain the time it takes to develop a project of this scale.

It is also clear that almost without exception, communities have high expectations that the Project, if it proceeds, will provide assistance to communities in priority areas, such as access to water, provision and delivery of education and health services, and improving livelihoods. It is expected that such assistance will target the less fortunate within communities, including women, youth and the old. Demand for more information on the Project as it moves forward was also evident.

4.4 Historic Engagement Activities

The following subsections present a summary of stakeholder engagement to date within the AoI relating to previous activities and the associated LLCOP project.

4.4.1 Exploration and appraisal – 2010 onwards

The Operator has been active in Kenya since 2010 and oil exploration activities have been occurring within the area of operations (northwest Kenya) since 2011. During this period, the extent and complexity of stakeholder engagement activities at a national, county and community level has increased.

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

4.4.2 Development Project (Phase 1) ESIA Scoping Consultation – November 2015

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

The objectives for each meeting were the same:

- Provide information on the Project and details of the 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 PAPs.

Two teams comprised of Golder and Tullow staff facilitated meetings. One team conducted the majority of meetings in Nairobi and the second team helped with meetings in Turkana with regional stakeholders.

The list of stakeholders consulted was drafted in consultation with NEMA. Based on NEMA's advice, Golder was not advised to hold formal public meetings at the community level. The main reason for delaying broader disclosure was to wait until there was a more clearly defined Project Description. However, all stakeholders were encouraged to share information. 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 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 ESIA and stakeholder engagement process. Presentations were provided to all stakeholders on request.

In addition to the presentations, two Topic Sheets were used on (1) Oil and Gas Life Cycle; and (2) The ESIA Process were 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 Operator staff were present at all meetings held in Lodwar for the purpose of translation, if desired, however, no translation was requested.

The ESIA 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. The number of participants who signed the attendance register at each meeting is detailed in Table 4.4-1.

Table 4.4-1: ESIA Scoping Meetings – Total Attendees

Date	Meeting / Type	Total Participants
04 Nov 2015	Ministerial Forum - Nairobi	19
04 Nov 2015	Northern Rangelands Trust - Nairobi	1
04 Nov 2015	Deputy Governor/Turkana County Ministers - Lodwar	6
05 Nov 2015	Regional NEMA and WRMA – Lodwar	2
06 Nov 2015	UN Forum - Nairobi	4
09 Nov 2015	International NGOs (Development) – Nairobi	8
09 Nov 2015	International NGOs (Environmental) – Nairobi	9
10 Nov 2015	Kenyan National NGOs – Nairobi	7
10 Nov 2015	Turkana County Commissioner and Police Coordinator - Lodwar	3
10 Nov 2015	National Land Alliance – Nairobi	1
11 Nov 2015	Turkana Media Briefing – Lodwar	10
12 Nov 2015	Turkana NGO Forum - Lodwar	30
12. Nov 2015	International Organisations (General Re-invited) – Nairobi	7

Date	Meeting / Type	Total Participants
13. Nov 2015	National Assembly Committee on Environment and Natural Resources - Nairobi	1
18 Nov 2015	Turkana Basin Institute - Nairobi	1
Total Attendees		109

Several key meetings did not take place due to scheduling conflicts and many meetings had lower participation that expected. Key government meetings that were cancelled include:

- Parliamentary Committee on Environment & Natural Resources – Nairobi;
- Senate Committee for Environment & Natural Resources – Nairobi;
- Turkana Governor – Lodwar; and
- MCAs, County Speaker – Lodwar.

The Operator's Social Performance and Government and Public Affairs teams provided disclosure materials to all key government officials and conducted follow-on meetings, as requested.

During the meetings, a total of 188 issues, questions and concerns were documented (Figure 1).

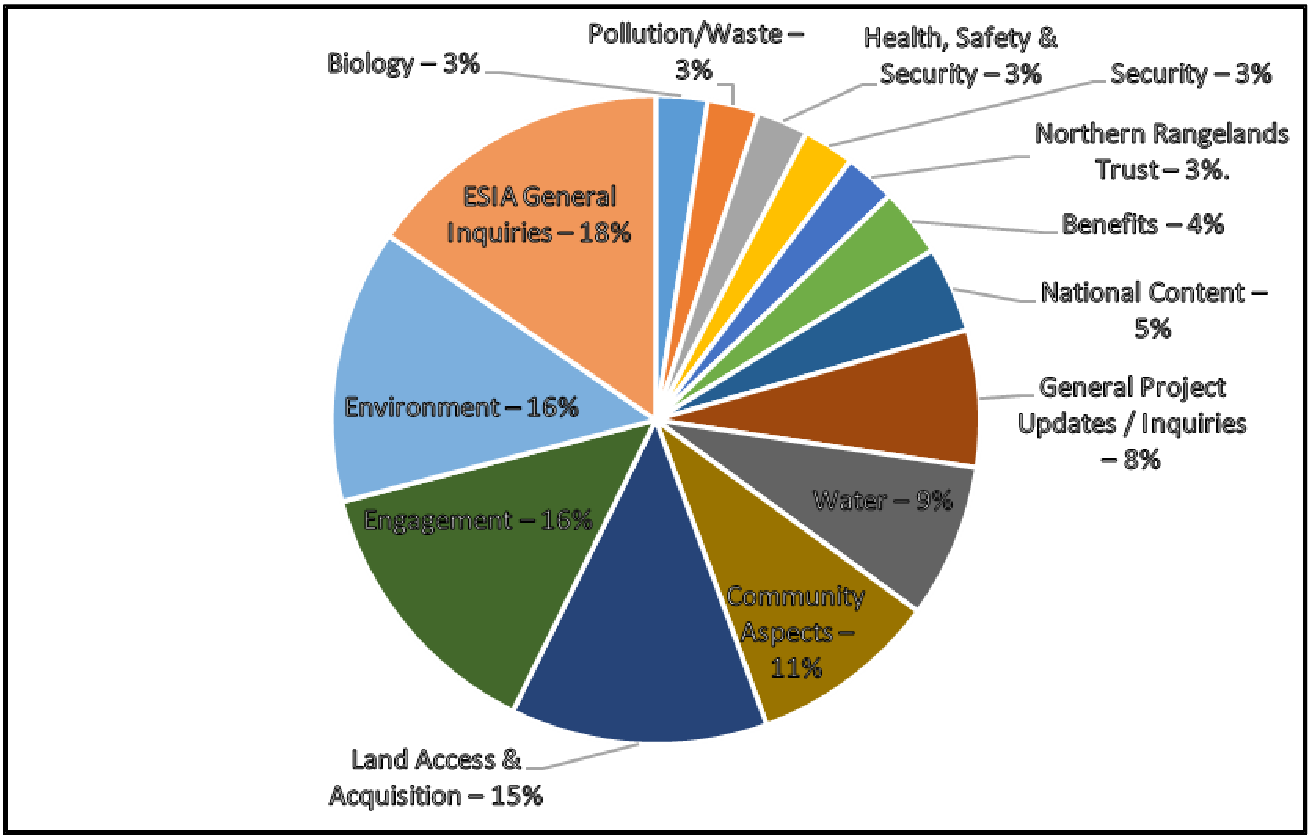

Figure 4.4-1: Percentage of total issues raised during FFD scoping consultation (2015)

The most commonly raised topic was in relation to the ESIA, its scope and clarity on how the process would be conducted. These issues represented 18% of the total comments made. Attendees also sought clarity on the difference between the development ESIA and previous impact assessments conducted during the exploration and appraisal work.

Both engagement and environment issues represented 16% of the total of all comments. Among environmental issues, the most commonly raised question was in relation to water, where the Project might source water and whether usage might affect local communities. In response, attendees were informed of the process used to consider numerous options for water and that there are currently the following four options under consideration - the Turkwel Gorge Reservoir, Lake Turkana, local ground water and distant ground water.

Questions on engagement underlined the importance and the challenge of including local communities and project-affected people in all ESIA work. All attendees agreed that holding public consultations at the settlement level would be unhelpful unless there was more specific clarity on the Project footprint and associated engineering design. Participants raised the issue of developing various methods for information disclosure, especially in the context of high illiteracy rates. Each meeting highlighted the importance of the Project SEP, which will outline methods for continued engagement and the methods to be used. The SEP will be a public document. Attendees to these meetings will be informed once it is made public. Attendees were encouraged to review and provide feedback on the schedule and methods proposed presented in the SEP.

Land access and acquisition represented 15% of the total issues raised and was a clearly emotive issue for many participants. Several comments highlighted the regulatory challenges in acquiring land while the Kenyan Community Land Bill has not yet been passed into law. Question on land also focused on how land acquisition will take into account the pastoralist livelihoods of local residents near the Project. Numerous participants, especially at the County-level stressed the importance of regional and community participation in the development of the Land Access Framework (LAF). Given the regulatory uncertainty, attendees were told that the land acquisition process and consultation would be on-going and would include inputs from a broad number of stakeholders, including local communities. 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.

National content questions, especially those related to employment and procurement opportunities, were especially important in County-level meetings. Many stakeholders explained the acute tension between national content and local content, indicating that employment given to people outside the County of operation needs to be clearly justified. Many general comments stressed that the Project needs to demonstrate that training for more skilled employment will start as early as possible. Responses summarised what the Operator has done to date through support for vocational education in Lodwar and the Enterprise Development Centre.

Inquiries about the Northern Rangelands Trust (NRT) were raised in several meetings. The 28 October 2015 public announcement of a new project supported by the Operator in Turkana led many stakeholders to assume the ESIA might be related to the NRT project. The announced project was linked to a five-year grant agreement with the NRT that will support communities in Turkana and West Pokot Counties to establish and operate six community conservancies. Questions raised during the ESIA Scoping meetings were primarily linked to land access.

4.4.3 EOPS Phase II ESIA Scoping Consultation – May 2016

The EOPS Phase II 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 4.4-2.

The objectives for each meeting were the same:

- Provide information on the EOPS Phase II project and details of the EOPS Phase II 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 potential PAPs.

The team comprised of the Operator, Golder and EMC staff. The Operator 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[3]).

The Operator agreed with NEMA that community consultation would occur at a later date once a more clearly defined EOPS Phase II Project Description was 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 Phase II 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 Phase II 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 Phase II Project and the EOPS Phase II 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 Operator staff were present at all meetings held in Lodwar for the purpose of translation, if desired, however, no translation was requested.

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 4.4-2: EOPS Phase II 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

[3] Engagement in Uasin Gishu did not extend beyond the scoping phase due to the change in EOPS Phase II project description

Date	Meeting/Type	Total Participants
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	MCA and 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 previous engagement 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 (Members of Parliament (MPs), Senator, and Women's Representative). Golder understands that these stakeholder relationships were managed by the Operator's 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%:
- General Project Updates/Inquiries – 16%;
- Community Aspects – 11%:
- ESIA General Inquiries – 11%; and
- Land Access & Acquisition – 5%.

4.4.4 EOPS Phase II ESIA Consultation – June 2018

The EOPS Phase II 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 4.4-3.

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 4.4-3: EOPS Phase II 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, Civil Society Organisation (CSO) and Faith Based Organisation (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
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

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 Phase II Project and review the EOPS Phase II 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[4] 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 Phase II Project and the EOPS Phase II 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 Operator 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 Community Resource Centres, where full copies of the ESIA and Non-technical Summary will be available for at least 30 days.

During the meetings, a total of 327 issues, questions and concerns were documented (Figure 4.4-2).

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

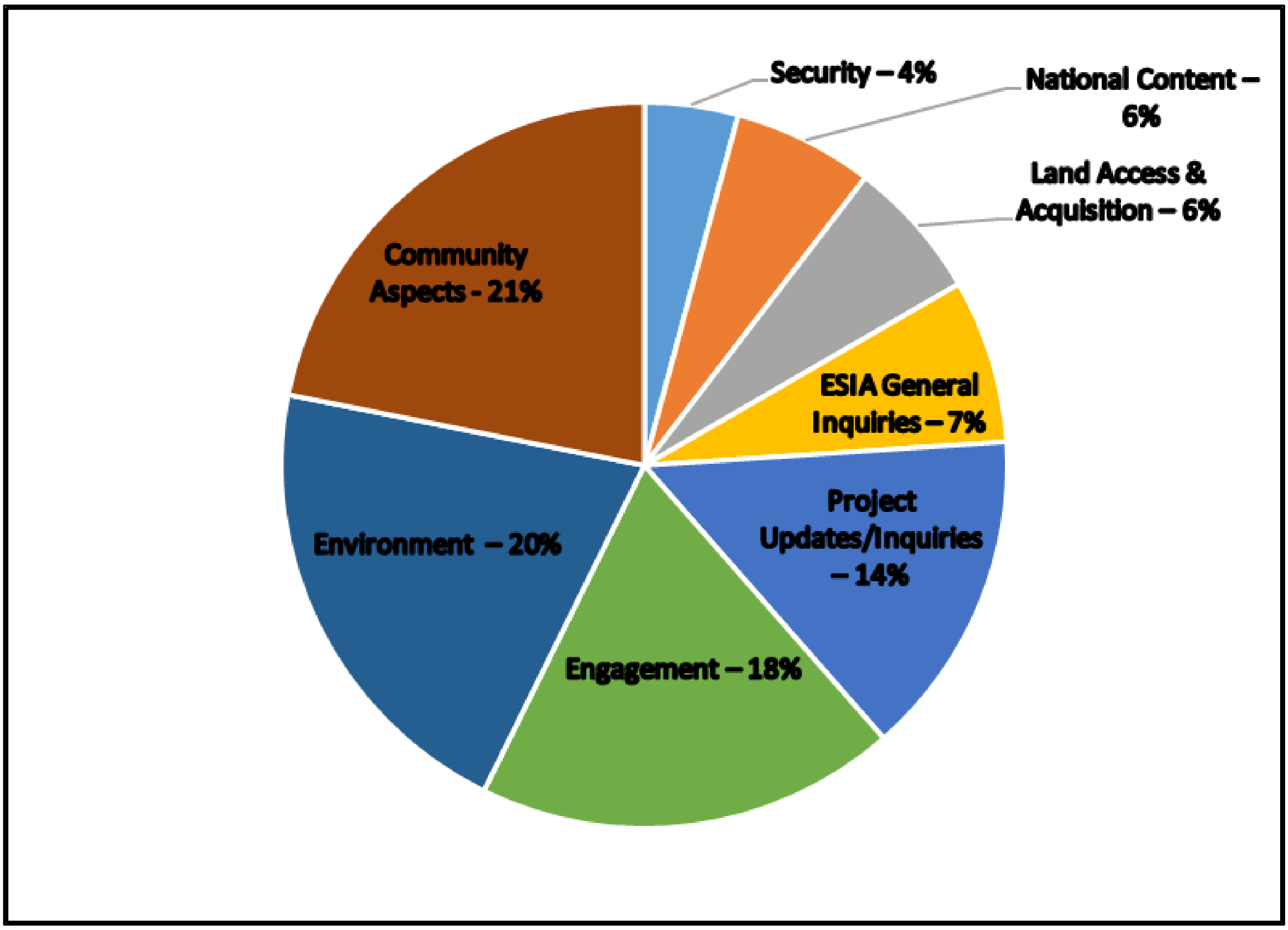

Figure 4.4-2: Percentage of total issues raised during EOPS Phase II ESIA consultation (2018)

4.4.5 LLCOP

4.4.5.1 ESIA Scoping Consultations (Turkana only) – June & December 2018

An LLCOP ESIA Scoping Consultation meeting in Turkana was held on 29 June 2018 at the Cradle Hotel, Lodwar, Turkana County. Thirty-eight attendees signed the attendance register, four of which were from the Golder/ESF team. The objectives of the meeting were to provide more information about the proposed pipeline project and proposed mitigation measures and to provide stakeholders with an opportunity to contribute comments and to raise issues of concern, questions and possible suggestions.

Two ESIA Consultation meetings were held on 20 December 2018 at the Cradle Hotel, Lodwar, Turkana County. Twenty- six attendees signed the attendance register for the first meeting and the second meeting was held for the Turkana County Elders. The objectives of the meeting were to provide stakeholders with more information about the project and mitigation measures and to provide stakeholders with an opportunity to contribute comments and to raise issues of concern, questions and possible suggestions.

4.4.5.2 Community Meetings (Turkana only) – January 2019

The following community meetings were held in Turkana (relating to LLCOP) during January 2019. The objectives of the meeting were to provide stakeholders with more information about the project and mitigation measures and to provide stakeholders with an opportunity to contribute comments and to raise issues of concern, questions and possible suggestions.

- Lokori Community Meeting where 68 people signed the attendance register.

- Katilia Community Meeting where 361 people signed the attendance register.
- Kalapata Community Meeting where 265 people signed the attendance register.
- Lokichar Community Meeting where 313 people signed the attendance register.

4.4.5.3 LLCOP ESIA Consultation Meetings (Turkana only) – July 2019

The following LLCOP ESIA consultation community meetings were held during July 2019. The objective of the meeting was to provide the preliminary results of the ESIA and to provide stakeholders with an opportunity to contribute comments and to raise issues of concern, questions and possible suggestions.

- Lodwar Community Meeting where 55 people signed the attendance register
- Lokori Community Meeting where 75 people signed the attendance register

4.4.5.4 Turkana NGOs Meeting – July 2019

An LLCOP ESIA Project Disclosure Consultation meeting was held on 12 July 2019 at the Solomar Gracious Hotel, Lodwar, Turkana County. Thirty-four attendees signed the attendance register, four of which were from the Golder/ESF team. The objectives of the meeting were to provide more information about the proposed pipeline project, the main findings of the ESIA and proposed mitigation measures and to provide stakeholders with an opportunity to contribute comments and to raise issues of concern, questions and possible suggestions.

4.4.6 Foundation Stage ESIA Consultation - 2020

Consultation for the ESIA for the Foundation Stage of the South Lokichar Development for Upstream oil production in South Lokichar was planned for 2020 but could not be fully completed due to COVID-19 travel restrictions.

4.5 Issues Raised During Historic Engagement Activities

Issues raised during previous EOPS Phase II and LLCOP ESIA consultation engagement activities are presented in Table 4.5-1. These issues are provided as a reference and for information only.

Table 4.5-1: Issues Raised during Previous EOPS Phase II and LLCOP Consultations

Issue Raised	Chapter where addressed in ESIA
Air Quality	Section 7.1 (Air Quality), Section 7.6 (Landscape and Visual), Section 7.7 (Biodiversity), Section 7.8 (Ecosystem Services)
Noise & Vibration	Section 7.2 (Noise and Vibration),
Water Quantity	Section 7.3 (Water Quantity), Section 7.8 (Ecosystem Services), Section 7.9 (Social)
Water Quality	Section 7.4 (Water Quality), Section 7.9 (Social)
Soils	Section 7.3 (Water Quantity), Section 7.5 (Soil)
Landscape & Visual	Section 7.6 (Landscape and Visual), Section 7.8 (Ecosystem Services),
Biodiversity	Section 7.7 (Biodiversity)
Ecosystem Services	Section 7.8 (Ecosystem Services)
Social	Section 7.7 (Biodiversity), Section 7.9 (Social)
Cultural Heritage	Section 7.8 (Ecosystem Services), Section 7.9 (Social), Section 7.10 (Cultural Heritage)

4.6 Issues Raised During ESIA Engagement Activities

All comments and questions raised at the open house events and stakeholder meetings have been collated and will inform further stakeholder engagement activities, events, and further development of mitigation and management plans. The full consultation report is included in Annex II and a summary of where issues are discussed in the ESIA is also presented in Table 4.6-1.

Table 4.6-1: Issues Raised during ESIA Consultations

Issue	ESIA Section where issue is addressed
Jobs, contracts, benefits	Section 7.9 (Social)
Project information	Section 5.0 (Project Description)
ESIA methods and results	Sections 3.0 (Impact Assessment Methodology) and 7.0 (Potential Impacts and Mitigation)
Conservation issues	Section 7.7 (Biodiversity)
Land access	Section 7.9 (Social)
Land acquisition and compensation	Section 7.9 (Social)
Water	Section 7.3 (Water Quantity), Section 7.4 (Water Quality), Section 7.8 (Ecosystem Services) and Section 7.9 (Social)
Community development	Section 7.9 (Social)
Waste	Section 5.0 (Project Description), Section 7.0 (Potential Impacts and Mitigation)
Pollution	Section 7.1 (Air Quality), Section 7.2 (Noise and Vibration), Section 7.3 (Water Quantity) and Section 7.4 (Water Quality).
Health	Section 7.9 (Social)
Safety and Security	Section 7.9 (Social)
Engagement, Consultation and Grievance process	Section 7.9 (Social) and Stakeholder Engagement Plan
Pastoral livelihoods	Section 7.8 (Ecosystem Services), Section 7.9 (Social) and 7.10 (Cultural Heritage)
Culture and cultural resources	7.10 (Cultural Heritage)

5.0 PROJECT DESCRIPTION

5.1 Introduction

This Section of the ESIA report:

- Presents the technical components of the Project and details construction and operational processes.
- Outlines incorporated Project design measures which have been identified and incorporated within the FEED phase for the Project. As presented in the ESIA Methodology chapter (Chapter 3.0), these measures are referred to as 'incorporated measures'.
- Provides a summary of the analysis of alternatives carried out for aspects of the Project Design.

5.2 Project Location

The Project is located in the South Lokichar Basin in Turkana County, north-west Kenya between Lake Turkana and the Turkwel River valley, approximately 450 km north of Nairobi. The location of the Project Area of Influence (as defined in the ESIA Methodology Chapter 3.0) is shown in Figure 5.2-1 and the location of Project facilities within the regional setting is shown in Figure 5.2-2.

The Lokichar basin and proposed development area is at an elevation of approximately 700 metres above sea level (masl).

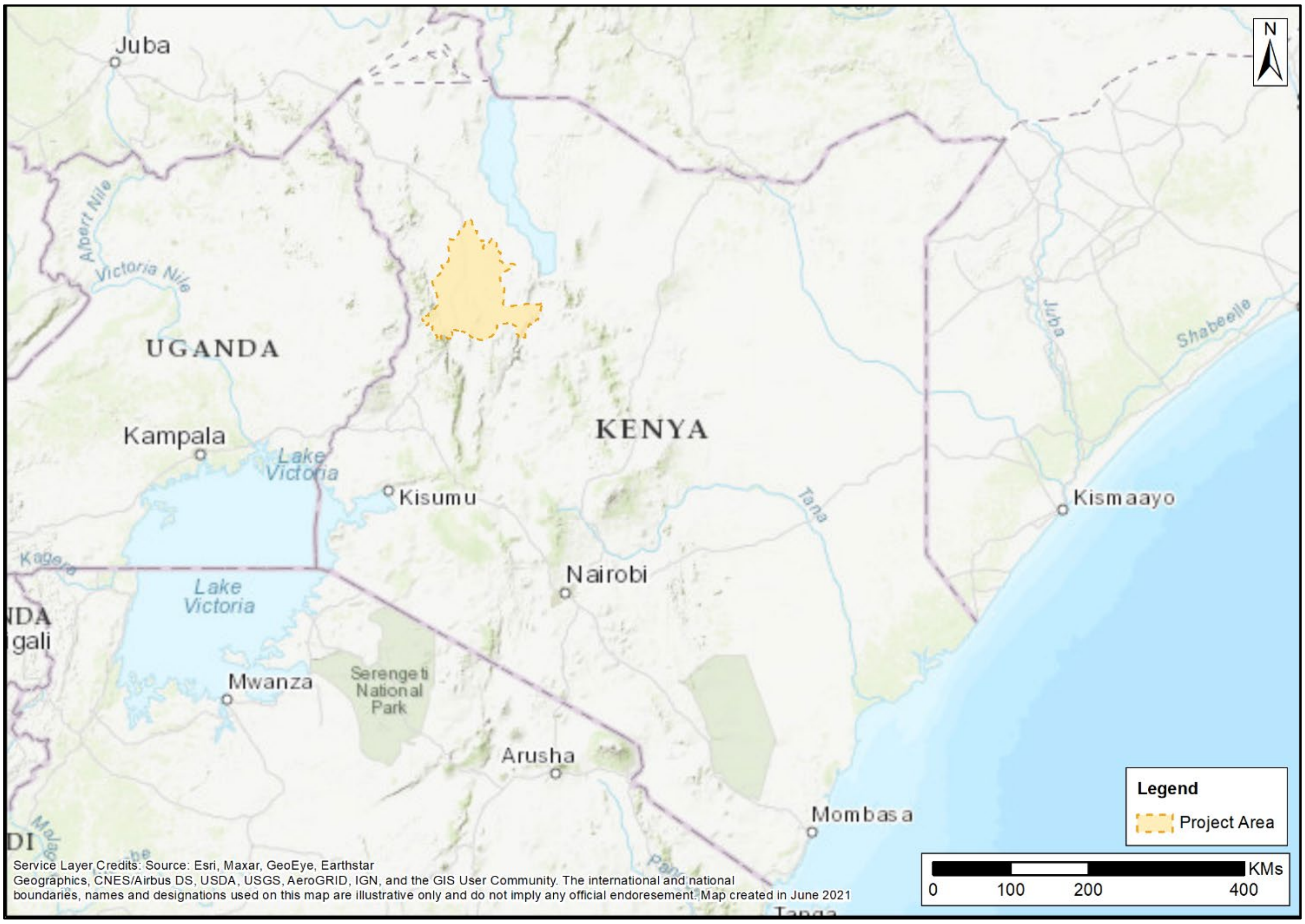

Figure 5.2-1: Project Location

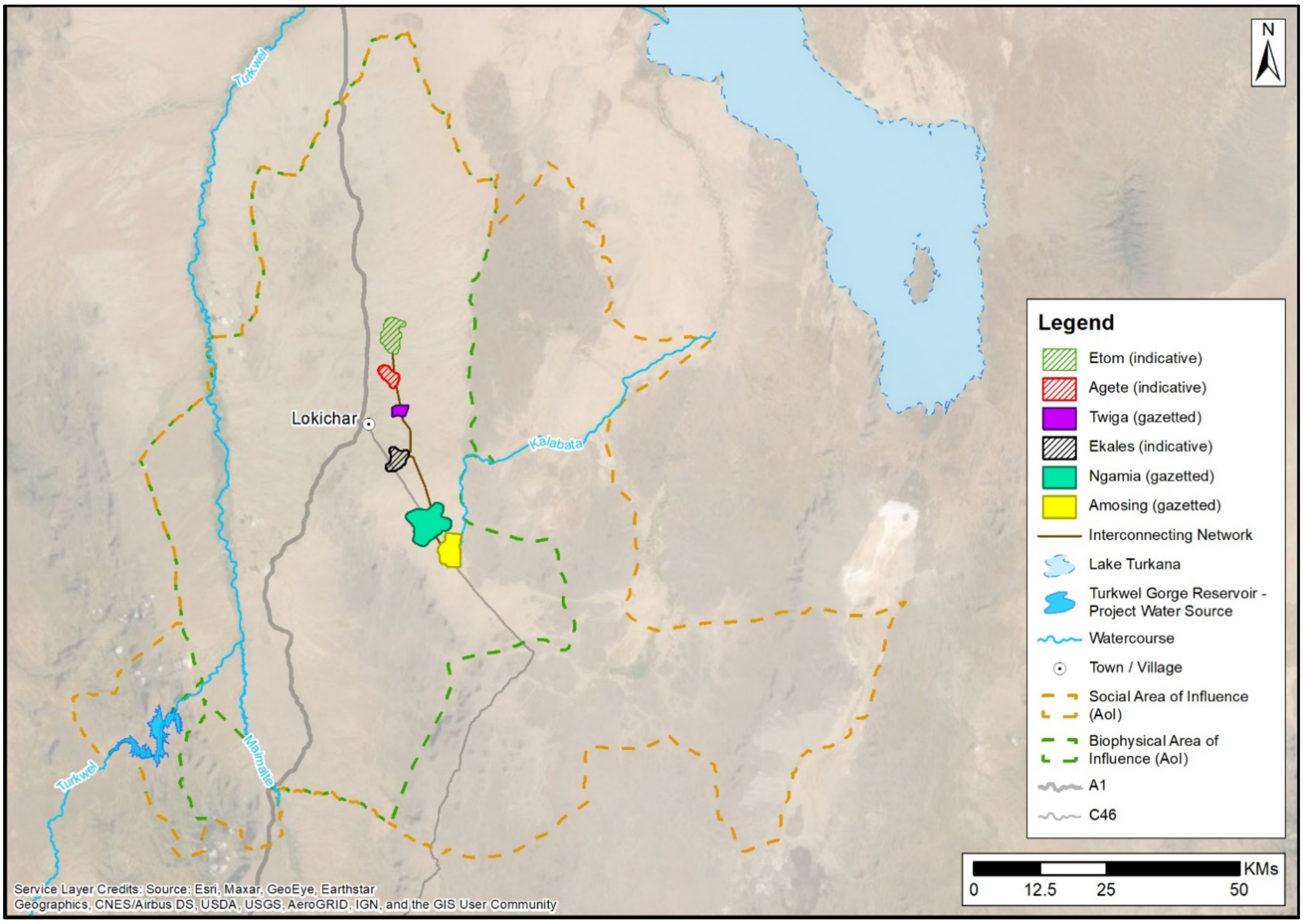

Figure 5.2-2: Regional Project Setting

5.3 Previous Field Development

There has been previous development in the South Lokichar Fields prior to this Project. The first well was drilled in January 2012. As part of exploration and appraisal activities, extended well testing activities were undertaken initially in 2015 and again in 2017-2018.

The EOPS was then designed to de-risk full field development by ensuring that the crude oil was better characterised, and its handling properties better understood, as well as to ensure that critical infrastructure required for full field development (such as roads) was in place. EOPS, as planned, entailed the medium term (2 years) transportation by road of crude oil from the South Lokichar basin to Mombasa for export. The EOPS Project is concluded.

The Early Oil Pilot Scheme Phase II operations and decommissioning were permitted under a separate ESIA (Golder, 2018, ref. 1654017.718).

5.4 Field Development Overview

The South Lokichar Development Project is a 130,000 barrels of oil per day development, focused on producing resources from a number of fields located within the South Lokichar Basin from blocks 10BB and 13T.

Six oil fields will be developed over the Project timeline:

- Amosing, Ngamia, Twiga first oil in Year 3 (36 months after completion of construction);
- Ekales first oil in Year 5;

- Agete first oil in Year 7; and
- Etom first oil in Year 10.

Oil will be produced from production wells located on multiple wellpads across the six fields. Initial focus will be on developing the most mature areas of Amosing, Ngamia and Twiga.

Due to the reservoir properties, artificial lift is required to transfer the fluid from the reservoir to the surface. The wellpads will be connected into a system of buried trunklines and flowlines (gathering network) to transfer fluids to the CPF for treatment and stabilisation.

The Project will use water injection to sustain and improve the rate of recovery from the reservoirs which make up the fields. Water for the Project will be sourced from the Turkwel Gorge Reservoir, located in West Pokot, to the south-west of the facility. The water pipeline route, design and construction will be separately permitted and are outside the scope of this ESIA.

The water conveyed from the Turkwel Gorge Reservoir will be treated at the CPF to meet the injection specification before offtake for other water needs for the Project and distribution at pressure via the water injection network to wellpads for injection. Once production has started and the CFA is operational, produced water will eventually replace the need for make-up water.

There will be a network of pipelines to convey the water received at the CPF to the wellpads for water injection and to return crude oil to the CPF. Service water for other activities at the wellpads will also come from the CPF and will be treated prior to distribution.

The CPF will be located within a central hub, the CFA, which will be located adjacent to the Ngamia oil field. The CFA will contain accommodation, waste management facilities, offices, laydown areas and warehouses as well as facilities required for production, and to support construction and operating activities. The CPF will process the oil from the production wells, including the following stages of treatment:

- Degassing of the oil;
- Separation of oil and water;
- Stabilisation of the oil; and
- Heated storage, prior to transport by the export pipeline.

Within the CFA is the Lokichar Export Facility (LEF) which is included in the scope of the separately permitted and operated pipeline Project: LLCOP (Golder, 2019, ref. 1772867.554). A plot area of 80 m x 80 m is allocated within the boundaries of the CFA layout to support the pump station and required utilities including power and service water (not within this ESIA scope). The first export of crude from the Lamu Marine Terminal is expected within two months of start-up.

Project components located outside of the CFA will include the existing airstrip at Kapese (currently under a leasing arrangement but will be used by the Project) and infield access roads.

The main power supply to production wells will be provided using high voltage overhead lines from the substation located in the CPF.

A summary of the Project is provided in Figure 5.4-1.

5.4.1 Facilities Overview

The Project consists of the following key facilities which are considered as part of this ESIA:

- Expansion of existing wellpads, creation of new wellpads and drilling and associated well construction activities for 61 Firm and 12 contingent wellpads containing 1,126 wells;
- All infield flowlines, trunklines, fibre optic network and electrical distribution;
- All facilities located within the CFA perimeter fence including the CPF, an ancillary area, the Integrated Waste Management Facility (IWMF), a permanent accommodation camp, a temporary accommodation camp, a drilling area and a construction laydown area. The LEF is located in the CFA, and whilst it is separately permitted and operated as part of LLCOP, it is also considered as part of this ESIA;
- Use of the existing Kapese Airstrip;
- Accommodation camps (temporary camps at CFA for enabling works, rig camp and drilling minicamps; and permanent camps at the CFA, and use of the camp at Kapese Airstrip);
- Addition of a new engineered landfill facility at Ngamia;
- Infield roads (except the existing Kenyan national roads);
- Water sourced from the Turkwel Gorge Reservoir; the water pipeline route, design and construction will be separately permitted and is outside the scope of this ESIA;
- Electrical connection adjacent to CFA;
- All telecommunications network and equipment;
- People, material and waste movement throughout construction and operations; and
- Borrow pits for aggregate for construction of infield roads and oil gathering network.

The design life for all permanent facilities is 25 years.

Existing facilities, including the Kapese Airstrip, Kapese Base (camp), existing wellpads, wells and production facilities, and water supply boreholes do not form part of the Project covered by the scope of this ESIA in terms of construction, but will be used during operations.

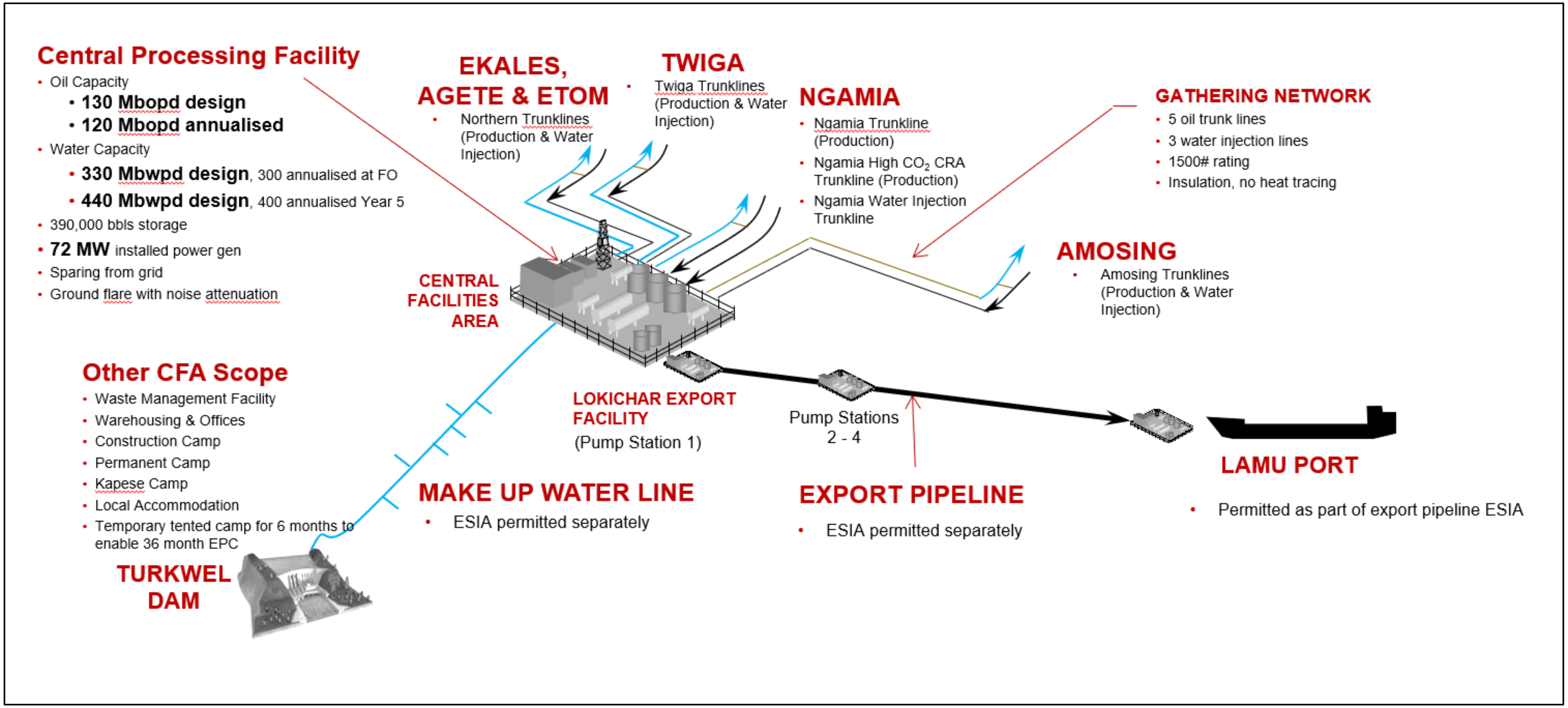

Figure 5.4-1: Development Overview Including Selected Existing Facilities

Associated Facilities

- The spur from the Kenya Electricity Transmission Company (KETRACO) transmission line sub-station to the CFA is considered as an Associated Facility, but the very short length of this, and its proximity to the CFA itself, means that issues and impacts associated with construction of the spur line are considered as part of the construction and operation of the CFA itself.

The following items do not form part of the Project scope and may require separate permitting/approval activities:

- Removal of supply route pinch points (e.g. lifting of existing Overhead Transmission Lines (OHTL)) will be subject to a separate approval procedure;
- Turkwel – Lokichar – Lodwar – Lokichoggio transmission line which is currently scheduled for construction by KETRACO as part of the national electricity supply network.
- The make-up water pipeline (permitted separately to this ESIA) will improve access to water for communities along the proposed water pipeline route in West Pokot and Turkana. Along the route (approximately 90 km), the Project will make provisions for six community offtake points allowing County water services providers to access the water. These providers will be responsible for the treatment of the water to ensure it meets drinking water standards and the distribution to surrounding community water points.

5.4.2 Schedule Overview

The construction period for the first 14 wellpads will be completed 15 months from the start of construction, when drilling of the wells required for first oil will commence. The CFA, CPF and wells required for first oil will be constructed by month 36. The remaining wellpads will be constructed with wells drilled up to Month 96. Operations are assumed to last 25 years. The indicative schedule is summarised in Figure 5.4-2.

Construction will be undertaken by an EPC Contractor with international experience of the design and construction of major upstream facilities, supported by a range of specialist local and international sub-contractors. Parallel progress during construction of the CPF, CFA, wellpads, water pipeline and interconnecting pipework and infrastructure will be maintained by establishing separate construction teams.

The Project will follow the typical construction sequence for onshore facilities as detailed below:

- Enabling Works:
  - Pioneer camp, quarries, batch plant, temporary water system establishment, access road construction and site preparation.
- Early Works:
  - Construction of wellpads, CFA and CPF civil works, construction camp and temporary facilities establishment, construction of landfill and infrastructure construction.
- Main Works:
  - Construction of CPF, ancillary area and wellpad facilities, Interconnecting infield network, IWMF and permanent camp.
- Commissioning:
  - Commissioning and handover of systems.

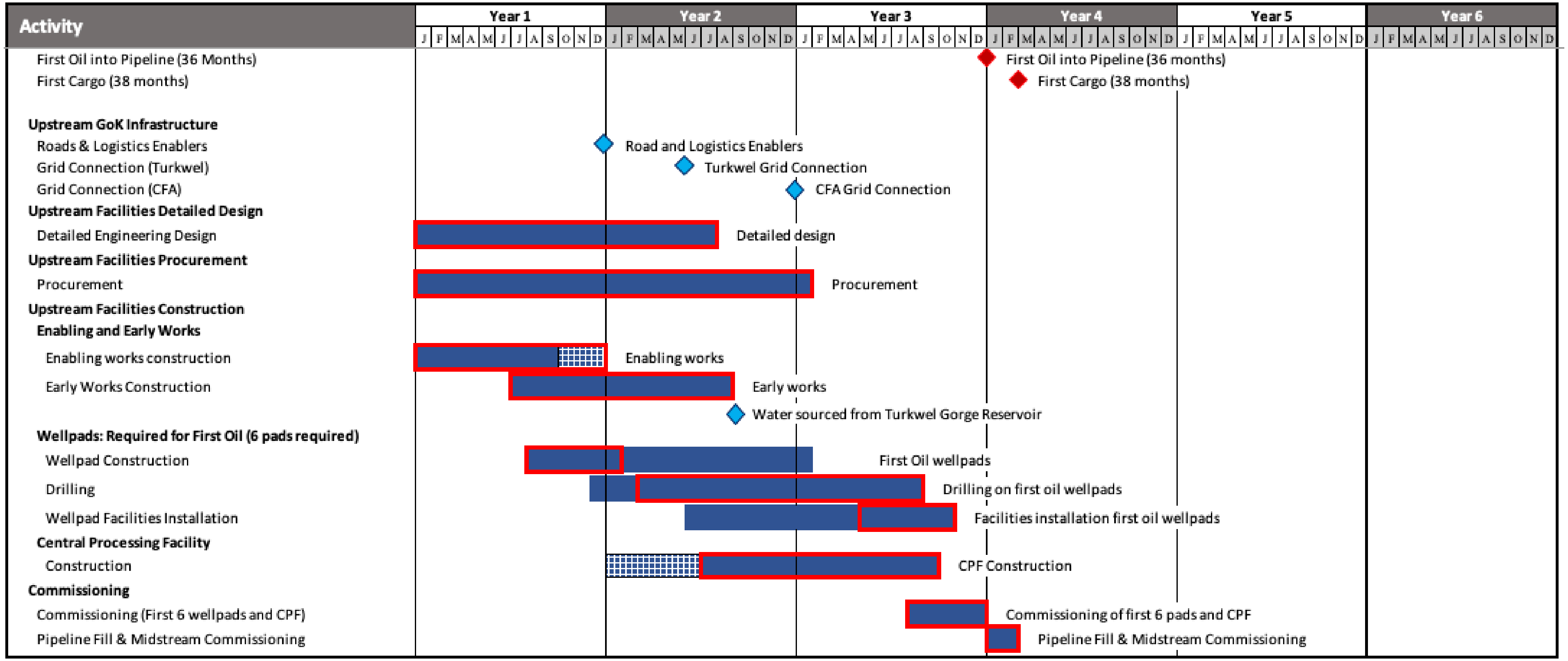

Figure 5.4-2: Indicative Project Schedule Showing Critical Items

5.4.3 Production Profile

The predicted production profiles for oil and make-up water are shown below in Figure 5.4-3.

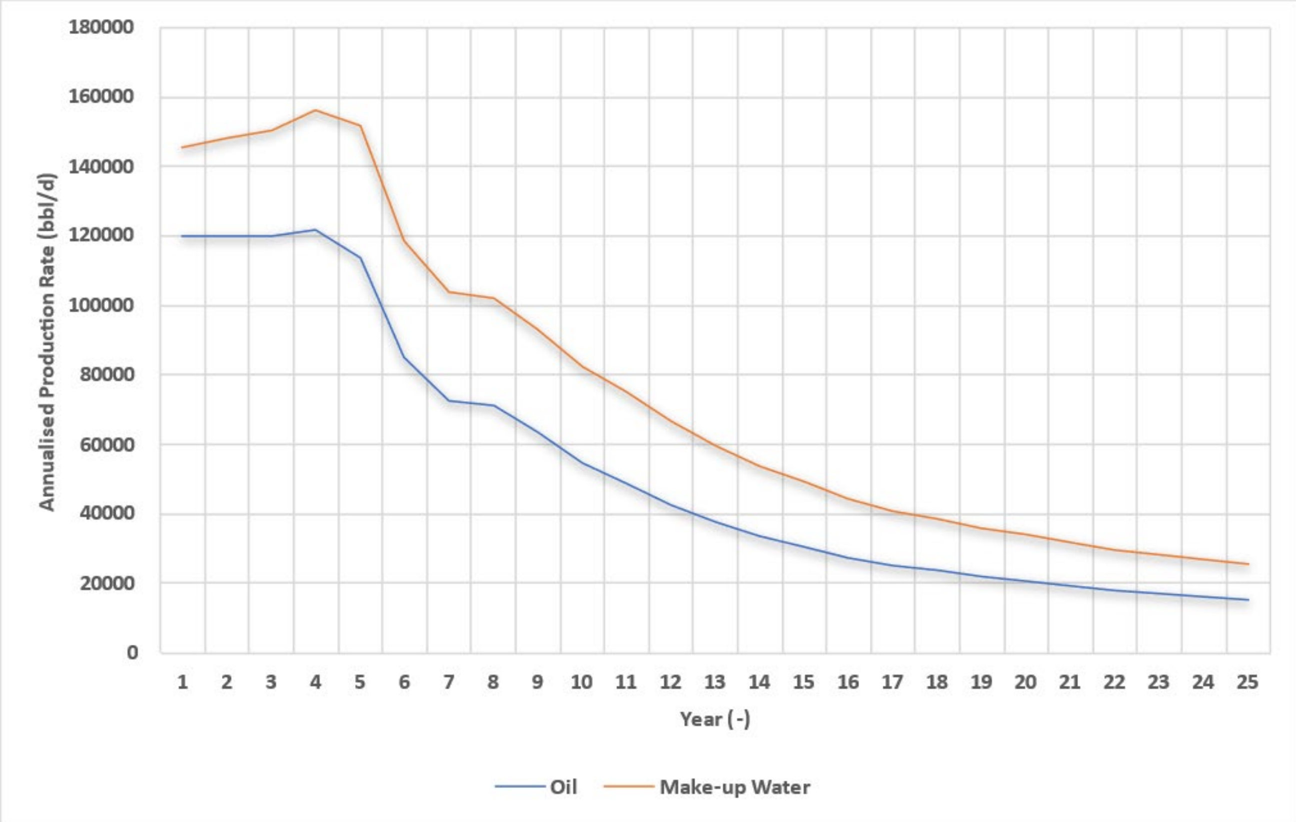

Figure 5.4-3: Predicted Production Profile

5.4.4 Oil Characteristics

Samples have been taken from the reservoir and analysed to determine the fluid composition and properties. The analysis has shown that the oil will be difficult to deal with when cold, due to the high wax appearance temperature (WAT) (62 to 67 degrees celsius (°C)) and the high pour point (39 to 48°C). From this perspective, the Project operating philosophy is to keep the oil above the WAT in the facility, flowlines and export pipeline.

No H_2S has been identified to date in the produced reservoir fluids. H_2S will be monitored and there will be a facility to inject Hydrogen Sulphide (H_2S) scavenger at the producing wellpads if H_2S concentrations increase above design levels. The produced fluids are expected to have a low sulphur content.

The CPF will be designed to accommodate the various carbon dioxide (CO_2) levels from the production fluids (there is a high presence of CO_2 from some parts of Ngamia, Agete and Etom).

5.4.5 Project Land Requirements

The NLC, on behalf of MoPM, has and will acquire gazetted “polygons” of land across the different oilfields. Within those polygons, the Project has identified a defined footprint of approximately 1,500 hectares versus the predicted polygon land area of approximately 11,000 hectares. In order to minimise the impacts of land acquisition, land not required by the Project within the polygons will continue to be available for community use. Indicative land requirements are provided in Table 5.4-1. The Project footprint is shown in Figure 5.4-4. Some of the contingent wellpads sit outside of the gazetted areas. If the contingent wellpads are required, the additional land will be acquired and gazetted following the standard land acquisition process.

Land acquisition for the Project will follow the statutory process to be undertaken by GoK to make land available for the Project and supplemental work to be undertaken by the Project to meet additional IFC requirements. The key principles for this approach are set out in the Project *Resettlement and Livelihoods Restoration Framework*. Following submission of the ESIA, the Operator will develop a Resettlement and Livelihoods Restoration Plan which will provide a record of work and studies done to date and set out the detailed plans, schedule, roles and responsibilities for implementation post final investment decision (FID).

The Project will make use of land that has previously been permitted and used by the Project for exploration and appraisal well pads, thereby reducing the amount of additional undisturbed land where direct impacts to land use and cultural heritage assets can occur. Previous well pads were subject to permitting by NEMA and by an internal Site-Specific Assessment process undertaken by the Operator.

Indicative land requirements are provided in Table 5.4-1. The infield Project footprint is shown in Figure 5.4-4.

Table 5.4-1: Indicative Upstream Facilities Land Requirements

Land component	Specific land	Estimated Land Requirement (ha)
CFA	CFA Outer	250
Wellpads	Wellpads	550
Landfill	Landfill Ngamia	50
Interconnecting Network (Oil gathering network, infield- OHTL and Road network)	Oil gathering network, infield-OHTL and Road network	650
	Total	**1,500**

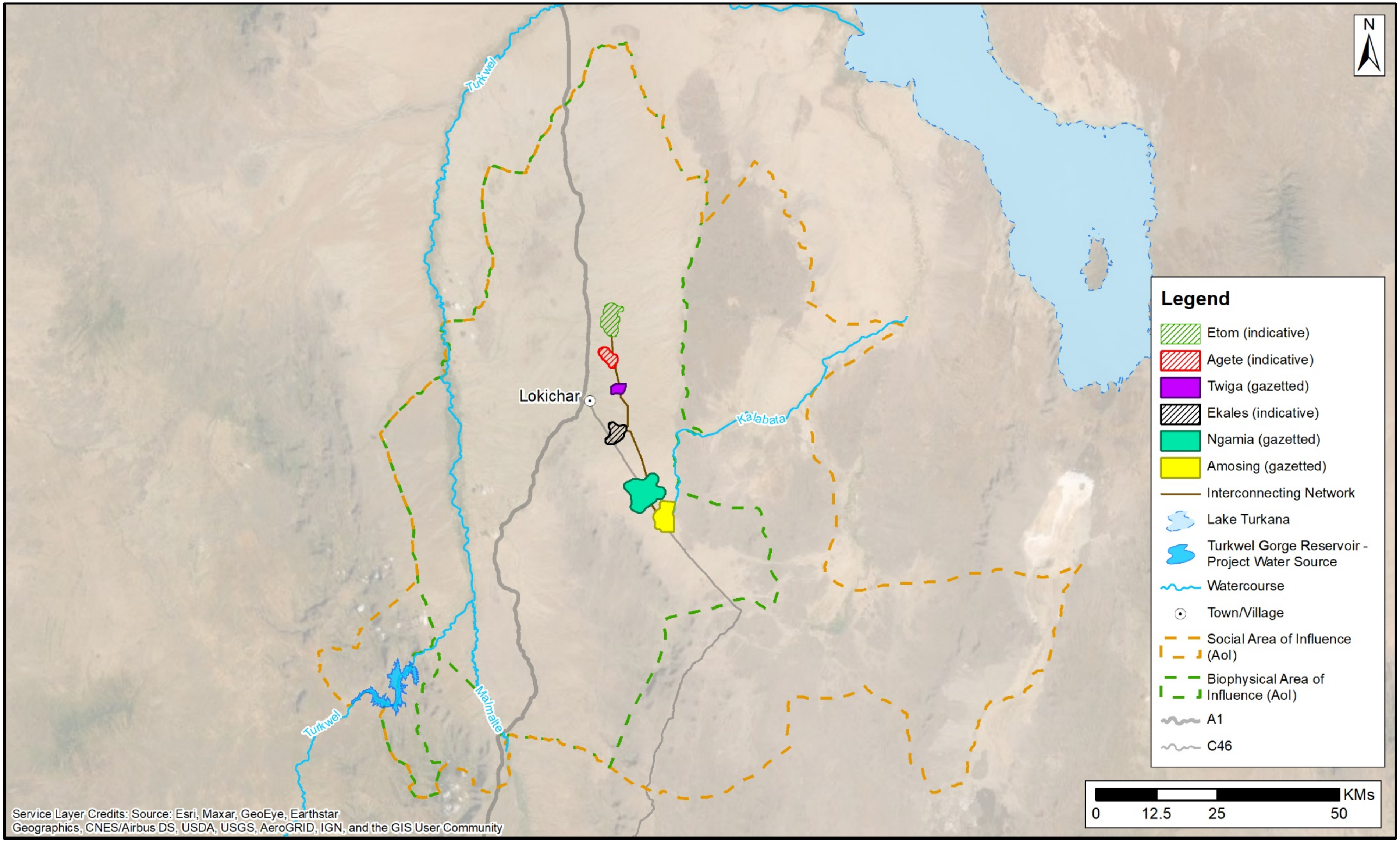

Figure 5.4-4: Infield Project Footprint

5.4.6 Water Demand and Supply

5.4.6.1 Construction Water Demand and Supply

Ten existing water production boreholes have already been drilled in the South Lokichar area. If they were all brought into service, the total yield would be an estimated 1,560 m^3/day. The existing boreholes will be used to support early and enabling works, prior to the availability of water via a pipeline from the Turkwel Gorge Reservoir (this is subject to a separate ESIA).

Estimated water demand from FID to First Oil (FO) is shown on Figure 5.4-5[1]. During the construction phase the estimated water demand will average at 1,550 m^3/day. Project water demand will be subject to further investigation as part of the detailed design process.

The current estimated water demand will exceed the existing estimated water production borehole yield of 1,560 m^3/day from month 20 of construction, prior to water being available from the Turkwel Gorge Reservoir via pipeline at around month 22. Current indication is that water will be trucked-in from Turkwel Gorge Reservoir between month 20 and 22 of construction. This approach will be separately assessed and permitted outside of this ESIA.

[1] The estimated peak at 3,540 m^3/day is due to LLCOP hydrotesting requirements. Project water demand, presented in Figure 5.4-5, includes water for hydrotesting of LLCOP, the water pipeline and the infield flowlines, however the ESIA only assesses the discharge of hydrotest water from the infield flowlines. Discharge of hydrotest water for the proposed water pipeline and the LLCOP, will be assessed under separate ESIAs (one for the water pipeline – pending and one for LLCOP – already completed).

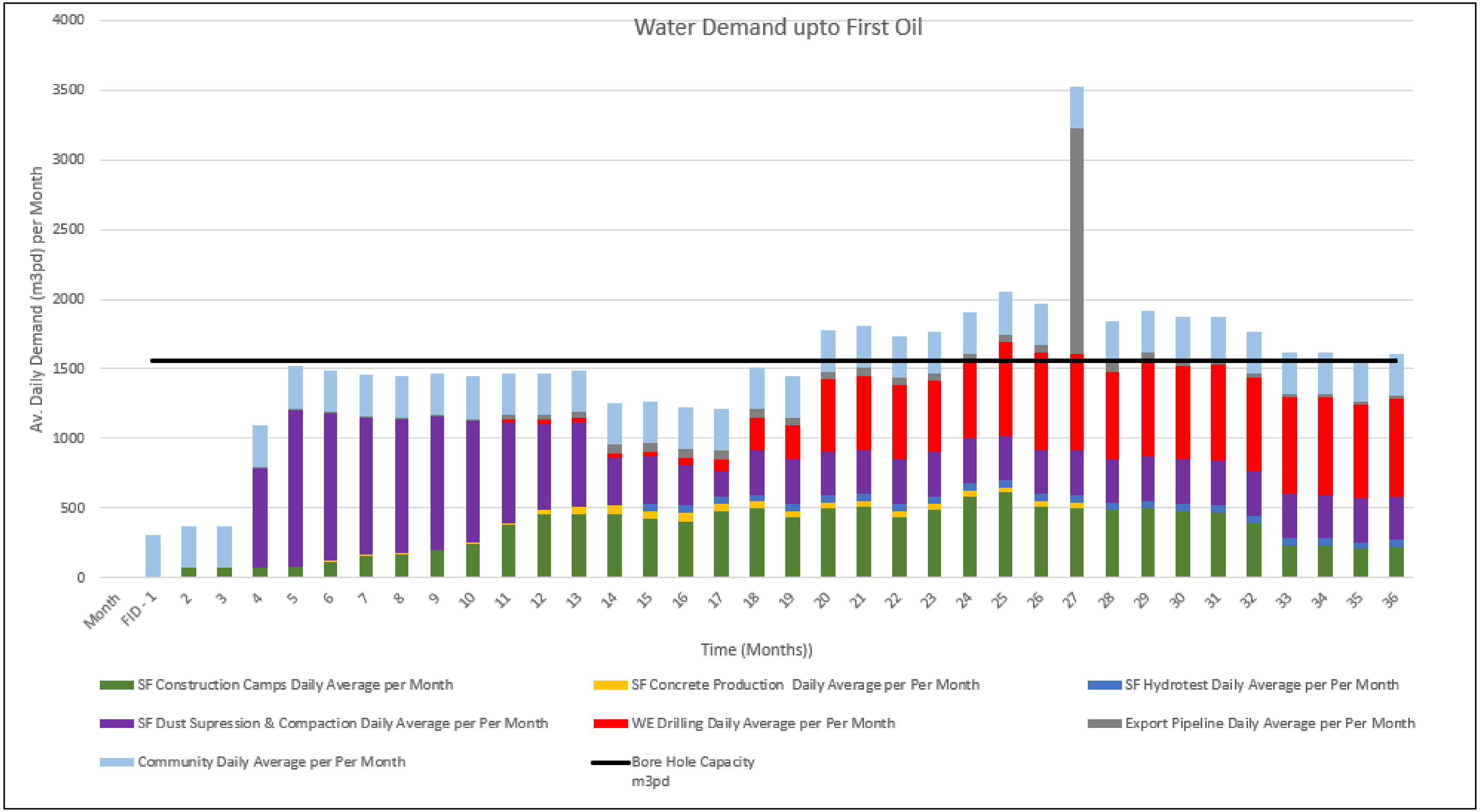

Figure 5.4-5: Estimated Water Demand – Final Investment Decision to First Oil

5.4.6.2 Operations Water Demand and Supply

During operation of the facility there will be an estimated peak demand in Year 4 (Figure 5.4-6). The demand will reduce through the Project phase, linked to the oil production rate. Water sourced from the Turkwel Gorge Reservoir will provide this water.

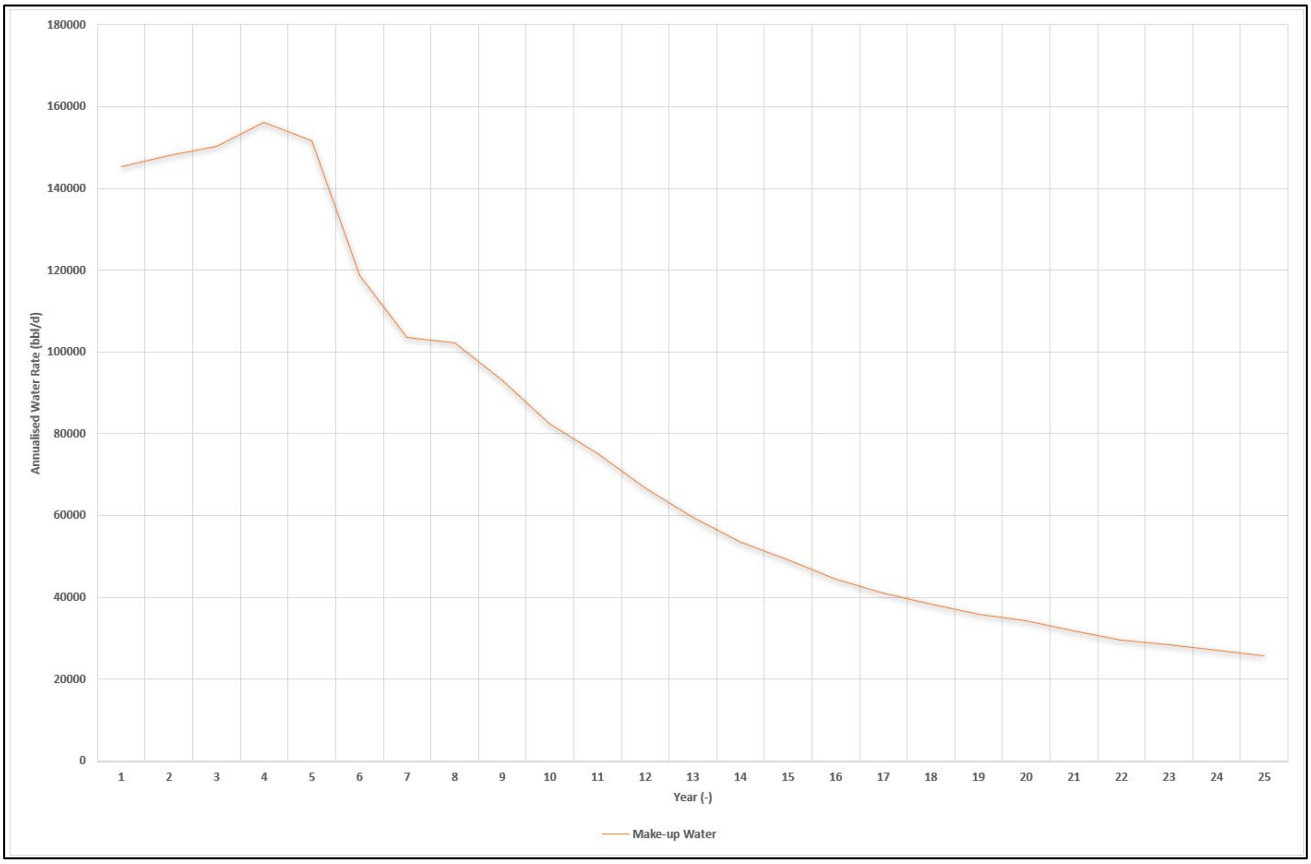

Figure 5.4-6: Operational Water Demand - Post FO

5.4.7 Power and Heat

5.4.7.1 Construction Power Demand and Supply

Power supply to construction camps, work areas and warehouses will be provided by temporary standalone diesel generators.

Power demand for the drill rigs (4 drilling rigs, 2 completion rigs) will be up to 4 megawatts (MW) per rig (12 MW total). Power will be provided by temporary diesel generators.

5.4.7.2 Operations Power Demand and Supply

The estimated produced gas and fuel gas demand for the life of field is shown in Figure 5.4-7. During the initial years of operation, the predicted produced gas flowrate is in excess required demand for fuel gas. The remaining gas (excess gas) declines over the first 6 years, until the facility becomes gas deficient from year 6.

Power generation for the CPF will be provided, by 3 Gas Turbine Generators (GTG) with a maximum rating of 24 MW each to meet the facilities power demand. Produced gas from the reservoir will primarily be used for power and heat generation. A connection to the local power grid is required to allow for power import. Waste Heat Recovery Units (WHRUs) will be installed with each of the GTGs, each with a maximum rating of 48 MW and will recover heat from the GTG exhaust. In addition, two cross exchangers on the oil rundown line are provided to recover excess heat from the treated oil to heat the make-up water and produced water streams.

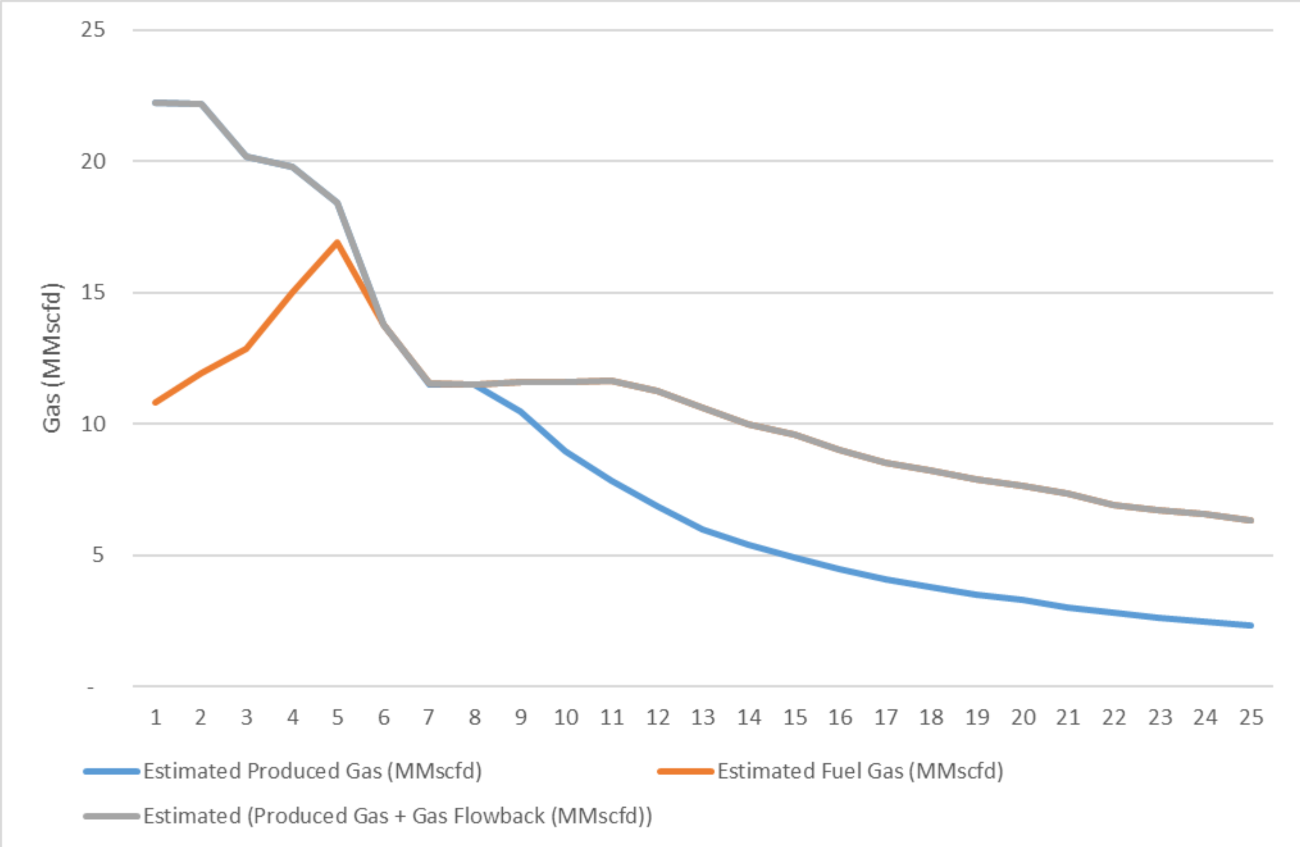

Figure 5.4-7 Estimated Produced Gas and Fuel Gas Demand for the Life of the Field

The substation located in the CPF will form the main source of the power distribution system meeting the total peak power demand for the following areas:

- CPF;
- CFA (including camp, ancillary area and IWMF, LEF);
- Engineered Landfill; and
- Production wells.

A new overhead transmission line (OHTL) will be routed from CPF to each field substation. At each wellpad there will be a substation.

For the permanent camp, a new power supply will be routed from the CPF substation to the ancillary area substation/electrical room. Backup power generation will be provided by a diesel generator located in the ancillary substation, for temporary use in case of failure of power generation/grid.

5.4.7.3 Supplementary Power Source – Grid Connection to CPF

The design for the supplementary power source is based on connection to the grid at the Project location. The interface with the grid tie-in point and the CPF will be by a high voltage (HV) substation, constructed by KETRACO, adjacent to the CFA, as part of the Turkwel to Lokichoggio transmission line expansion project.

The spur from the KETRACO transmission line sub-station to the CFA is considered as an Associated Facility, but the very short length of this, and its proximity to the CFA itself, means that issues and impacts associated with construction of the spur line are considered as part of the construction and operation of the CFA itself.

The grid connection will provide power supply to cover GTG unavailability and any outages (planned or unplanned maintenance) of the GTGs, meeting peak demand and providing continuous power once fuel gas is deficient. It is therefore planned that the grid connection is available during early field life (required from Year 1).

5.4.7.4 Back-up Power Generation

The GTG (dual fuel: gas and diesel) will form an independent package and consist of engine, alternator, control panel, batteries and other auxiliary systems required for normal operation or self-starting under test or main grid supply failure and black start. Separate diesel generators will be connected to plant low voltage (LV) essential loads during power generation failure.

5.4.7.5 Commissioning Power Supply

There are two scenarios to consider, as the potential connection of the external grid relies on 3rd party involvement. Those two scenarios are:

- Power available from the grid; and
- Power must be internally generated.

Where power is to be internally generated, the emergency diesel generator will be required to run essential services until the main GTGs can be started on diesel. Once operational, production will be targeted to ramp up as quickly as possible to ensure sufficient gas is generated to start another GTG on fuel gas, and so curtail diesel consumption as quickly as possible. A relatively slow increase in production flowrate, and therefore gas production, will require a longer period before fuel gas is available for the GTGs.

5.4.7.6 Excess Gas Management

In the initial years of operation, the predicted produced gas flowrate is in excess of the required demand for fuel gas (see Figure 5.4-7 above). The remaining predicted gas (excess gas) declines over the first 6 years, until the facility becomes gas deficient from year 6 (when other sources of power would be required).

Excess gas will be re-injected into the reservoir, preventing the requirement for continuous flaring during normal operations. When the excess gas is required, this can be extracted and used to limit the power import from the grid.

5.5 Wellpad and Wells

5.5.1 Existing Wellpads and Wells

The appraisal drilling campaign required the drilling of wells across the oil fields. To support this activity there are already 20 wellpads. The size of the pad and the number of wells drilled varies from pad to pad. Where existing pads are required as part of the Project, they will be adapted, and the facilities will be upgraded in line with the Project wellpad design.

5.5.2 Field Layout

In total, 61 wellpads will be developed as part of the Project (20 of these are existing wellpads (from Exploration and Appraisal (E&A) activities or relating to EOPS Phase II)). In addition, 12 contingent wellpad locations have been identified. The contingent wellpads do not need to be developed as part of the current project but may be required in the future. If these are required and sit outside of the gazetted areas, the additional land will be acquired and gazetted subject to the land acquisition process.

The Project will develop 1,126 wells, with each wellpad containing up to 24 wells (combination of producer and injector).

The indicative breakdown of wellpads between the oil fields is detailed in Table 5.5-1 and presented in Figure 5.5-1.

Table 5.5-1: Project Wellpad Breakdown by Oilfield

Field	Pad Count	Contingent Pad Count
Amosing	11	1
Ngamia	17	2
Twiga	4	1
Ekales	7	1
Agete	5	1
Etom	17	6
TOTAL	61	12

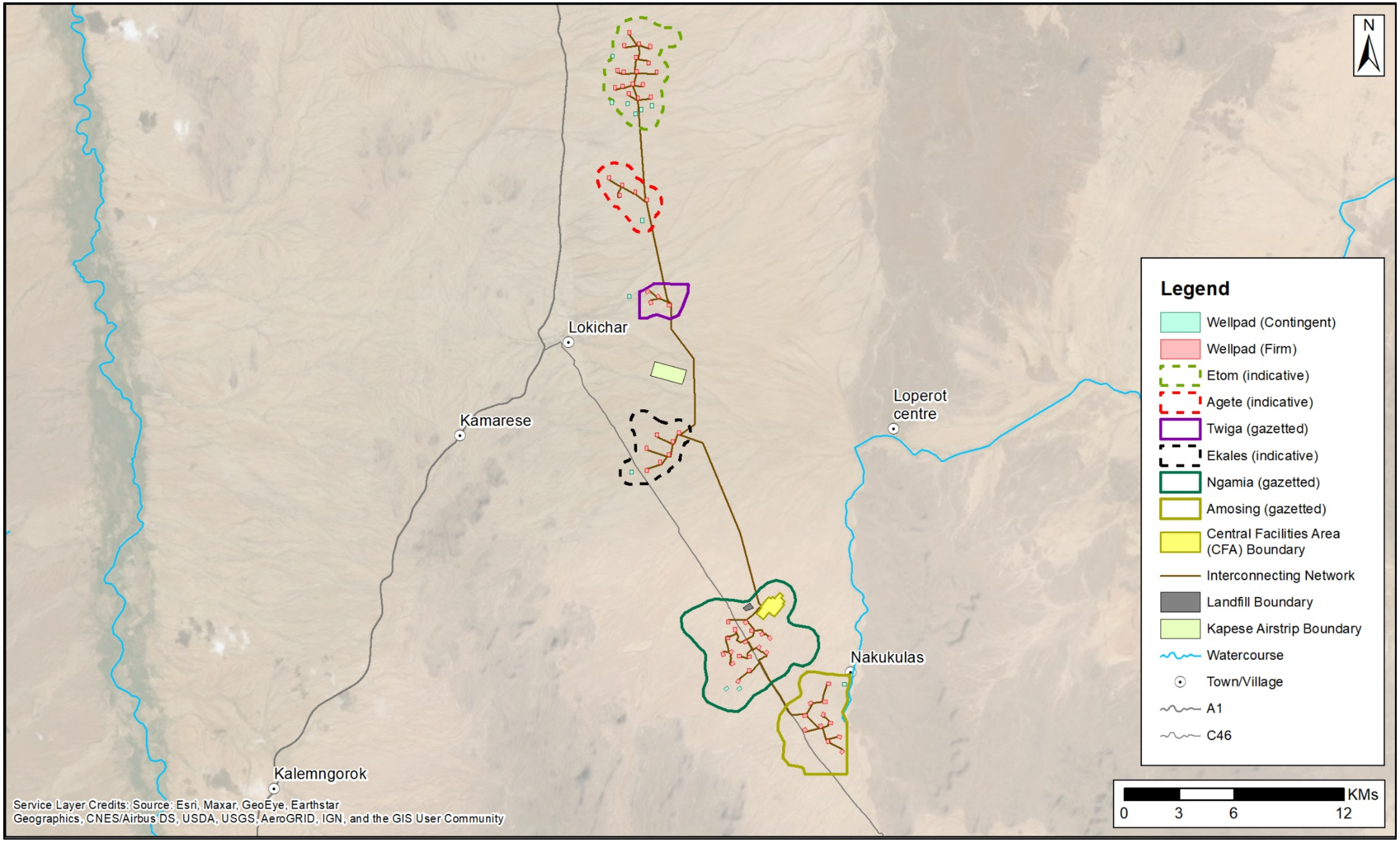

Figure 5.5-1: Project Field Layout

5.5.3 Wellpad Facilities

The wellpad area will be prepared based on the total number of wells expected per pad. The standard wellpad area is 250 m x 200 m. For wellpads with a low well count, allowing all wells to be located in a single row, the wellpad area will be reduced to 250 m x 150 m. A typical wellpad layout is presented in Figure 5.5-2.

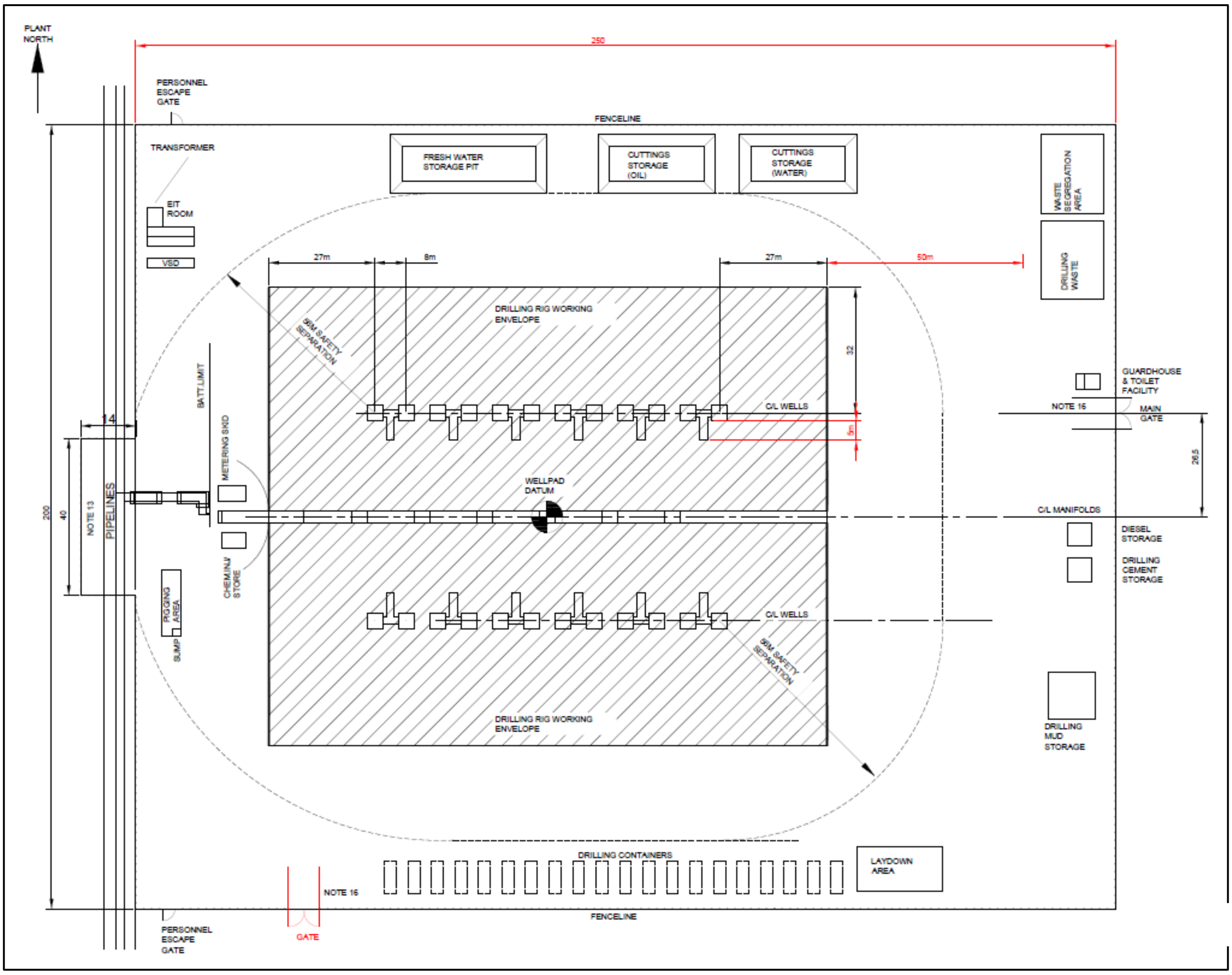

Figure 5.5-2: Typical Wellpad Layout

A buffer area of 15 m with cleared vegetation outside of the wellpad fenced perimeter will be maintained for mixing and disposal of water-based mud (WBM) cuttings with native soil in line with previous practice from EOPS.

The following items are provided on the wellpad.

- Artificial Lift - each well will be provided with artificial lift pump powered from the CPF, via the infield power distribution network;
- Chemical Storage - approximately 6 m³ of bunded storage at each wellpad for 30 days' supply of demulsifier;
- Diesel Storage - outdoor diesel/fuel storage area with bunding;
- HDPE lined pits - Fresh Water Storage Pit, Cuttings Storage Pit (Oil/synthetic), Cuttings Storage Pit (Water), Drilling Mud Pit, Drilling Waste Pit, Drilling Cement Pit;

- Multiphase flow meters;
- Drainage:
  - The wellpad is sloped such that rainwater runs to the external ditch that runs around the perimeter. Discharge from the external drainage ditch can be controlled to prevent the discharge of oil contaminated water to the local environment. Any oil collected in the interceptor will be removed and disposed of; and
  - The cellars are provided with a sump to allow for collection of contaminated water. All cellars will be emptied by a gully suction truck and removed for treatment at the IWMF.
- The chemical storage or pigging areas are provided with a kerbed concrete area to contain any spillages;
- The septic tank will be periodically emptied with sewage treated at the IWMF;
- Security - the wellpads will be continuously manned by a security guard stationed in the guard house. CCTV is provided, monitored from the control room in the CPF;
- Pig Receivers/Launchers; and
- Service water supply and storage - for well services' activities on the wellpads throughout the life of the facility (piped supply all fields apart from Twiga, where water will be supplied by truck).

5.5.4 Wellpad Construction

The wellpads are required to be constructed in phases. Initial construction is required to be completed prior to drilling. The sequence of construction comprises the following:

- Site Preparation:
  - Clearing and grubbing;
  - Cut and fill;
  - Excavation of pits;
  - Site levelling and drainage;
  - Access roads; and
  - Perimeter fence and gates installation.
- Installation of below ground facilities and infrastructure;
- Drilling operations and well completions, including removal of drilling spoils;
- Construction of above ground well site facilities;
- Commissioning of wells and equipment; and
- Handover and demobilisation.

The work on each wellpad needs to be scheduled in a sequential manner to allow construction groups to work on more than one wellpad at a time. Presently it is estimated that each wellpad will take approximately 2 to 3 months to construct, which includes the steel (or concrete) cellars. The current construction sequence assumes no requirement for piling of foundations.

Drilling fluids will be required during the drilling campaign:

- Water based mud (WBM) for the surface hole section, which is designed to mitigate contamination to shallow aquifers. Water is the continuous phase, and the main additives are polymers, bentonite, potassium sulphate, weighing materials and chemicals to control pH, fluid loss and other drilling fluids properties.
- Synthetic based mud (SBM) for the production hole section, which is designed to minimise formation damage, wellbore instability and shale reactivity. Synthetic oil is the continuous phase with brine droplets in emulsion. The main additives are synthetic oil, salt/brine, emulsifier, weighing/bridging materials, and chemicals to control alkalinity, fluid loss, viscosity, gel strength and other drilling fluid's properties.

The site will be sloped slightly to encourage rainwater to run off and prevent the site flooding. Flood defences will also be required for the wellpads and to provide purpose-built drainage for clean surface water, which will be discharged to the closest natural lugga. Typical wellpad layout will have an evaporation ditch internal to flood protection berm where required. Drainage will be put in place to ensure no increase flood risk downgradient of the wellpads.

During the drilling phase, the wellpad will have a bunded diesel storage area to support temporary power generation. Part of the wellpad will be used for the storage of drilling wastes and therefore the drillings waste/ cuttings pit, cutting storage pit and drilling mud pit, will be provided with bunds to contain any rainwater run-off. The bunds will be lined to prevent soil contamination.

5.5.5 Well Facilities

The Project consists of 1,126 planned wells. Each wellpad will contain up to 24 wells (combination of production and water injection wells), with the specific number of wells drilled from each pad dependent on the location within the field and the reservoir performance.

The well design will adopt a three-casing policy. This will help reduce the potential risks associated with any uncontrolled hydrocarbon release. Each casing section is detailed below:

- Conductor casing - for structural support and isolation of shallow unconsolidated formations;
- Surface casing - for protection of shallow aquifers from contamination during drilling of the hydrocarbon zones; and
- Production casing - for controlled production of hydrocarbons as well as their long-term isolation from the surface for life of field.

The well head will be of a Christmas tree design which will ensure they fit completely within the cellar (fully submerged). The Christmas tree design will provide all required connections for production and monitoring of the well performance.

5.5.6 Well Construction

Wells will be drilled simultaneously by four drilling rigs (inducted in a phased manner). A typical drill rig is shown in Figure 5.5-3.

Figure 5.5-3: Typical Drilling Rig

During drilling of each well, a system will be installed on the wellhead that acts as a robust mechanical barrier against any hazardous release of hydrocarbons to the environment. This is known as a Blow Out Preventer (BOP) and comprises a large, specialised valve to prevent the uncontrolled release of fluids from a well.

5.5.7 Well Commissioning and Start-Up (Stimulation)

Wells will be completed and suspended using packer fluid. Wells will be started up when the wellpad facilities have been completed and hooked up to the gathering network. Well clean-up will involve flowing the wells (including packer fluid) to the CPF. The following comprises the chemical requirements for the packer fluid:

- Biocide;
- Oxygen (O_2) scavenger;
- Corrosion inhibitor; and
- Potassium formate.

Wellpad facilities will be commissioned prior to hydrocarbon introduction. Due to the phased construction of wellpads, new wellpads will be hooked up and commissioned throughout the first few years of operation.

5.5.8 Operations

In the first few years of operation it is anticipated that the wellpads will be continually manned to some degree, with well workover and development drilling taking place and regular visits by operations and maintenance (O&M) personnel until steady-state operations have been achieved. Once unmanned, visits may be required on a daily, weekly or monthly basis to undertake well testing, basic sediment and water sampling, waste collection, chemical changeout and water injection choke adjustment.

A completion/workover rig will be available for running initial completions and subsequently conducting workover operations during the full life of the oil fields.

The Operator is committed to managing its facilities to minimise odour emissions. The Operator will monitor odour; and investigate and follow up any complaints.

5.5.8.1 Production Wells

Most producers will have jet pumps as the initial artificial lift method, with changeover to Progressing Cavity Pumps (PCP) or Electrical Submersible Pumps (ESP) once water cut has increased to around 60% or when there is insufficient spare capacity in the hot water system. The Twiga wells will have ESPs as the artificial lift method.

5.5.8.2 Water Injection Wells

Water injection wells are located on each wellpad and will have manual flow control valves to allow the flow to individual wells to be regulated. The required water injection temperature is 83°C for years 1 to 4, which may be reduced to the same temperature as production fluids, of around 65 to 75°C. The maximum flowrate for a single water injector ranges from 600 barrels of water per day (bwpd) up to 3,200 bwpd.

5.5.8.3 Gas Injection Wells

Excess gas will be re-injected into the reservoir.

5.5.8.4 Wastewater

Sewage will be collected in a portable septic tank and, along with general waste, will be periodically transported to a centralised treatment area at the IWMF for processing.

5.6 Central Facilities Area (CFA) and Central Processing Facility (CPF)

5.6.1 CFA

The layout of the CFA is shown in Figure 5.6-1. The footprint is approximately 1,940 m x 950 m. It is designed to co-locate the following central facilities (shown as permanent or temporary):

- CPF – Permanent (further details in sections below);
- LEF - Permanent (*not within the Project ESIA scope, covered in LLCOP ESIA)*:
  - The LEF is located on the south-west perimeter of the CPF and within the CFA site, with the export pipeline running below ground from the LEF, through the CFA and beyond. The LEF and export pipeline fall under the LLCOP work scope and therefore the LEF introduces an interface between the Midstream Contractor and the CPF/CFA Contractor at the specified battery limit.
- Ancillary Area - Permanent:
  - The ancillary area is located to act as a buffer zone between the CPF and camps. The function of the ancillary area is to provide a safe area outside of the CPF to locate some utilities and provide a safe working environment for operators; and
  - The ancillary area contains utilities (make-up water storage tanks and treatment, firewater storage and pumps, emergency generators, diesel storage, potable water storage and pumps and service water pumps), training area (firefighting); paring; fenced laydown; and buildings (gatehouse, control and admin building, laboratory, emergency response facility, warehouse, workshop and vehicle service area).
- IWMF – Permanent;

- Permanent Accommodation Camp - Permanent:
  - Accommodation provided for approximately 500 personnel during operations.
- Temporary Camps - Temporary:
  - Construction camp (approximate 2,000 bed capacity);
  - Rig camp (approximate - 400 bed capacity); and
- Drilling Area - Temporary:
  - The drilling area will be 750 m x 500 m or equivalent sized plot of land, fenced, graded, surface water drainage and gates for establishing the base camp and staging/storage area.
  - The base area will be used for staging accommodation facilities and also plot space for warehousing.
  - The drilling area will be provided with a dedicated road access from the C46 to minimise traffic disruption during construction/operations.
- Construction Laydown Area - Temporary.

The CFA will have varying levels of security and internal access roads between the facilities.

5.6.2 CPF

The CPF is a single, centrally located facility which will perform all the required processing to produce on-specification crude oil for export. The processing scheme will incorporate facilities to separate gas and water from the oil. The oil will be stabilised by separation stages at elevated temperature to meet a true vapour pressure suitable for storage in floating roof tanks. The oil will be routed from the tanks and metered via oil export metering before leaving the CPF via the LEF for export.

The CPF overview is illustrated in Figure 5.6-2, with layout presented in Figure 5.6-3.

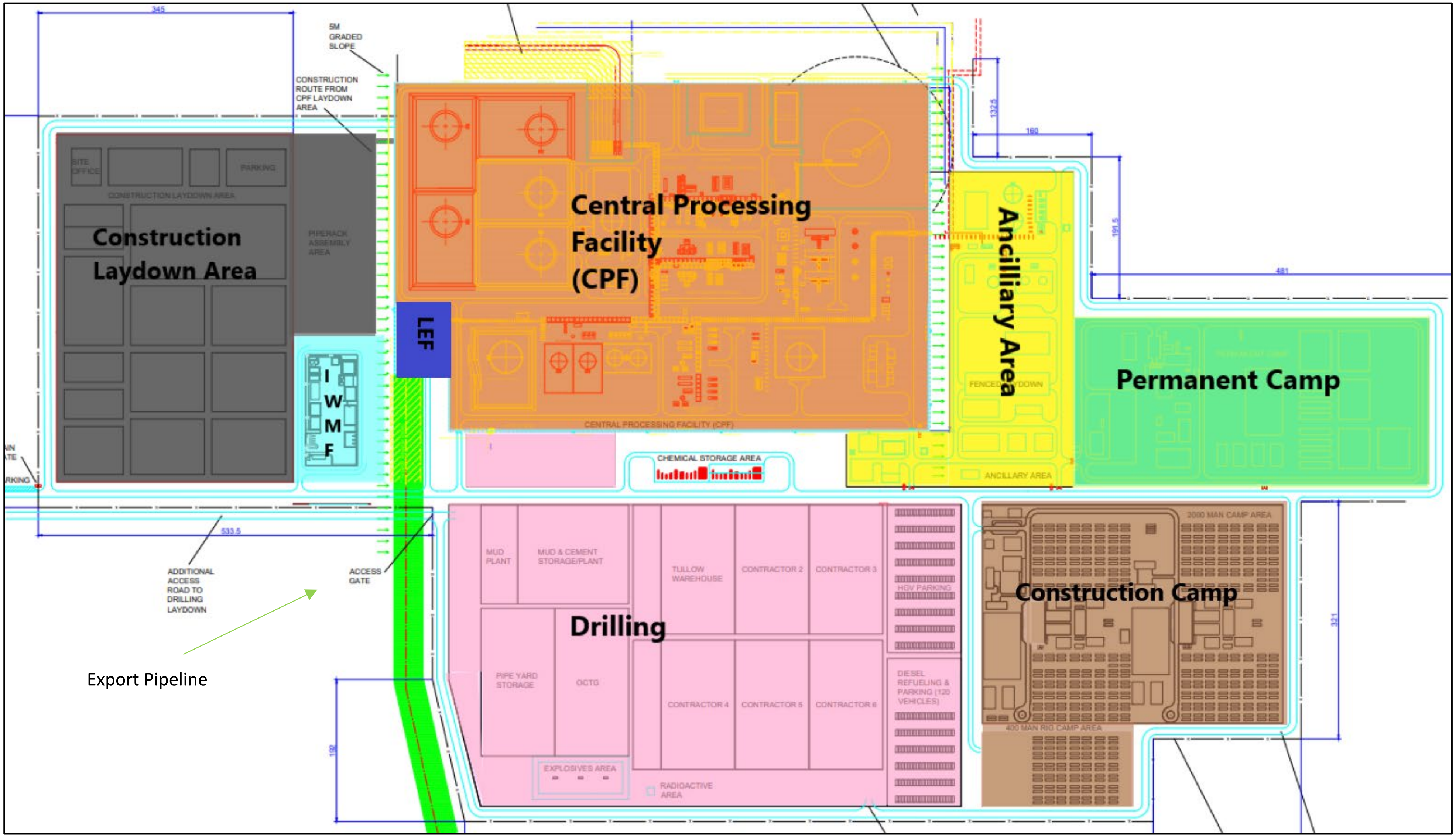

Figure 5.6-1: CFA Layout

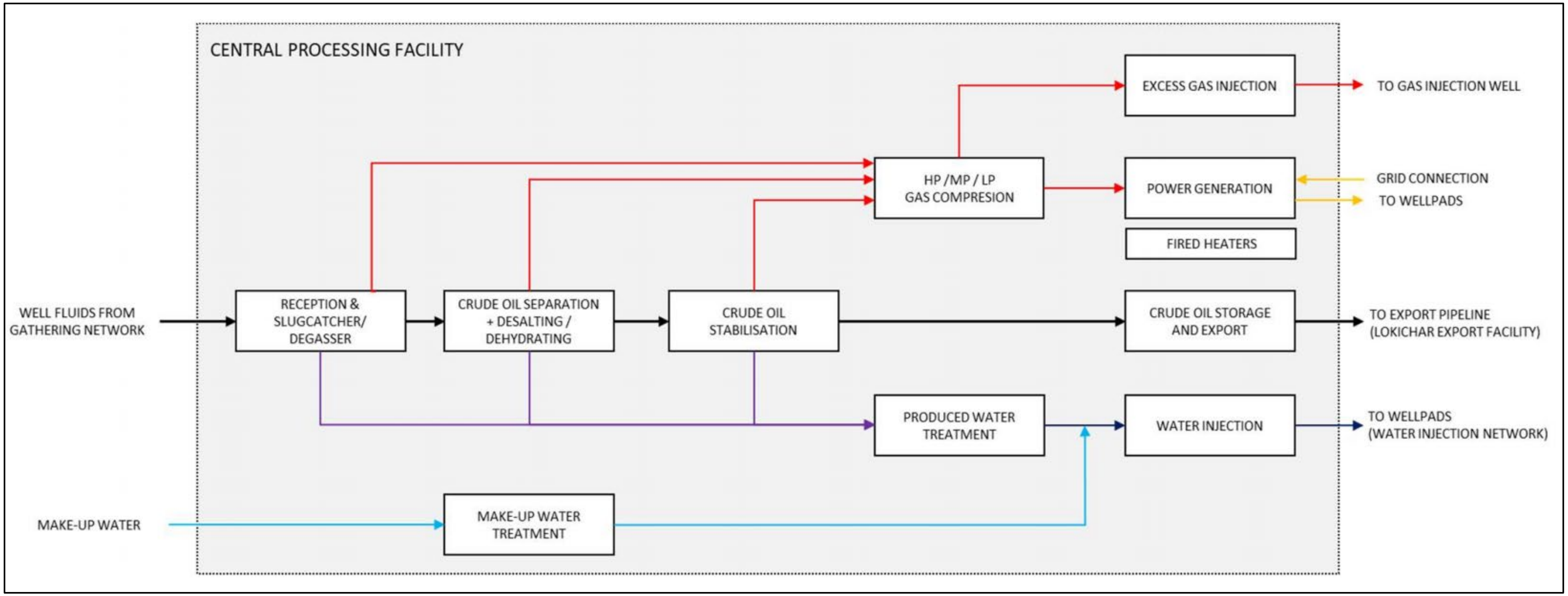

Figure 5.6-2: CPF Overview

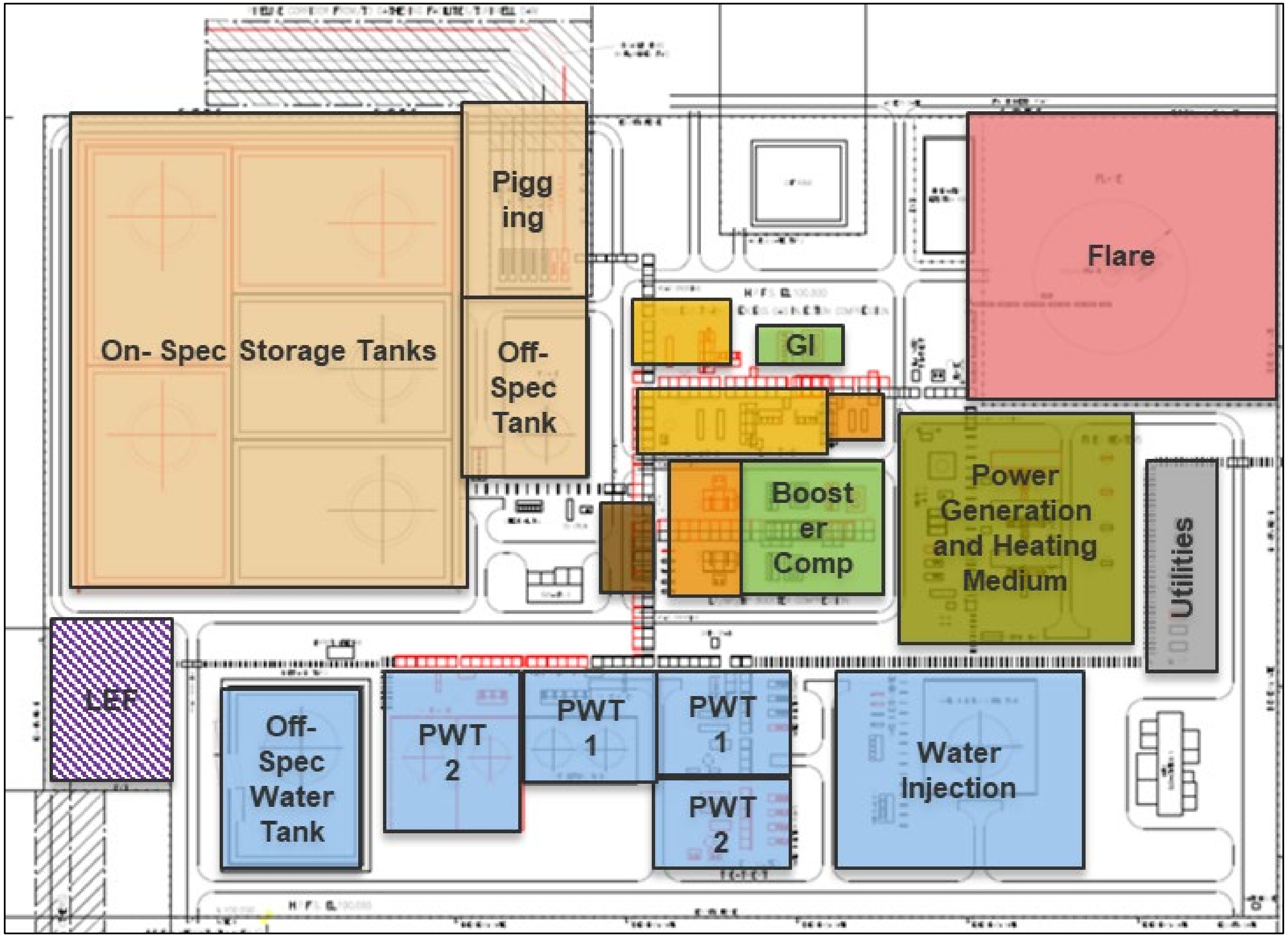

Figure 5.6-3: CPF Layout

The CPF system features are listed in Table 5.6-1.

Table 5.6-1: CPF system features

CPF system feature	Description
Pig Receivers	Pigging is required to inspect the integrity of the main pipeline and to clean it periodically.
Oil Train	The oil train provides the required separation and stabilization of the oil to meet the export specifications.
Ngamia High CO_2 Production	An area of the Ngamia reservoir has been found to contain significant levels of CO_2. High CO_2 wells are connected to dedicated high CO_2 well pads and a dedicated high CO_2 trunkline connected to the CPF. When mixed with the associated gas from the other fields, the concentration of the CO_2 is not significant. The gas is subsequently used for power generation or excess gas-injection.
Oil Storage & Export	Stabilised oil is sent to on-spec (meeting export specifications) crude oil storage floating roof tanks which provide a total of 3 days storage at peak production rate. The storage tanks are insulated and heated to ensure product contents are maintained above 64°C. Oil from the storage tanks is pumped to the LEF for export. Off-spec oil is diverted to the off-spec (outside export specifications) crude oil storage fixed roof tank, from where it can be pumped back to the inlet production manifold for reprocessing.
Gas Compression	Separated gas is compressed, with subsequent routing of the majority of the gas for conditioning (superheated) for use as fuel in gas turbines and fired heaters. The remainder of the gas (i.e. excess gas) is routed for further compression, with subsequent injection into an injection well.
Excess Gas Injection	Provision will be made to re-inject the excess gas into the gas injection wells, with potential to produce the gas later in field life in the event of fuel deficiency.
WHRU	WHRUs recover heat from the GTG exhaust and two cross exchangers on the oil rundown line and use the excess heat from the treated oil to heat the make-up water and produced water streams. Once production has started, a heating medium will be required throughout the plant to achieve operational targets.
Water Treatment and Injection	Separated water is treated in produced water treatment facilities to a specification suitable for re-injection into the reservoirs, with injection volumes supplemented by make-up water (sourced from the Turkwel Gorge Reservoir) that is heated/treated in make-up water treatment facilities to the required injection water specification.
Heating Medium	WHRUs directly coupled to the installed GTGs will be the primary means of heat generation, supplemented by fired heaters to cover interruptions in GTG operation.
Power Generation	Power generation is provided, in the base case, by 3 GTG units with back-up power supply provided by the Kenyan National Grid to cover interruptions in the GTG power supply.
Water Supply	Make-up water is sourced from the Turkwel Gorge Reservoir to the Ancillary Area and is stored with firewater in two storage tanks. The water is treated to meet water injection specification.
Drains	The enclosed drain system will collect liquids from normally pressurised and hazardous equipment prior to their maintenance. Oil from the closed drain drum is returned to the main process drain.

CPF system feature	Description
	The hazardous open drain system collects liquids from areas potentially contaminated with oil which include spillages, overflow, wash down from equipment, kerbs/drip trays/piping, flooring and rain/deluge. Collected oil is held in the open drain drum (via vessel internals) to prevent release to the environment. All treated run off will be sent to the evaporation pond. The uncontaminated water from surface run off will be discharged without further treatment via drainage ditches.
Evaporation pond	Contaminated runoff will be discharged to the evaporation pond. Once water has evaporated, the residue will be disposed of as hazardous waste.
Instrument Air and Nitrogen	Nitrogen and instrument air systems are provided to allow for the safe operation of the facility. Nitrogen is used to blanket fixed roof tanks to prevent the formation of explosive atmospheres.
Chemical storage and use	Provision for the injection of a variety of chemicals is allowed for within the CPF, some of which are continuous and others batch or intermittent when certain operating conditions exist. Storage in the ancillary area will use the containers in which the chemicals are supplied and will be stored for no more than 30 days at all facilities. Within the CPF, chemical storage will not exceed volumes required for more than 7 day's supply.
Firewater	The CPF is provided with a firewater ring main, serviced by the firewater system contained in the Ancillary Area.
Facility Storage Tanks in CPF	Crude oil, make-up water/firewater, injection buffer, off-spec crude, off-spec water, potable water, produced water settling tank, mineral oil tank and diesel tank.

5.6.3 CFA and CPF Construction

The CFA and CPF will be the centre of construction activities. Due to the nature of the schedule, all areas will be worked on simultaneously. The construction will follow a sequence of enabling works, early works, construction installation period and commissioning.

The enabling infrastructure works that will be carried out in the CFA prior to mobilising to site includes upgrades to existing access roads, the installation of new access roads in the vicinity of the CFA and vegetation stripping, ground levelling and earth compaction within the CFA footprint.

Construction will involve civils works to prepare the area, erection of safety fencing and any pre-fabrication of concrete structures for the CPF. Earthworks will be carried out in conjunction with the installation of underground services, where possible. Concrete works will include a batching plant to supply all the Project requirements including aggregates. Subject to geotechnical surveys, piling works may be required.

The construction of the CFA will use a hybrid method, including stick build, modularisation and pre- assembly, as follows:

- Stick Build will be used for the majority of structural steel and piping for all areas;
- Modularised construction will be used for more complex structural steel and piping components (Pre-assembled racks (PAR's); Pre-assembled units (PAU's) and skid mounted equipment modules) in the CPF to reduce the manpower peak;
- Pre-assembled structural frames and piping will be used for the CPF; and
- The main racks for the CPF area will be assembled at ground level and then lifted into position.

The construction method for buildings will be dependent on the complexity, for example fewer complex buildings will be stick built, although modular and prefabricated construction will be used where required. Large equipment will be pre-assembled where possible, although tanks will be erected on site by dedicated crews and construction equipment. Vessels and heat exchangers will be assembled at ground level and lifted into position and any units which are shipped in multiple components, for example flares, blowers, heaters, GTGs, will be assembled on site in their final location.

5.6.4 CPF Commissioning

The following systems are required to be operational prior to start-up:

- Gas compression/fuel gas;
- the Vacuum Deaerator Package and Injection Water Buffer tank, to allow for injection into the wells when the system has been brought up to temperature;
- Heating medium;
- Other utilities e.g. flare, instrument air, nitrogen, chemical injection facilities;
- The diesel storage tanks will be full and supply pumps available; and
- Control Systems - The Integrated Control and Safety System (ICSS) and Fire and Gas Shutdown system at the CPF will be available at commissioning (power supply from the grid, emergency diesel generator or Uninterruptible Power Supply (UPS)). The wellpad control system will be available (powered through grid or main power generation).

5.6.5 CFA and CPF Operations

The CFA will act as an operations hub for the development. All operations personnel will be located within the 500-bed permanent camp. The control room, administration building, workshops and laboratory are all located within the ancillary area, local to the CPF. The operators will access the CPF as required to carry out their daily maintenance and observation tasks.

The CPF will require significant operations attention. Operators are required to undertake routine maintenance activities, while ensuring the process operating conditions are optimised. The majority of the operations activities will be carried out from the adjacent ancillary area.

5.7 Infield Network

5.7.1 Flowlines

The well fluids will be gathered in a system of flowlines / trunklines to a centrally located CPF. Following the same in-field pipeline routings there will be a network which will distribute the re-injection water to the wellpads in order to maintain reservoir pressure.

The infield network includes the following: production pipelines, water injection pipelines, excess gas injection pipeline, service water line, power transmission cables and communications fibre optic cables between the CPF and the wellpads, including the associated corridor and infrastructure. Service water pipeline distribution system will be provided to supply service water to all Ngamia and Amosing wellpads. Service water supply to all other fields will be transported by truck.

The gathering network will not have a leak detection system. The flowlines will be buried and are fully welded lines with flanged joints at the wellpad. If a leak were to occur it would most likely be at these joints, which will be visible. Due to the waxy properties of the crude, any leak would solidify on exposure to the atmosphere.

The minimum depth of cover (to the top of the pipeline) for the interconnecting network are detailed in Table 5.7-1.

Table 5.7-1: Depth of Cover to Top of Pipeline

Category	Minimum Depth of Cover[1]
Pipeline General	1.2 m
Watercourse – No Scour Potential	1.5 m
Watercourse – Scour Potential	2.0 m
Road/Track	1.5 m

a) Minimum depth of cover may need to be increased based on results of upheaval buckling assessments.

5.7.2 Gathering Network

The gathering network consists of a network of pipelines sized to meet production requirements. A main spine trunkline is provided connecting each field directly with the CPF).

Individual wellpads are then connected to the trunkline via a series of flowlines. All lines remain below ground from the CPF until they arrive on a wellpad.

All trunklines and flowlines will be pigged (inspection) as part of regular maintenance activities.

5.7.3 Water Injection Network

The injection network follows the same infield pipeline routings to distribute the re-injection water to the wellpads to maintain reservoir pressure. Two main trunklines are provided to connect wellpads to the north and south of the CFA to the CPF.

Individual wellpads are then connected to the trunkline via a series of flowlines. All lines are insulated to minimise heat loss and remain below ground from the CPF until they arrive on a wellpad.

5.7.4 Service Water Network

The service water system is buried and follows the injection network but does not supply the Twiga wellpads. The service water system is designed to supply water to each wellpad to support drilling activities. Infield trucking of water will be required for Twiga.

5.7.5 Communication Network

The fibre optic cables used to enable telecommunication are, where relevant, routed in the same corridors as the flowlines and water pipeline.

5.7.6 Construction

5.7.6.1 Watercourse Crossings

Watercourse crossings will be installed using open cut techniques wherever possible. A desk-based scour assessment will be completed for each watercourse crossing and a pre-construction survey of each lugga/watercourse crossing will be completed to verify the assumptions and outcome of the desk-based scour assessment. Scour potential and scour depth will be assessed for up to a 1 in 100-year event.

Where scour depth is determined to be 0.5 m or less, the crossing will be considered as ‘non-scour’. Where scour depth is greater than 0.5 m, the crossing will be considered as ‘scour potential’. The following will be implemented at scour potential crossings:

- Pipelines will be installed below the depth of scour unless civil protection works are installed.

- If required depth of pipeline cover is greater than 3 m, then civil protection works will be installed and depth of pipeline cover can be maintained at a minimum of 2 m.

Work on ephemeral rivers, smaller streams/luggas will be planned to take place during the dry seasons when no flow is anticipated. If unavoidable, flow will be diverted and redirected into same watercourse further downstream.

5.7.6.2 Road Crossings

Road crossings will be installed using open cut techniques. The only exception is at crossings of the C46 and A1 roads. At these locations, base case crossing method will be a trenchless technique (e.g. auger bore).

For open cut installation, concrete slabs will be installed above the pipeline at crossings of tarmac roads, gravel roads and graded roads.

For trenchless installation techniques, insulated pipe will be installed within a casing pipe.

5.7.6.3 Track Crossings

Where potential exists for future upgrade of tracks, concrete slabs will be installed above the pipeline.

5.7.6.4 Service Crossings

At crossing of buried services (e.g. cables, pipelines), minimum separation of 600 mm will be maintained between interconnecting network pipelines and the service being crossed. Concrete slabs will be provided to protect the interconnecting network pipelines.

5.8 Overhead Transmission Lines

The main power supply to production wells will be provided using overhead lines from the substation located in the CPF area. The OHTL will be routed from the CPF substation to provide power to the wellpads in the oil fields. Pylons will typically be approximately 15 m high. Pylons can be extended when a higher clearance height (e.g. over roads) is required. The maximum height of these pylons is approximately 21 m. The infield OHTL routes are shown in Figure 5.8-1.

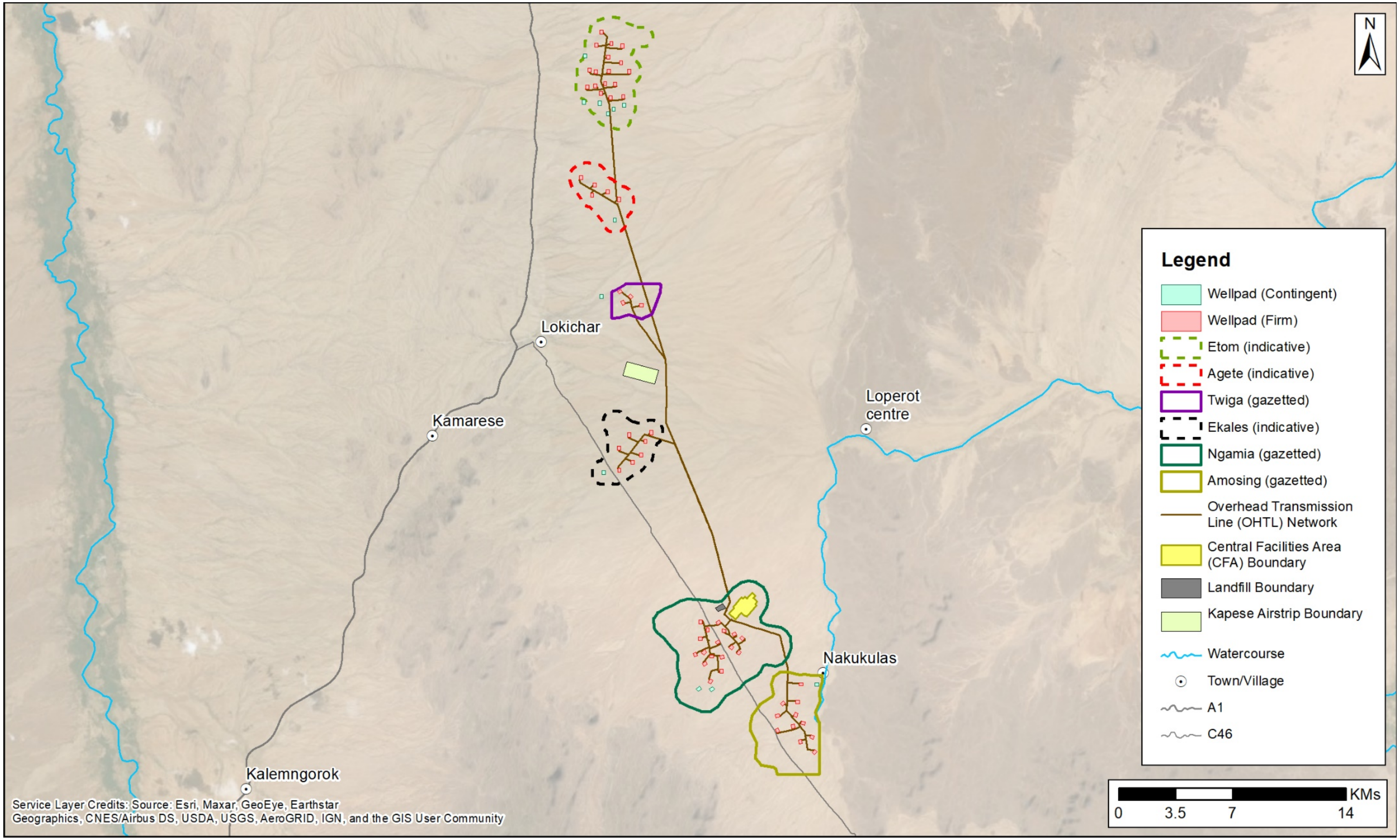

Figure 5.8-1: Infield OHTL Network

5.8.1 Construction

The Construction Right of Way (RoW) is 30 m for the infield flowlines, with an additional 10 m RoW for the OHTL.

The infield network (including the OHTL) will be constructed in parallel with the CPF. Construction of the network will start at the CPF and branch out to the wellpads. Construction activities will include preparation works, installation of crossing culverts, trenching (with the gathering network, water injection and fibre optic lines in one trench and service water lines in a separate trench), installation and connection. An indicative flowline installation sequence is presented in Figure 5.8-2.

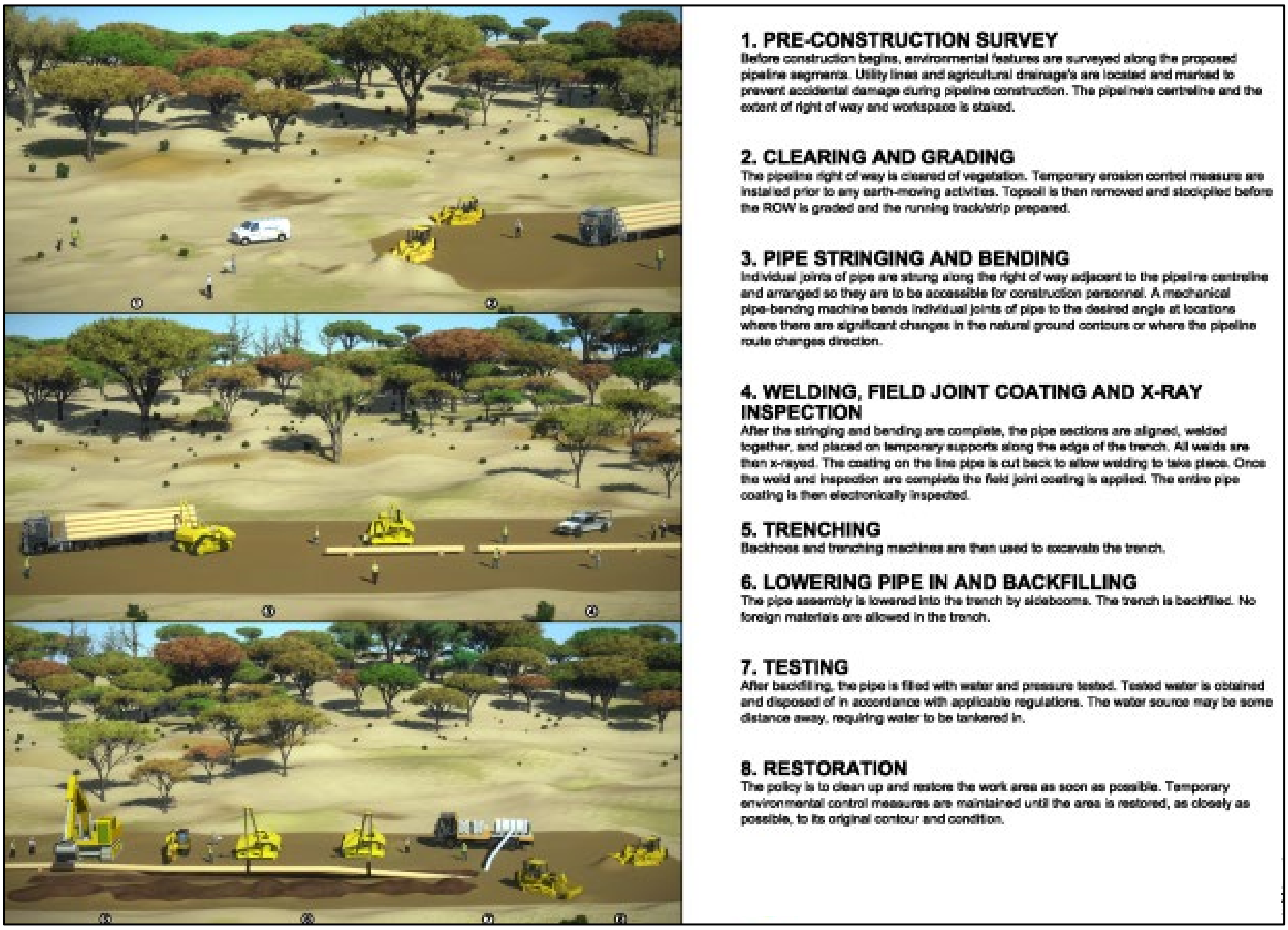

Figure 5.8-2: Indicative Flowline Installation Sequence

5.8.2 Commissioning

Hydrotesting of the CPF and infield flowlines will be undertaken to confirm the strength and integrity of the systems. Hydrotest water will be sourced from the Turkwel Gorge Reservoir and the existing boreholes and is considered as part of the construction water demand volume calculations outlined in Section 5.4.6.1. This water is considered raw water and as such, additional water quality testing may be required prior to hydrotesting.

It is anticipated, due to the construction sequence, that not all test water will be able to be re-used. In this case, quantities of test water will need to be discharged during construction. At the completion of hydrotesting activities, test water will be discharged from the pipeline system into purpose-built ponds. Water will be designated for alternative Project use (e.g. dust suppression) or evaporated in these ponds, following the requirements set out the Project *Hydrotesting Philosophy*.

5.8.3 Operations

The infield flowlines operating conditions (temperature and pressure) will be continuously monitored. Trunklines on the gathering network will be pigged using the permanently installed pig traps to monitor pipeline integrity. The flowlines will be periodically pigged using temporary pig traps. The water injection trunkline will be pigged periodically to monitor pipeline integrity. All waste from pigging activities will be collected and returned to the CPF for processing.

5.9 Access Roads

The construction of access roads required by the Project will be the responsibility of the Project. The national roads (C46 and A1) will remain the responsibility of GoK.

Roads will be designed to manage runoff and discharge at an equivalent rate to pre-construction, while maintaining quality in line with Project water quality standards (Annex I) standards. Wherever practical, the infield roads will utilise existing roads. The infield road network is shown in Figure 5.9-1.

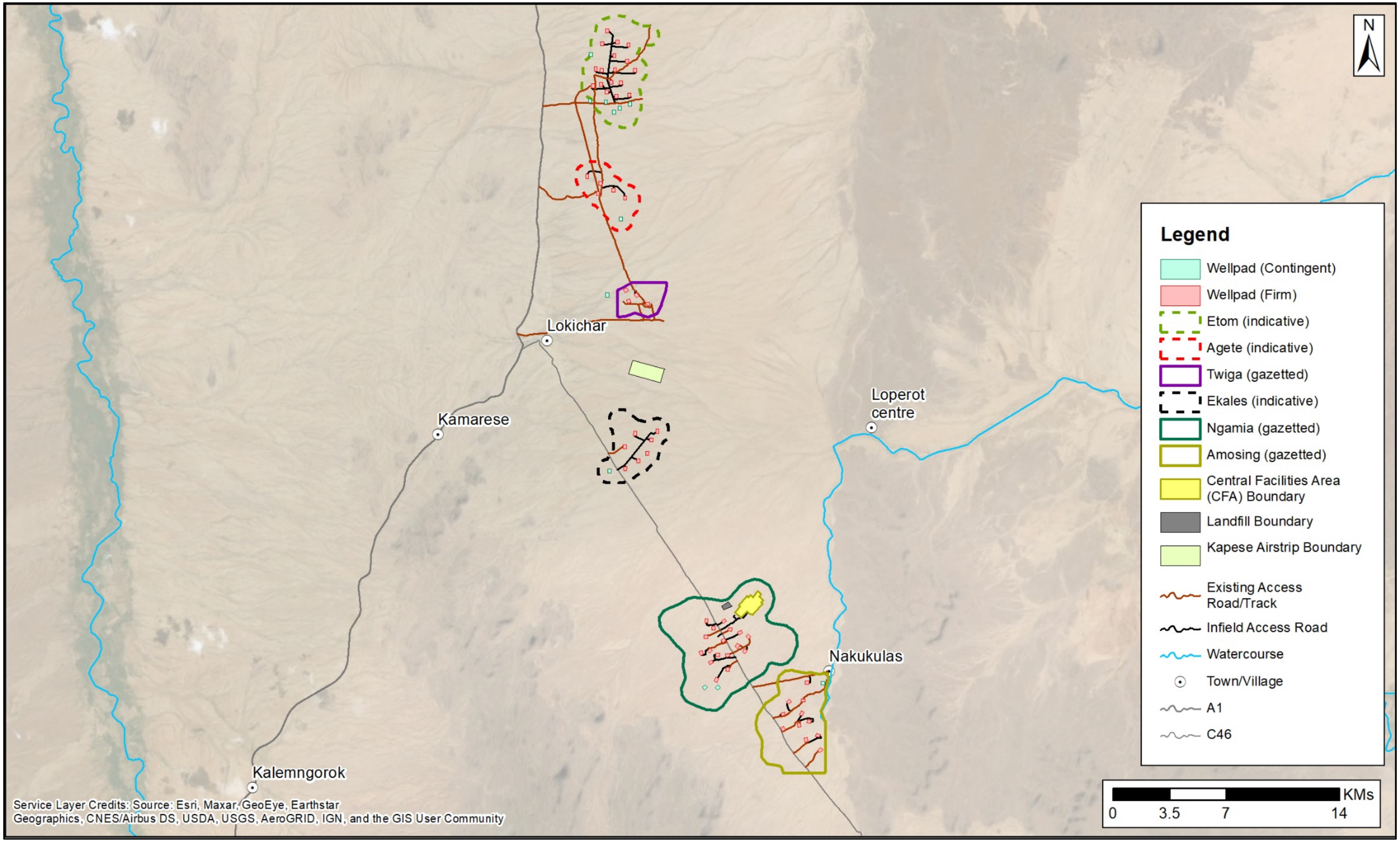

Figure 5.9-1: Infield Road Network

Infield access roads will be designed to provide access to the infield facilities from the existing main C46 road. Roads will be designed in accordance with GoK Design Manual for Roads and Bridges[2].

Access roads will 6 m wide double seal gravel-bituminous surfaced road with 1.5 m gravel shoulders (2 lane) and will be constructed to meet the well drilling sequence and the facilities construction sequence.

Project traffic will be governed by the *Transport Management System* which will meet the requirements of GIP. Project speed limits will be set based on the road location and potential risks identified as part of the ESIA process and will not exceed national speed limits.

5.10 Workforce

5.10.1 Construction Workforce

Site manpower requirements are developed based on an average 60 hour working week, using the construction schedule and the man-hours associated with each discipline and trade. A construction manpower histogram is provided in Figure 5.10-1.

The estimated site peak manpower for FO consisting of the CFA, pipelines, water abstraction and FO wellpads is approximately 2,400 people.

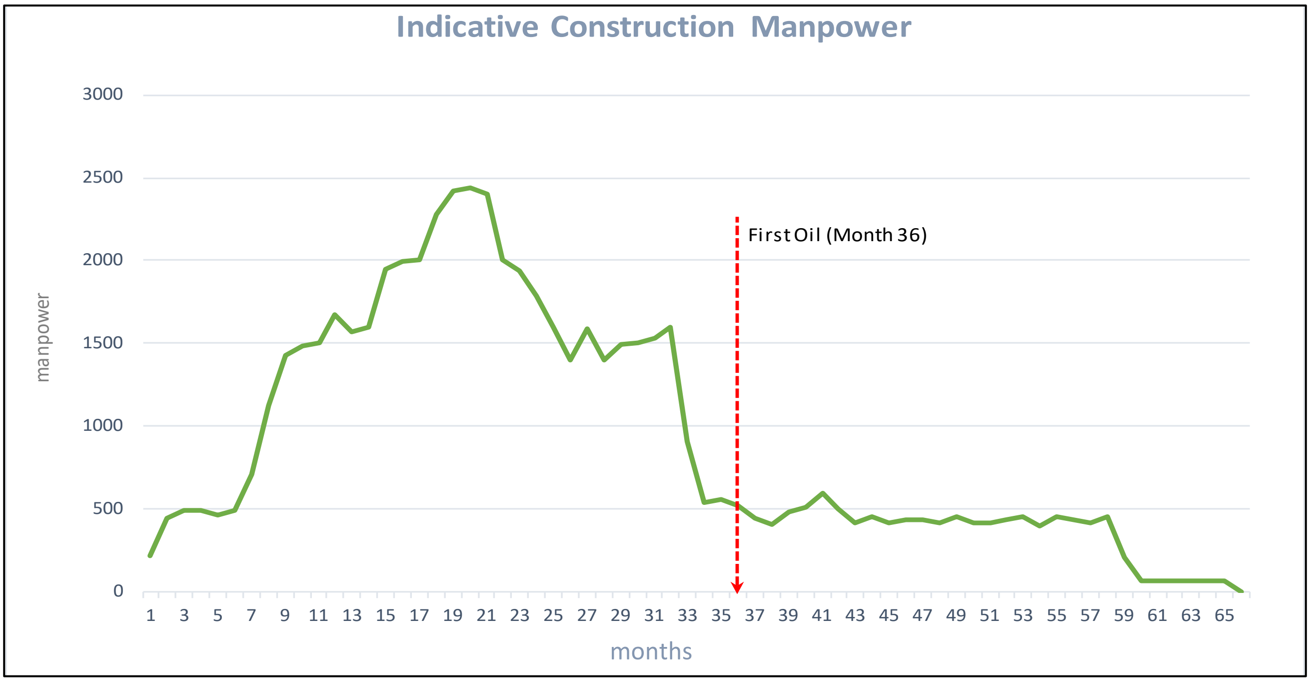

Figure 5.10-1: Construction Manpower Requirements

Final construction manpower figures will be determined by the EPC Contractor. Manpower will be suitably trained, qualified and experienced in oil and gas construction or related industrial construction projects. The jobs associated with the Project will require varying skill sets and will offer employment opportunities for unskilled, semi-skilled and skilled workers. The estimated breakdown into unskilled, semi-skilled and skilled is as follows:

- Unskilled – 15% of manpower requirements;

[2] The Republic of Kenya- Ministry of Roads. Design Manual for Roads and Bridges, 2009

- Semi-skilled – 25% of manpower requirements; and
- Skilled – 60% of manpower requirements.

The Construction manpower will consist of the following workforce categories:

- Construction management (managers, deputy managers, superintendents and supervisors);
- Construction engineers (e.g. process engineers, mechanical engineers, quantity surveyors);
- Construction skilled craft (e.g. electricians, pipe fitters, plumbers, IT technicians, paramedics);
- Construction semi-skilled craft (e.g. crane operators, roofers, truck drivers, catering personnel, riggers); and
- General labour (e.g. labourers, cleaners, security).

The final manpower requirements will be determined during detailed design and construction tendering. The EPC Contractor will be required to employ Kenyan nationals in the workforce, as set out in the *Local Content Plan*.

5.10.2 Operations Workforce

Manpower during operations is approximately 500 personnel. Accommodation for around 350 personnel will be required including upstream operators, midstream operators, catering personnel and well engineer/servicing personnel. In addition to the personnel with accommodation on site, there will be up to an additional 200 people sourced from the local community to fill roles such as guards, and IWMF workers. Some local workers will not require in-camp accommodation. It is planned that some expat roles required initially will eventually transition to Kenyan nationals over the life of production.

The final manpower requirements will be determined during detailed design and pre-commissioning.

5.11 Accommodation

5.11.1 Construction Accommodation

There will be three temporary construction camps and one permanent camp.

Based on FEED definition construction and drilling manpower schedules, peak construction will occur in month 19, requiring around 2,400 skilled, semi-skilled and unskilled labour.

The main camps will be located at the CFA with satellite camps on the wellpads and at Kapese. These are estimated to comprise:

Enabling Works:

- Existing camp at Kapese - 300 beds;
- Utilising available Local Beds (Lokichar) - 400 beds;

Early Works:

- Kapese - 300 beds;
- CFA - 300-person tented camp would be located at the CFA to provide accommodation during the installation of the construction camp;
- Drilling mini-camps - 20 personnel moving with each rig (4 drilling rigs and 2 completion rigs);

- Utilising available Local Beds (Lokichar) - 400 beds;

Main Construction Works

- Kapese - 300 beds;
- CFA construction camp - 2,000 beds;
- Drilling mini-camps - 20 personnel moving with each rig (4 drilling rigs and 2 completion rigs); and
- Utilising available Local Beds (Lokichar) - 400 beds.

Initially, one construction pioneer camp will be set up, using the existing camp at Kapese or an estimated 300-person camp at the CFA. This will support the construction of the enabling and early works as the CFA and the main construction camp are developed.

A mini-camp will be erected on each pad for providing accommodation to the rig workers. It will have a capacity of 20 personnel. Freshwater (non-drinking) will be supplied to the mini-camp via water tankers during the initial phase (prior to CPF operation) and through dedicated water supply lines post set-up of CPF. Bottled water from a reputable source will be used for drinking purposes. Sewage will be collected in a portable septic tank and along with general waste will be periodically transported to a centralised treatment area for processing.

A residential area will be located within the CFA and will be designed to house both the permanent and construction camps. The CFA construction camp will provide an estimated 2,000 beds and will support the construction of the main works. It will be developed in a phased manner to allow it to be scaled up and down as required. At the end of the construction period, the construction camp will be demobilised with the exception of all the necessary facilities to provide an estimated 500-bed permanent camp, which will be retained. All temporary buildings will be removed at the end of the construction phase.

All camps will include a potable water treatment and distribution system and sewage collection and treatment system.

5.11.2 Operations Accommodation

The residential area within the CFA will be designed to house both the permanent and construction camps. Accommodation will be provided for approximately 500 personnel during operations. Several buildings from the construction camp will be retained for the permanent camp.

The camp facilities will include the following:

- Clinic;
- Admin Building;
- Messing facility and kitchens;
- Accommodation buildings for staff;
- Recreational buildings;
- Laundry & site shop;
- Fire station and fire training centre;
- Sewage treatment plant (STP);
- Domestic waste storage;

- Security fencing;
- Football field; and
- Landscaping.

5.12 Waste Management

5.12.1 Introduction

Waste planning has been in line with the waste hierarchy, national and international legislation and industry best practice.

The waste management approach is to house an IWMF at the CFA which will act as a waste reception, handling, volume minimisation, treatment and storage facility during operations. An engineered landfill will be constructed which will accept drilling waste pre-FO and construction waste, and some operations wastes that cannot be handled at the IMWF. The IWMF will be designed and operated in accordance with the requirements of the Environmental Management and Coordination (Waste Management) Regulations (2006).

5.12.2 Waste hierarchy

The nature of many of the waste streams involved in drilling and construction projects restricts options for reduction, reuse and, in some circumstances, recycling due to the hazardous nature of some waste streams and limited alternative waste management opportunities. To address this, the Project has considered the following categories of waste reduction, which can reduce the hazardous nature of some waste streams, thereby presenting opportunities for reuse and recycling.

Source Reduction: Source reduction is the process of eliminating or reducing the volume and/or hazardous properties of waste through use of appropriate equipment or technology, process or procedural modifications, refurbishment of equipment, substitution of raw materials and efficiency improvements in housekeeping, maintenance, training or inventory control. Waste management procedures will outline commitments to waste reduction at source wherever possible for the activities falling within its direct control.

Reclaim/reuse: Reclaim and reuse activities allow the use of materials or products in their original form. Waste streams that can be easily reclaimed/reused include excavated soils that can be re-applied to land, for example for land forming, as well as packaging and materials that can be returned to the supplier through return schemes and back-hauling arrangements for reuse or reclamation.

Recycling/recovery: This does not include the closed loop (i.e. internal) recycling of materials within a given process, as this would fall under the waste reduction at source step but refers to the conversion of recovered waste into more usable materials. Example of wastes that are readily recyclable include scrap metal, uncontaminated wood, electrical and electronic waste and tyres. Large amounts of inert material can also be recycled as aggregate and engineered fill, for instance for road construction.

Waste to energy: This refers to the recovery of energy from waste material that cannot be reclaimed, reused or recycled; normally via thermal or biological methods. This treatment method applies to wastes that have a high calorific value, such as oily/hydrocarbon materials, plastic, tyres, wood, paper and food waste.

Disposal / treatment and disposal: Waste material that cannot be dealt with using any of the previous steps, either because of its nature or because alternative management methods are not available or are not viable, needs to be disposed of to landfill. Certain waste may require treatment prior to disposal to ensure that their potential impact to the environment is reduced.

5.12.3 Waste Phasing

Multiple waste streams will be created across the three phases of drilling, construction and operations. Waste arisings will fluctuate as the drilling and construction phases progress, requiring waste treatment and processing technologies that are flexible both in terms of volume as well as waste characteristics. Waste arisings throughout the operations phased are expected to be stable. Project phasing relating to waste management is outlined in Table 5.12-1.

Table 5.12-1: Waste Phasing

Phase	Duration
Drilling	55 months, whereby waste volumes peak and are sustained at peak levels for approximately 45 months. The exception to this is the completion/ workover chemicals wastewater stream, which continues over the life of the project.
Construction	46 months, whereby waste volumes are at peak levels for the first 18 months due to the generation of inert waste (i.e. excavated material).
Operations	25 years, with waste generation rates relatively stable for the duration of the period.

For the principal phases defined above, it is important to consider phase sequencing and overlaps, (particularly with regards to drilling and construction), which offer an opportunity to consolidate the waste, ensure sufficiency of provision and potentially share treatment facilities.

5.12.4 Waste Streams

Following an internationally recognised categorisation, types of wastes expected from the Project include (but not limited to):

- Activated Carbon;
- Ash;
- Batteries;
- Blasting Sand/Materials;
- Cement and Concrete;
- Construction Debris;
- Containers – Drums, Barrels, Gas cylinders;
- Drilling Fluids;
- Drill Cuttings;
- Drilling Muds (WBM and SBM);
- Domestic Waste / Trash;
- Electronic and Computer Equipment;
- Filter – Air & Water;
- Filter – Contaminated;

- Fluorescent Bulbs;
- Glass Glycol and Antifreeze;
- Hydrocarbon – Impacted Debris (oily rags);
- Hydrocarbon – Waste Mixture (Vehicle wash water – Construction phase only, Off-spec condensate);
- Insulation (non-asbestos);
- Ion Exchange Resin;
- Medical Waste;
- Mercury Containing Equipment;
- Oil – Used (Vehicle waste oil, skimmed oil, oil wastes, lubricant oil);
- Paint (And other coating wastes);
- Plastic and Rubber;
- Scrap Metal;
- Silica / Alumina Desiccants;
- Sludge – Chemical;
- Sludge – Domestic Sewage;
- Sludge – Hydrocarbon (Pigging waste, completion fluids, pipeline corrosion products, tank bottoms); and
- Tyres.

Naturally occurring radioactive materials (NORM) are dissolved in very low concentration during normal reactions between water and rock or soil. There is potential for radioactive scale deposits inside the oil-field pipe. It has been assumed that NORM will be generated, this assumption will be confirmed during the operation phase by monitoring of pigging waste quality.

5.12.5 Engineered Landfill

An engineered landfill will be developed for the management of waste arisings from all three phases (drilling, construction and operations) to ensure the availability and suitability of local landfill disposal routes and mitigate the difficulty in providing and managing a construction waste only landfill provided by the EPC contractor.

The EPC contractor will be responsible for managing wastes within its own facilities that arise during the construction phase but will use the landfill.

The landfill will be located close to the CFA (and IWMF) in the Ngamia field. This site is still subject to detailed study and geotechnical investigation which will determine the nature and depth of soil at the proposed landfill site as well as the depth to rockhead. At least three boreholes will be extended into groundwater to provide upstream and downstream groundwater monitoring locations as well as to prove the depth of groundwater.

The wastes will be accommodated in engineered cells designed for the specific waste classifications. Inert, non-hazardous and hazardous wastes will be disposed of in discrete cells and will not be mixed.

Due to the pre-treatment of wastes, only residual wastes will be disposed to landfill. The inert wastes and the hazardous wastes will not contain any degradable content and should therefore produce negligible gas. The waste disposed of in the non-hazardous cells will be pre-treated so that the majority of the degradable content is removed prior to disposal.

Non-organics only will be directed to the landfill (such that biodegradable or hydrocarbon waste will not be sent to landfill without prior treatment). No organics (such as wood, paper, palettes and packaging, oily wastes, muds, cutting, digested sludges etc.) will be directed to landfill (without prior treatment) as this would increase the landfill capacity over the project design life and increase its complexity from a leachate management and landfill gas management perspective.

No liquid waste will be directed to the landfill, however the types of waste that will be received at the landfill include:

- Inorganic solids;
- Concrete;
- Some plastics and recyclables;
- Treated drilled cuttings and waste aggregates;
- Hazardous Waste Incinerator/ pyrolysis bottom ash;
- Hazardous waste incinerator air pollution control residue;
- Medical waste incinerator bottom ash; and
- Medical waste incinerator air pollution control residue.

The engineered landfill will be designed to an appropriate scale to accommodate the estimated drilling, construction and operations wastes as outlined in Table 5.12-2.

Table 5.12-2: Estimated Engineered Landfill Waste Quantities

Waste Classification	Drilling (m^3)		Construction (m^3)	Operations (m^3)	Total (m^3)
	Up to First Oil	After First Oil			
Inert	0	0	16,921	0	16,920
Non-hazardous	72,647	182,791	182,791	35,847	306,560
Hazardous	163	356	281	336	1,136
				Total	**324,616**

The waste inventory indicates that there is an estimated total waste capacity requirement of 324,616 m^3. The landfill will be arranged into 13 cells in accordance with Table 5.12-3.

Table 5.12-3: Estimated Landfill Cell Volumes

Cells Total Number	Phase	Cell Type	Estimated Cell Volume (m3)
1	All	Inert	16,920
1	All	Hazardous	1,136
10	Drilling and Construction	Non-hazardous	270,713
1	Operations	Non-hazardous	35,847
		Total	324,616

The landfill liner systems will comprise a combination of engineered clays and silts (to be confirmed by ground investigation), geosynthetic clay liner and High-Density Polyethylene (HDPE) geomembrane. The inert cell will be lined by a geological barrier of *in situ* or reworked site derived soils if they meet the permeability requirement, otherwise an artificial sealing layer. Non-hazardous cells will be lined with geosynthetic clay liner, HDPE welded geomembrane and provision for leachate drainage. The hazardous waste cell will be made up of a geosynthetic clay lined geological barrier, HDPE welded geomembrane sealing layer and provision for protected leachate drainage.

It is assumed that the highest rate of leachate generation will occur within an open cell. Once completed, cells will be capped reducing any potential for infiltration. The new landfill site is not anticipated to have the capability to discharge wastewater to any surface water feature or to the ground with the possible exception of inert leachates although this will need to be confirmed via environmental risk assessment. Minimising leachate generation is therefore a key component of the site operational concept.

Prior to construction of the landfill facility, baseline monitoring will be carried out to establish an environmental baseline of the groundwater conditions beneath the site. The groundwater monitoring points will be installed as a part of the geotechnical investigations undertaken as a part of detailed design of the facility. Monitoring of groundwater will continue from installation of the boreholes throughout the operational life of the site and into closure to monitor the groundwater beneath the Site to monitor any effects on the local and regional groundwater. Gas and leachate monitoring will be undertaken to understand any gas and leachate migration in the landfill.

5.12.6 Treatment and Disposal of drill cuttings

WBM and SBM cuttings are generated at each well site during the drilling phase. SBM cuttings will be collected and transported to a centrally located cuttings treatment facility where it is planned to be thermally treated to remove residual SBM and any traces of hydrocarbons. This will be the first such facility in Kenya and will be designed in accordance with international standards. The thermally treated waste is inert and is no longer hazardous and will be sent to disposal in the landfill.

The cuttings treatment facility will be designed for the treatment of up to 752 m^3 of material per month, which is more than the monthly generation rate currently estimated from 4 drill rigs, which is estimated at 649 m^3 per month. The landfill site accommodates the disposal of SBM drill cuttings post thermal treatment.

WBM cuttings will be disposed of around the perimeter of the wellpads where they are generated.

5.12.7 Wastewater Management During Construction

Wastewater in the camp area will be collected in the camp sanitary drainage system which will collect waste from all sanitary and toilet facilities, kitchen equipment, floor drains and laboratory non-oily and non-chemical sink wastes. The wastewater will be treated in a temporary sanitary water treatment unit in the construction camp. The toilets in all construction areas will have holding tanks to collect the wastewater. Sewage from these tanks is collected and transferred by bowser to the camp wastewater treatment units for processing.

Once the IWMF is completed, the facilities may be used by contractors.

5.12.8 Integrated Waste Management Facility (IWMF) Design

An IWMF will be constructed and operated to process the waste streams generated during the drilling and operational phases. The landfill will be used to manage any inert, non-hazardous and hazardous waste streams that cannot be processed at the IWMF.

The IWMF will consist of various treatment facilities based on the quantities and characteristics of the waste generated over the lifetime of the project and a rigorous approach to waste management.

A realistic level of reuse and recycling across all suitable waste streams has been assumed. Waste volumes requiring treatment and/or disposal have therefore been based on these assumed pragmatic levels, and not on the maximum possible levels of reuse and recycling that could theoretically be achieved.

The IWMF will be designed to incorporate the types of wastes and methods outlined in Table 5.12-4 below.

Table 5.12-4: Waste Treatment Method at IWMF by Phase

Phase	Recycling/ reprocessing off site by third parties	Recycling onsite	Anaerobic Digestion	Incineration
Drilling	Used chemical plastic containers, used chemical metal drums, scrap metal (uncontaminated), damaged drill pipe, damaged drilling equipment, drilling camp general waste, untreated/uncontaminated wood waste, damaged well casings, used fuel containers, rig site commercial waste, damaged downhole pumps, damaged production tubing, packaging waste, SBM at end of drilling.	Produced water, ash as an aggregate.	Drilling camp organic waste, drilling camp food waste, sewage sludge, rig site commercial waste.	Pre-treated medical waste, used chemical plastic containers, treated/ contaminated wood waste, used fuel containers, oily waste/ rags, pit/ tank bottoms, rig site commercial waste, Flare knockout waste, packaging waste.
Operations	Used chemical plastic containers, used chemical metal drums, scrap metal (uncontaminated), untreated/ uncontaminated wood waste, rig site commercial waste, damaged downhole pumps, packaging waste, SBM at end of drilling, metals extracted from incineration ash. Packaging - card, office waste, food waste,	Scrap metal (maintenance waste: offcuts, pipes, cable, wire, damaged tools, fixings, welding rod, damaged equipment, swarf etc), packaging - metals, packaging - plastic, packaging - card, glass bottles, broken windows, office waste, general domestic waste, vehicle waste - tyres, vehicle waste -	Food waste, general domestic organic waste, sewage sludge.	Pre-treated medical waste, Packaging - plastic, packaging - card, office waste, general domestic waste, vehicle waste - tyres, vehicle waste - used oil, vehicle waste - filters, vehicle waste - coolant, vehicle waste - miscellaneous,

Phase	Recycling/ reprocessing off site by third parties	Recycling onsite	Anaerobic Digestion	Incineration
	general domestic waste, sewage sludge.	batteries, vehicle waste - use oil, vehicle waste - filters, vehicle waste - coolant, vehicle waste - miscellaneous, e-waste, used chemical containers, Incinerator Ash, pigging waste, slops tank waste, spent filter elements, spent filter media, industrial electrical waste, paints/ coatings.		medical waste, used chemical containers, laboratory waste, tank sludge, pigging waste, slops tank waste, spent filter elements, spent filter media, chemical waste, paints/ coatings.

The IWMF will consist of the following waste processing and handling facilities:

- Recycling Facility;
- Incineration Facility (IF);
- Autoclave – for medical waste;
- Anaerobic Digestion (AD) facility;
- Sewage treatment plant;
- Effluent treatment plant (ETP); and
- General and medical waste shredder, crushers, shaker and other solids handling machinery.

The proposed layout of the IWMF is provided in Figure 5.12-1.

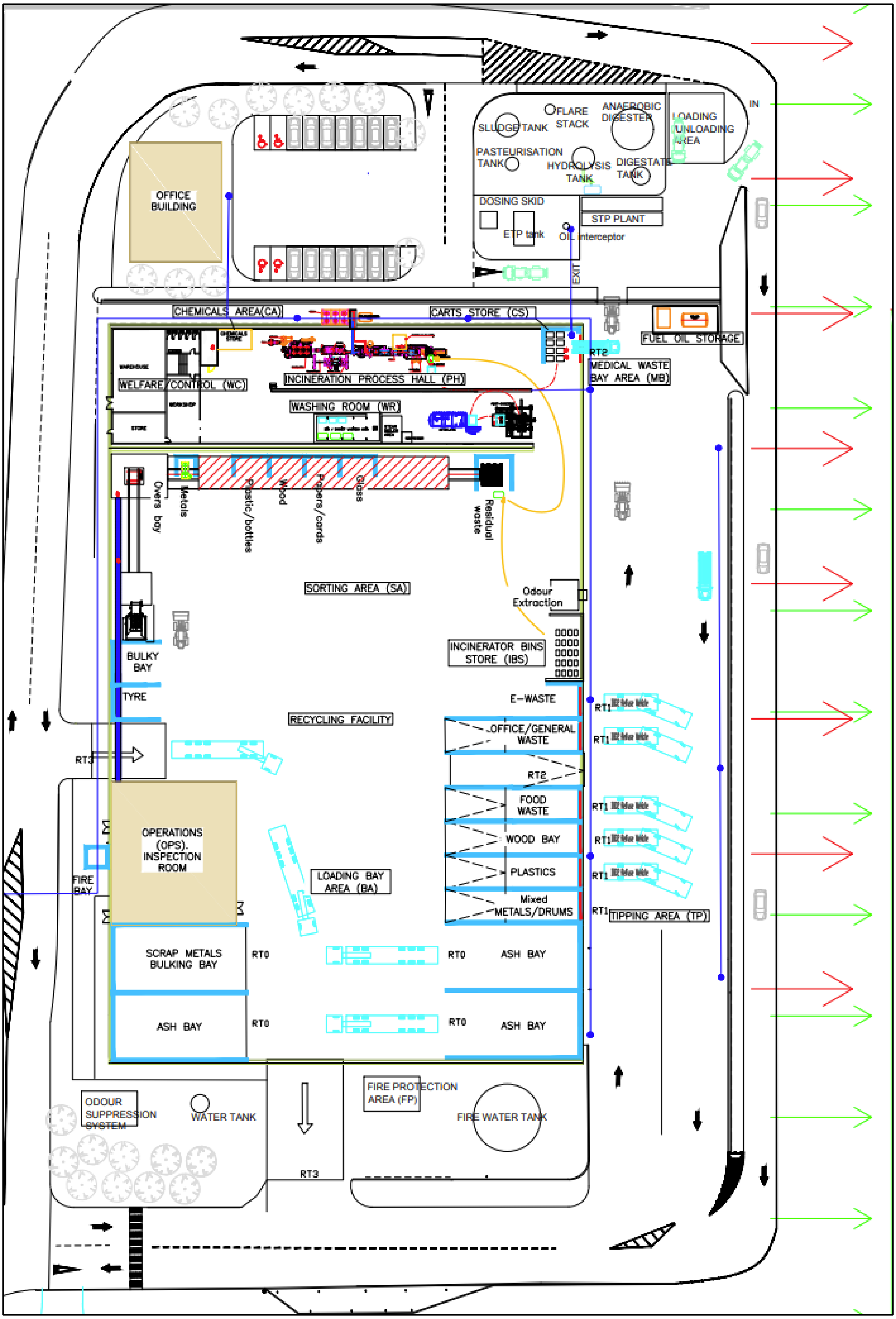

Figure 5.12-1: Proposed Layout of the IWMF

The estimated monthly waste treatment profile is outlined in Table 5.12-5 below

Table 5.12-5: Estimated Waste Monthly Profile at IWMF

Waste Technology	Drilling phase maximum monthly throughput in m^3	Operational phase maximum monthly throughput in m^3
Anaerobic Digestion	19	30
Autoclave	0.3	15
Incineration	154	49
Sewage Treatment	1,632	3,042
Effluent Treatment	921	1,471

The IWMF will have a waste reception area, weighbridges, tipping bays, storage and quarantine bays to separate-out bottom ash and segregate other residual hazardous and non-hazardous waste and a workshop and staff facilities. There will be road infrastructure linking to the landfill site. Odour abatement will be included in the facility design and management practices.

The IWMF will be located such that routine access by waste collection/ delivery vehicles does not conflict with other site wide use and minimises risks to site personnel. It will also consider impacts of odour on the residential camp based on prevailing wind direction and within the overall plot space, the IWMF facilities will be separated by a minimum of 100 m from the camp.

5.12.8.1 Recycling Facility

The Recycling Facility will receive and sort a variety of wastes to recover items for re-use, recycling or further processing thereby maximising diversion from landfill. The Recycling Facility will include enclosed waste reception and tipping areas for commercial wastes, camp waste and drilling site general waste. Processing equipment will be used to remove some recyclables from the residual waste (e.g. metals) and the remaining residual waste suitable for incineration will be transported in bins to the incineration facility. Collected food and green wastes will also be received and bulked for transport to the AD facility.

All waste tipped will be visually inspected for compliance with the permit issued in line with the Waste Management Regulations (2006). Any hazardous waste or incorrectly declared waste streams will be quarantined and dealt with in accordance with the Operator’s waste management procedures. All waste inputs and outputs will be recorded on an electronic system within the weighbridge, management of which will ensure the site remains within its design tonnage.

5.12.8.2 Incineration Facility

The incineration plant consists of a Rotary-Kiln, Induced Draft Blower, ash removal system, automated feeding system using buckets, a Secondary Combustion Chamber, Flue Gas Treatment (FGT) and Continuous Environmental Monitoring System (CEMS), fuel oil system for burners and a flue gas stack at 4.9 m in height (subject to confirmation via atmospheric dispersion modelling).

The proposed Rotary Kiln incinerator will be operating at high temperatures of >1,100°C hence will be capable of carrying out complete combustion of any incoming waste types (including plastics). The FGT will consist of Selective Non-Catalytic Reduction (SNCR) injection within the combustion chamber. This will be followed by dry, semi-dry or wet scrubbing (the use of anhydrous lime in a semidry scrubber is recommended due to robustness, higher efficiency and minimal production of wastewaters, however this will be confirmed in later design stages). From the scrubber, partially treated flue gas will be further treated in ceramic or bag filtration system with activated carbon injection to remove the remainder of the contaminants before being discharged into the atmosphere via exhaust stack. This semi-dry solution will be sufficient to remove pollutants and produce a treated exhaust gas stream compliant with the limits as defined by NEMA and without the need for quenching.

5.12.8.3 Autoclave

A medical waste sterilisation system will consist of a sterilisation chamber or autoclave, low pressure steam boiler, post-shredder and a steam washing facility for waste transportation carts.

The steam boiler system will be diesel oil-fired with packaged auxiliaries and automatic control, safety and alarm system to monitor water level and pressure. Dry saturated steam will be used to supply instant heat to the autoclave as well as supply low pressure steam to the carts washing room in the incineration facility. The steam supply to the carts steam wash area will be regulated to required temperature and pressure.

5.12.8.4 Anaerobic Digestion

Collected waste i.e. organic waste, food waste, sewage sludge and commercial waste from the drilling and camp sites (approximately 55 m^3/month maximum during drilling phase) will be delivered to IWMF and stored in a dedicated onsite bunker prior to delivery to the AD facility area via a front-end loader. The AD system will be made up of the following facilities:

- Digester Feed Preparation;
- Hydrolysis Tank;
- Pasteurisation Tank;
- Anaerobic Digester;
- Biogas Storage; and
- Digestate Tank.

5.12.8.5 Effluent Treatment Plant

The IWMF Effluent Treatment Plant will be designed to receive effluent (up to 2.2 m^3/hour during the operational phase) from the following sources:

- Site surface wash water;
- Site spillages;
- Site surface contaminated run-off water;
- Effluent (occasionally from other sites); and
- Water treatment rejects (operations phase).

Effluent from respective sources will be collected via a network of underground drainage channels discharging into a staged treatment facility.

5.12.8.6 Sewage Treatment Plant

The Sewage Treatment Plant will receive throughput from following sources:

- Camp and operations black and greywater (up to 6.1 m^3/hour peak); and
- ETP treated effluent.

The proposed Sewage Treatment Plant comprises the following elements integrated into a single unit:

- Primary settlement chamber;
- Primary aeration chamber;
- Secondary settlement chamber;
- Anaerobic filters; and
- UV disinfection.

5.13 Local Materials Sourcing

It is estimated that approximately 1.7 million tonnes of aggregate will be needed during construction for surfacing access roads, fill materials, permanent & temporary facility, foundations, etc. Aggregates will also be needed for use as padding material for pipelines.

A *Borrow Pit Management and Rehabilitation Procedure* has been developed which outlines requirements for approvals, preliminary screening and site investigation, site selection, identifying potential receptors, consultation, impact assessment, project planning, environmental management, community health and safety, blasting, rehabilitation planning and monitoring.

As part of this process, the EPC Contractor will finalise the design and location of borrow pits. The specifications and locations described in the FEED documentation and as summarised and assessed in this ESIA will provide the basis for these designs. Where additional permitting is required by national and County authorities, this will be based on the location of the facilities described and impacts outlined in this ESIA.

Once the EPC Contractor has identified its preferred locations and designs, these will be subject to a risk assessment process and consultation will be undertaken with relevant stakeholders including local residents. Potential impacts will be identified and appropriate mitigation measures developed, which will be set out including any site-specific environmental and social management and monitoring requirements. These risk assessments, together with the supporting environmental and social management plans will be submitted to NEMA and other applicable regulatory agencies for review and approval under the framework of the EIA Licence granted for the Project. Approval for construction and operation of these facilities will be provided through a variation to the EIA Licence.

All excavated material will be screened and reused where possible to minimise the need for new aggregate. Aggregate will be sourced from local suppliers where possible and otherwise from new licensed borrow pits. Contractors will conduct regular audits to ensure compliance with Kenyan law to verify the compliance and validity of licenses.

5.14 Construction Logistics

5.14.1 Freight transport to Project Site

The Project will require significant quantities of material to be brought to Site during each phase of the Project. Logistics and transportation needs will require the application of all modes of transport, including sea, air, road and rail, as illustrated below in Figure 5.14-1.

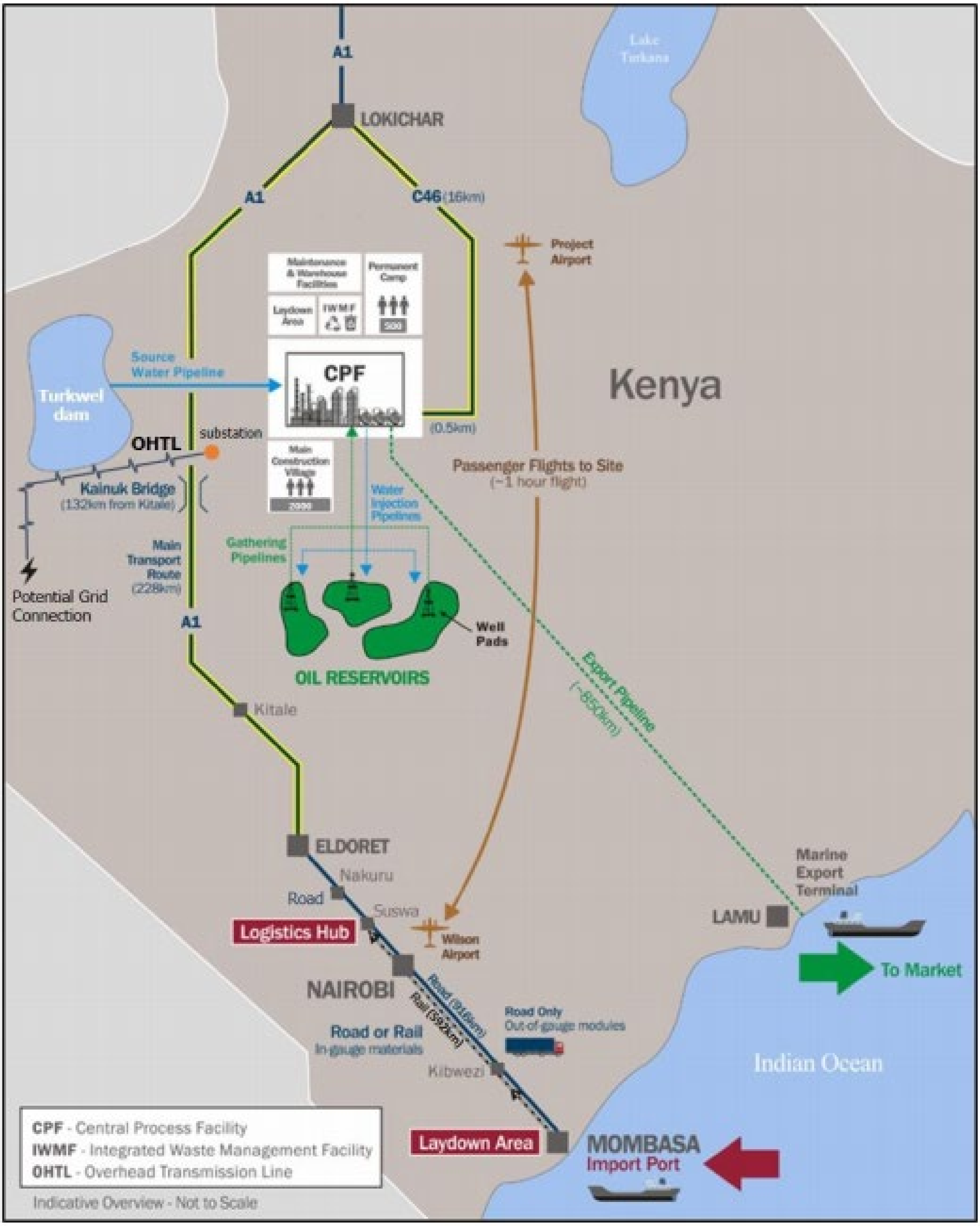

Figure 5.14-1: Project Logistics and Transportation Infrastructure Schematic

The remote location of the Project Site, the condition of the current logistics infrastructure in Kenya and the distances between the ports, industrial centres and project sites add to the complexity of Project logistics. Both materials and personnel logistics are required to support the Project during the development and production operations phases.

Contractors will each be responsible for planning and managing the movement of all their material and personnel from the point of origin to the Project Site.

The Operator will manage its logistics health, safety and environmental risks via its transport management system.

5.14.1.1 Sea Freight

Contractors will use the main commercial Port of Mombasa for sea freight (with private ports in Mombasa and the commercial port in Lamu also available). Studies have confirmed that based on current capacity and planned expansion, the Port of Mombasa can handle the inward cargo volumes and types of equipment/materials required by the Project for all phased development options.

5.14.1.2 Air Freight

Nairobi airport will be used for air freight and then onwards by road to site.

5.14.1.3 Rail Freight

Break-bulk and dangerous goods cargo can only be transported by road currently, and in-gauge containerised cargo should ideally be transported by rail to the Naivasha inland container depot. From Naivasha, road transport will need to be used for the final transportation to the Project Site.

5.14.1.4 Road Freight

The chosen road option of Mombasa – Nairobi – Nakuru – Eldoret – Kitale – Lokichar is part of the main route to Uganda. The distance is 1,074 km and the estimated travel time by truck is approximately 4-5 days for in-gauge cargo based on average travelling speed of 50 km/h; 8-hour maximum allowable driving time (compulsory resting); night-time traveling is not allowed (traveling allowed from 6:30 am to 6:00 pm); and one driver per truck. For goods of East African country origin, the transport route is to use in-gauge road cargo via Nairobi, Eldoret and Lokichar.

5.14.1.5 Delivery Volumes

It is estimated that approximately 625,000 tonnes of cargo will be moved to the Project Site via Mombasa port of which approximately 485,000 tonnes will be containerised cargo. Based on the logistics studies, transporting containerised cargo (20 ft and 40 ft) via rail to Naivasha and then by road to the CFA, is the preferred option.

The remainder of cargo (out of gauge cargo, break-bulk and dangerous goods cargo) will be transported via truck from Mombasa to the Project Site in Turkana.

Logistics studies have indicated that there will be approximately 75 outbound vehicle loads from Mombasa per day. With a 5-day trip each way, it is anticipated that there will be 750 vehicles per 10-day cycle in transit.

Aggregate required for preparatory works will require an estimated 1.7 million tonnes to be delivered to Site. The aggregate will be sourced from borrow pits within approximately 20 km of the Project.

The nearest cement factories are located in Athi River near Nairobi and will be transported by road to site.

5.14.1.6 Logistics Coordination Centre

A centrally managed Logistics Coordination Centre (LCC) located in Nairobi will be in place to enable end to end visibility throughout each supply chain, in order to detect any logistical challenges early enough to manage an impact on project schedules and cost and to ensure that the most efficient, timely, economical and safe movement of materials, supplies, equipment and people is undertaken by each work stream. The LCC will also assure that all logistics activities are conducted in compliance with overall project safety requirements, international standards, statutory requirements and ultimately in line with the integrated project schedule. Ultimately, the LCC will also present an important avenue for contractors' logistics functions to elevate any schedule conflicts and overall logistics challenges. It will also allow different contractors to share information amongst each other on international and national logistics operations which may present consolidation and cost savings opportunities.

5.14.2 Drilling and Construction Logistics

5.14.2.1 Laydown Areas

Temporary laydown areas will be located at the CFA, Kapese airfield and at wellpads.

The dominant traffic volume source is aggregates required for site preparation. Other sources are associated with the delivery of food and fuel, CPF chemicals and well chemicals with minor sources including the delivery CPF plant, the GTGs and the rig pads. Estimated infield trucking requirements are provided in Table 5.14-1.

Table 5.14-1: Estimated Infield trucking requirements

		Truck Movements		
	Total Tonnage	Year One	Year Two	Year Three
Wells/Drilling	181,036	675	2024	675
CPF	16,925	200	652	252
Wellpad	4,736	62	185	62
Power Distribution	500	7	20	7
Interconnecting Flowlines	11,442	451	451	451
Site Prep	1,655,286	22,882	23,811	22,882
Food & Fuel	-	7,327	5,626	5,626
Waste Transport	-	1,266	1,266	1,266

Post year three, to support the ongoing construction and hook-up of wellpads, it is envisaged that all material will have been previously supplied to the CFA and stored.

5.14.2.2 Drilling Logistics

Drilling material and equipment will be transported to site and primarily stored within the drilling area at the CFA. As required to support the drilling campaign, material will be moved to multiple staging areas within the fields (existing wellpads will be utilised for this purpose). All well-related materials will be delivered by the individual contractors to the primary storage area at the CPF.

Infield movements will be carried out through a dedicated fleet of prime movers and trailers. This fleet will also carry out the drilling and completion rig moves between wellpads. The fleet will consist of approximately 70 prime movers and a variety of standard and low bed trailers.

5.14.2.3 Construction Site Logistics

EPC Contractors will be responsible for all logistics, personnel movements and materials management. Materials and equipment for the permanent works at wellheads and remote locations will be stored in the

Laydown Area which is part of the CFA until relocated to the site area for installation. Materials will be delivered to the worksites on trailers, flatbed trucks and pickup.

The work force working outside of the CFA will be taken to the workfaces by a fleet of buses. Workers in the lodged in the Construction Camp in the CFA and working in the CPF will walk to their work area. The local workforce living in the local community will be transported to site on a fleet of buses and taken home at the end of shift.

Self-drive off site will be limited and approved on a case-by-case basis via Journey Management Plan submission and authorised by the Execution Contractor's Transport Manager / Site/Construction manager. A limited number of personnel movements will operate under the self-drive principal. Vehicles operating under the self-drive regulations will be GPS tracked and have 2-way communication with the Transport Operations Room.

5.14.3 Waste Collection, Storage and Transport

The Operator will establish waste management procedures for collecting, handling, storing and transporting waste in a manner that reduces the risk to the environment and people and maintains segregation and waste characteristics.

Any transfer of waste from storage area to treatment/disposal facility will be in accordance with applicable regulatory requirements and the Chain of Custody Duty of Care principles. When the waste is transferred to a third party, all parties must ensure they are legally authorised and licensed to handle, transport or recycle the waste within the requirements of Kenyan Laws and Regulations (Environmental Management and Co-ordination Amendment Act (2015). This is to include any back-hauling arrangements that are entered into for the transport of material off site. Haulage solutions are anticipated to be provided by local businesses and employees (80% at commencement, 90% after 5 years, and 100% after 10 years).

5.14.4 Personnel Transport

People will be flown from Nairobi to Kapese on a Bombardier Dash 8 Q400. During peak construction there will be one to four flights per day.

The site movement of personnel will include:

- Transport from airport to accommodation locations;
- Transport from accommodation to constructions site; and
- Transport from site to town for local hire personnel.

A combination of vehicles will be used for the transport of personnel dependent on the volume of people to be moved and their origins/destinations.

5.15 Operations Logistics

Project vehicles and movements will be a shared resource and organised through the LCC.

The airstrip will service a Bombardier Dash 8 Q400. A total of two return flights a week are planned from Wilson Airport Nairobi to the Kapese Airstrip in Lokichar for operations personnel. Passengers will be transferred within the field by a fleet of minibuses.

5.16 Operator Environmental and Social Management System

The Operator will prepare and implement an Environmental and Social Management System (ESMS), in line Kenyan regulatory requirements and the Operator's own environmental and social requirements, including meeting the management system requirements outlined in IFC Performance Standard 1 and ISO 14001.

An ESMS Framework Document will set out the processes and organisation to be adopted and implemented by the Operator so that it can achieve its environmental and social performance requirements. This will include the requirement for developing:

- Specific policies for Environmental Performance, Social Performance, Human Rights and Occupational Health and Safety;
- A Supplemental Assessment that meets the requirements of the IFC Sustainability Framework and Performance Standards; and
- A set of auditable management plans that capture the specific management controls, roles and responsibilities and monitoring requirements for implementation of its environmental and social requirements.

The primary objective is to have a single, consistent and simple approach to the planning and management of environmental and social risks, whilst retaining flexibility to manage specific issues in the most appropriate manner.

The Operator's commitments to its environmental and social performance from this ESIA will be captured in the documents outlined in Table 5.16-1.

Table 5.16-1: Documents Capturing the Operator's Commitments from this ESIA

Document	Summary of Contents
Environmental Performance Plan	■ This will capture commitments relating to: Air Emissions, Biodiversity, Climate Change, Hazardous Materials, Noise & Vibration, Soil Management, Waste Management, Water Resources. ■ For each section, there will be a summary of key issues, applicable standards, management controls, monitoring requirements and KPIs. ■ There will also be sections on monitoring compliance with the plan, evaluation and auditing, training, resourcing, roles and responsibilities. The Plan will be prepared to meet the requirements of ISO 14001:2015.
Social Performance Plan	■ This will capture commitments relating to: Community Development, Community Health, Safety and Security, Cultural Heritage, Influx, Infrastructure Routing, Labour and Working Conditions, Employment and Training, Resettlement, Livelihood Restoration, Transport Management (relating to community safety) ■ Mitigation measures relating to Local Content and Resettlement/Livelihoods will be mentioned in the Social Performance Plan but will each have its own standalone plan. ■ For each section, there will be a summary of key issues, applicable standards, management controls, monitoring requirements and KPIs. ■ There will also be sections on monitoring compliance with the plan, evaluation and auditing, training, resourcing, roles and responsibilities. The Plan will be prepared to meet the requirements of ISO 14001:2015.
Resettlement and Livelihood Restoration Plan	■ The Resettlement and Livelihood Restoration Framework (Annex I) has already been prepared and sets out a roadmap of preparatory activities to be undertaken

Document	Summary of Contents
	prior to FID and will feed into stakeholder engagement relating to Project land access. ■ A Resettlement & Livelihood Restoration Plan will be developed following submission of the ESIA and prior to FID. This will provide a record of work and studies done to date and set out the detailed plans, schedule, roles and responsibilities etc. for implementation prior to construction. The Plan will be disclosed in line with national and IFC requirements. ■ Implementation will commence immediately following FID, but some early works related to resettlement activities may be required to be undertaken prior to FID to support the construction schedule (to be confirmed).
Stakeholder Engagement Plan (Section 9.3 and Annex II)	■ This Plan has already been prepared, and outlines processes for: informing people of Project activities, schedule, potential impacts, local employment opportunities, community grievance resolution process. ■ The SEP outlines the Operator's approach to: stakeholder identification, engagement with various stakeholders, and an action plan for engagement for ongoing and planned activities. ■ The SEP will be updated and set out how the Operator will engage with stakeholders, including the ongoing management of a grievance procedure, information disclosure and consultation. It also sets out a series of engagement methods and events that are intended to maximise participation and to be appropriate for a given stakeholder group's needs and preferences. The SEP will ensure that the engagement process is credible and transparent and maintains simplicity in information comprehension, is as accessible as practically possible and maintains accuracy of information. ■ The SEP includes a section providing a detailed description of procedures for the resolution of complaints and grievances.
Emergency Preparedness and Response Plan	This Plan will include: ■ procedures on how to identify and respond to potential emergency situations, potential failure of risk controls and potential for incidents that would have health and safety implications for workers and/or the community; and environmental implications; ■ provision for emergency arrangements with contractors and collaboration with other appropriate and relevant third parties; ■ provision of equipment and resources and designation of responsibilities; and ■ process for review and revision as necessary to reflect changing conditions.
Supporting plans and procedures will be prepared as follows: ■ Code of Conduct;	

Document	Summary of Contents
	■ Worker Complaints and Grievance Procedure (separate to the community grievance and resolution process set out in the SEP); ■ Stakeholder Engagement Plan (Section 9.3 and Annex II) ■ Worker Health and Safety Plan which will set out the Occupational Health and Safety Management System requirements, prepared to meet the requirements of ISO 45001:2018. ■ National Content Plan (as part of the Field Development Plan;) ■ Local Content Development Plan (as part of the Field Development Plan); ■ Contractor Management Procedure (Section 9.2.3); ■ Procurement Procedure (to ensure that procurement of equipment, materials, chemicals and services (including labour) meet the Operator's environmental and social requirements; and ■ Environmental Incident Reporting Procedure (All non-conformances, incidents and near misses must be investigated to a level commensurate with the potential risk or outcome, to include lessons learnt and improvement recommendations).

5.17 Contractor Management

As part of the engineering, procurement and construction (EPC) tendering process, potential contractors will need to demonstrate understanding, resourcing and scheduling to meet the requirements set out in the Operator's Environmental and Social Management System. The Operator will assess environmental and social risks for each contract.

Prior to construction, the EPC Contractor will develop its systems and plans for implementing the Operator's environmental and social requirements. The Operator will assure that the EPC Contractor's systems and plans meet the requirements of the Operator's Environmental and Social Management System.

During construction, the EPC Contractor is responsible for implementing the Operator's environmental and social requirements which will be set out in the EPC Contractor's systems and plans. The EPC Contractor's responsibilities include communicating these requirements to subcontractors and monitoring their performance to assure implementation. Throughout construction, all contractors are required to provide workers and subcontractors with the means to ensure compliance with the requirements of the Operator's Environmental and Social Management System.

Whilst the EPC Contractor will implement the majority of the Operator's environmental and social requirements during construction (a contracted requirement), as "owner", the Operator will assure that the EPC Contractor has implemented its requirements, and appropriate resourcing will be provided to do this.

5.18 Control and Shutdown

The wells, wellpads and the CPF will be controlled by an ICSS, located in the wellpads and Instrument Equipment Rooms in the CPF. Wells, wellpads and the CPF will be linked to the central control room by means of fibre-optic cable.

The ICSS will comprise the following elements:

- PCS (Process Control System);

- ESD (Emergency Shutdown System); and
- F&G (Fire & Gas System).

5.18.1 Emergency Response

An emergency response facility is provided within the ancillary area of the CFA.

5.19 Decommissioning

This section provides an overview of the decommissioning activities that will likely be undertaken once individual facilities cease operation. Decommissioning refers to the dismantling, decontamination and removal of process equipment and facility structures and any appropriate remediation.

The likely decommissioning activities would be focused on:

- Production and injection wells with corresponding wellpads;
- The interconnecting network;
- Surface facilities in the CFA; and
- Other outfield infrastructure.

Decommissioning will be undertaken in accordance with Kenyan legislation and applicable standards. Decommissioning costs will be assigned in accordance with the license obligations will be included in the economic assessment of the development. Assuming there is no other use for infield and outfield facilities, all structures including production, processing, treatment, storage, pumping, power, and related infrastructure facilities will be dismantled for recycling, sold for scrap, or disposed to a suitably licensed NEMA-approved facility. The design will also allow for routine monitoring and inspection to ensure that there is sufficient information on the in-situ condition to support decommissioning.

Key considerations for decommissioning (both after construction and following the conclusion of operations) may include:

- Site reclamation;
- Extent of restoration and revegetation;
- Road access; and
- Disposal of contaminated materials and residues.

5.20 Management of Change

Although this Section has reported the Project design based on FEED (June 2021), there is always the potential for new activities or changes to Project activities, design or footprint prior to construction commencement that could lead to potential impacts that were not subject to assessment as part of this ESIA process.

This may include:

- design refinement or detailed design outcomes;
- changes in construction methodologies;
- obstacles encountered during construction;
- results of further field surveys and monitoring;

- comments or concerns from stakeholders; and
- changes in regulations or requirements by regulatory bodies.

The Operator will manage the environmental and social risks associated with any material changes to the Project design or the Operator's business processes as part of its Environmental and Social Management System. As part of this, the Operator will establish procedures to:

- Use a risk assessment process to identify any changes to the Project design or footprint that may result in a potential new impact or change in impact classification requiring additional mitigation or management.
- Notify regulators and other key stakeholders about proposed changes and secure agreement prior to implementing the change.

5.21 Analysis of Alternatives

5.21.1 Introduction

The design and configuration of the Project as described in the Project Description was developed through an iterative design process, which considered a variety of project alternatives for the Project. These included considerations for siting, layout, technology selection, produced fluids processing, transportation, storage, and export of the crude oil from the wellfields and associated CPF at Lokichar.

The design evolution of the Project is illustrated in Figure 5.21-1 below.

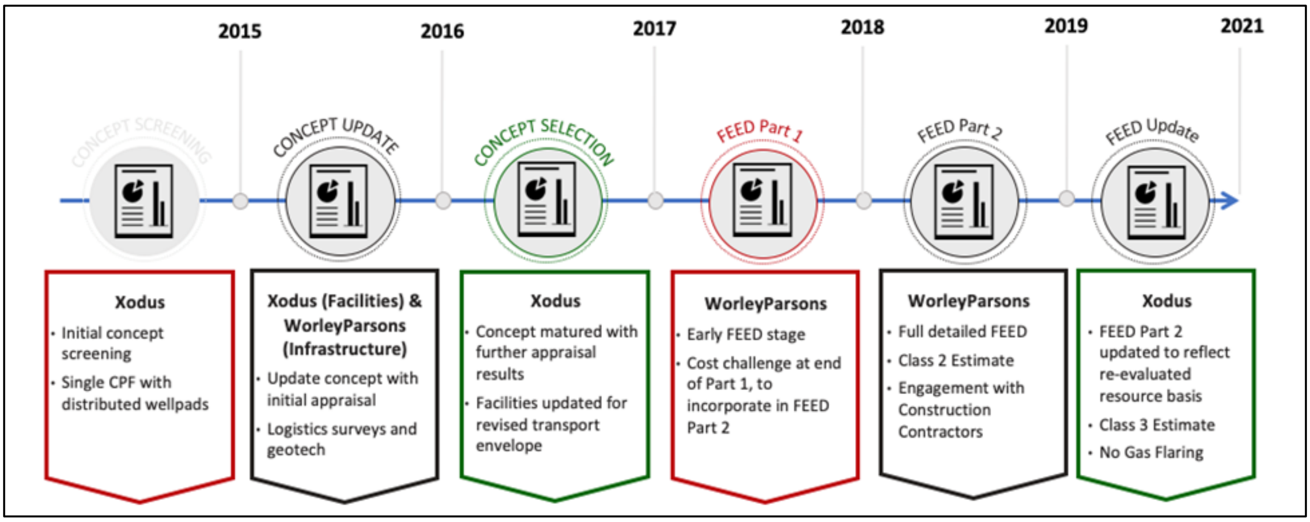

Figure 5.21-1 Project Design Evolution

5.21.2 Need for the Project

The development of the oil and gas industry in Kenya is considered to be an important strategic goal for achieving sustainable economic growth and the Project represents a fundamental component of this strategy. The Production Sharing Contract for Blocks 10BB and 13T provides authority to explore and produce oil in South Lokichar Basin. The route to market is provided by the LLCOP project which will be used to transfer stabilised oil from Turkana to the international export market via Lamu Port, whereby making oil production from the Project commercially feasible. Without the Project, the capacity of the GoK to deliver its aspirations for wider economic growth through oil export will be limited.

Under the Vision 2030 programme of the GoK, development of the oil and gas sector is identified as an economic imperative. In addition, the LAPSSET development is also part of the Vision 2030 process for the economic development of northern Kenya, providing a linear multi-spoke land corridor for strategic infrastructure development. It is a major initiative for Kenya and the East African region and, as part of its initial mandate, it includes the crude oil pipeline from Turkana to the Indian Ocean.

5.21.3 Project Alternatives

5.21.3.1 No-Project Option

The 'no project' alternative represents a scenario in which the Project does not exist. In such a scenario, it is considered that the baseline environmental conditions, would prevail and the impacts would not materialise. As such, whilst any adverse environmental and social effects would not occur, the beneficial socio-economic effects of the Project would also not be realised and the established need for the Project would not be met.

If the 'no project' alternative were pursued, then the LLCOP project would also become unfeasible, with the socio-economic benefits of that project similarly lost.

5.21.3.2 Refining Versus Crude Export

The primary strategic alternative that was considered focused on whether it was feasible to refine or partly process the crude oil at Lokichar. This was soon ruled out on economic grounds as the scale of the hydrocarbon resource discovered in the South Lokichar Basin is not sufficient to justify the large investment required to develop a refinery. In addition, the Lokichar crude has a high wax content (approximately 30%), which would require additional processing at high cost to produce a valuable product.

To be economically viable, refineries typically need to process large volumes of hydrocarbons on a constant basis (i.e., operating 24 hours a day) and need to be located where they can process large volumes of hydrocarbons. In addition, the local market for refined product (i.e., northern Kenya) would be too small to provide a viable market for large volumes of refined oil products. There would therefore still be a requirement for the long-distance transport of large volumes of processed hydrocarbon product to other market destinations, meaning a pipeline would still be required.

In order to develop the discovered hydrocarbon resources in the South Lokichar Basin, the only feasible economic option is to export the resources on a large scale. To realise the full potential of the reserves, such export would need to be international.

5.21.4 Facilities Siting Alternatives

5.21.4.1 Field Architecture and CPF Location

During development of the design, assessment of potential facility layouts was carried out to optimise the hydrocarbon gathering network. The objective was to offer a solution which minimised land take and infrastructure requirements, while minimising heat loss in the flow lines so wax deposition could be suppressed.

In addition, consideration was given to key design criteria including:

- Well fluids would reach the CPF at maximum arrival pressure, so no additional compression was required to move fluids through the oil and gas processing trains;
- Operational pigging for wax management would not be required;
- Wax formation would be mitigated by pipeline insulation and electrically heating the flowlines (heat tracing);
- Minimising distances and line sizes of flowlines; and
- Maximising routing to follow existing road networks to minimise impact to natural habitat and communities whilst allowing easy access to pipelines and flow lines for visual inspection and maintenance.

A location in the north-east of Ngamia was taken as the Base Case; it is considered optimal as it is close to the most productive and highest reserve base reservoirs (Ngamia and Amosing).

5.21.4.2 CFA Location

Early consideration was given to a development option which supported two CPFs, one located in the north of the field and one in the south. The Northern CPF would service Agete, Twiga, Ekales and Etom, and a Southern CPF would service Ngamia and Amosing.

Once the single CPF option was identified it was decided to locate it within the CFA to reduce the development footprint. Alternative CFA locations were considered, and the following factors were assessed to inform the decision-making:

- Flood risk;
- Geophysical risk;
- Geotechnical risk;
- Environmental sensitivities;
- Social sensitivities;
- Proximity to camps (drilling, pioneer, permanent);
- Personnel movement within the fields (day to day) - proximity to the C46 road and centralised between fields;
- Ease of access for removal of wells waste to the CFA;
- Reduce back pressures on the Amosing Field by reducing the distance to the CPF;
- Flow assurance;
- Minimising pipeline lengths; and
- Potential security issues.

Out of the sites investigated, two sites were considered feasible and based on further evaluation of a selected number of the criteria listed above, the location to the north of Ngamia was strongly favoured over the one between Ngamia and Amosing. Both locations are shown in Figure 5.21-2.

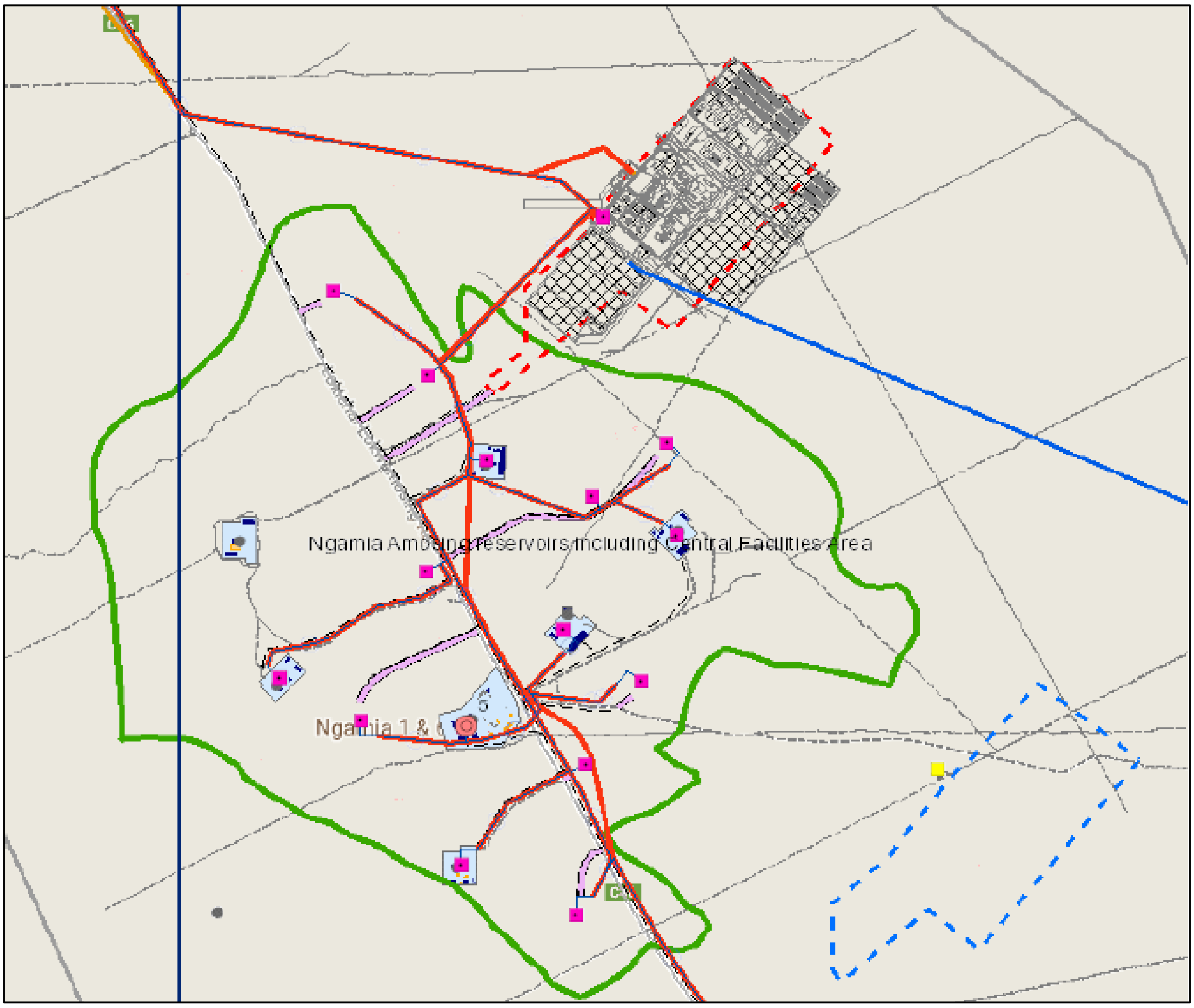

Figure 5.21-2 Base Case CFA (Red), Alternate Case (Blue).

5.21.4.3 Wellpad Siting

Initial studies evaluated single well tie-back vs a cluster (wellpad) development. The single well tie-back option was disregarded due to the increased land take requirements, increased operational complexity and cost associated with a more complicated infield pipeline arrangement.

The location of wellpads was predominantly determined based upon optimum placement relative to a sub-surface target or well targets. Once the sub-surface targets were determined and generated, well planning software was used to calculate the optimal position and number of pads required to reach the targets with a given set of trajectory criteria such as reach, maximum inclination, build rate and kick-off depth limitations.

The calculated locations were then initially compared to the location of any existing E&A pad locations. Where an existing pad was located in close proximity to a calculated pad location, the existing pad was selected in place of the calculated pad. In the case where a calculated pad location was so far from an existing pad location that the well trajectories would be significantly compromised, the new pad was selected.

Other factors that influenced locations of drilling pads included the following:

- The terrain is bisected by a significant number of ephemeral water courses or luggas;

- Social constraints such as the location of roads, homesteads and animal shelters are abundant, particularly in the areas around the luggas; and
- A local geological fault system.

5.21.5 Water Resource Options

5.21.5.1 Introduction

In order to meet the water demand for the Development and Production phases in the South Lokichar Basin, a strategic source of water is required. Water is a fundamental requirement for delivery of the Project and is required to enable injection of water into the oil reservoirs being developed. The implementation of a waterflood development on the South Lokichar oil reservoirs serves two key purposes:

- Enables the maintenance of pressure within the reservoirs as oil gets extracted – for each barrel of oil produced approximately 1.3 barrels of water will need to be injected to maintain the initial reservoir pressure; and
- Enables oil in the reservoir to be pushed from water injection wells to oil production wells to sustain oil recovery.

Notably the amount of oil recovered from the reservoir is directly related to the injection of water attributable to the combination of the two key drivers. If no water is injected the reservoir pressure would decline and the oil production wells would cease to flow. This would result in only one third of the oil in the reservoir flowing to surface and stop the viability and commerciality of the Project. Initial water resource assessments included:

- River Nile in Uganda;
- Turkwel Gorge Reservoir;
- Lake Turkana;
- Local groundwater;
- Indian Ocean;
- Distant groundwater; and
- Lake Victoria.

The seven options were reduced to a shortlist of four (Turkwel Gorge Reservoir; Lake Turkana; local groundwater; and distant groundwater), using a multi-criteria decision analysis technique and a programme of technical studies on the four remaining options was undertaken[3].

5.21.5.2 Preferred Option: Turkwel Gorge Reservoir

5.21.5.2.1 Rationale for Selection

The Turkwel Gorge Dam is a concrete-arch dam built in a narrow gorge, commissioned in 1991, with a maximum generating capacity of 106 MW and a quoted total reservoir volume of 1.6 billion m^3 in the Turkwel Gorge Reservoir. The Turkwel Gorge Dam and Turkwel Gorge Reservoir are on a tributary of the Turkwel River and fall under the remit of the KVDA.

The Turkwel Gorge Reservoir was formally selected as the preferred option for the following reasons:

- It can meet all the water needs of the Project;

[3] Strategic Water Supply for Development, Selection of preferred option, January 2016.

- It is owned and operated by a government body with a mandate to initiate projects that contribute towards poverty reduction and wealth creation, especially across administrative borders;
- The infrastructure needs are simple: one intake at the dam with power available on site; and
- Minimal water treatment requirements at the CPF.

5.21.5.2.2 Intake Locations at Turkwel Gorge Dam

Four potential intake options were studied including:

- Above the dam (Headrace);
- Below the dam (Tailrace);
- Turbine bypass; and
- Sluice Gate.

Option (iii) and (iv) were discounted early in the design development. From a security of supply perspective and to minimise potential operational changes in dam operation and impact on the Turkwel River system, the reservoir intake option (headrace) was selected.

It should be noted that the pipeline required to transport water from the Turkwel Gorge Reservoir to the CPF is subject to a separate ESIA process and will be permitted separately.

5.21.6 Technical and Process Alternatives

5.21.6.1 Wellpad Design

The Project is implementing a factory drilling operation on a cluster wells approach. The principal objectives of the "cluster" approach is to have multiple wells co-located on a single pad. This reduces the unit cost per well, increases the short-term production rate and maximises the cumulative recoverable oil volumes from the field. Well cost reductions are achieved through improved rig utilisation (i.e., a factory drilling operation). Applying a "*factory drilling*" operation employs specialised rigs designed to maximise drilling efficiencies and reduce drilling time and associated costs. These highly mobile units are optimised for rig moves.

All the other options considered have a greater environmental impact and increase land take, and potential for resettlement through an increase in footprint. Drilling efficiencies means shorter drilling times (and therefore noise impacts over shortened drilling periods).

Drilling will utilise a combination of WBM for the upper top-hole section and SBM for the lower sections. SBM was selected for the drilling of the lower sections to enable faster drilling and increased hole stability.

5.21.6.2 Wax Management Strategy

The oil produced from the South Lokichar Basin reservoirs has a high wax content, with a high wax appearance temperature. This creates problems in operation, as without careful management, wax will deposit on surfaces with the potential to impair or block flow through the gathering network and the CPF. Numerous strategies were reviewed, falling under two main categories, to assess how the wax deposition could be managed:

- Operational Management:
  - Regular operation pigging of flowlines to remove wax deposits; and
  - Intermittent flushing with hot water to remove wax.

Initial assessments ruled out operational pigging as the wax deposits may generate 'hard' wax that is impossible to remove with regular pigging. Moreover, operational pigging can be risky and may also result in blockages in the gathering system. Intermittent flushing with hot water was found to be inefficient, which meant that a large volume of water would be required over a prolonged period to remove the oil from the gathering system. In conclusion, pigging would not be feasible as the sole means of wax management, and continuous hot water flushing would be preferred over intermittent flushing. The system was designed to mitigate against wax deposition, by keeping the system warm, above the wax appearance temperature.

- Mitigation:
  - Electrically heat traced flowlines; and
  - Continuous hot water circulation.

All mitigation options involve ensuring the system is kept warm. To limit the heat losses to the environment and reduce the energy input requirements to the system, all flowlines will be insulated.

Continuous hot water circulation involves artificially increasing the water cut in the system at each wellpad by the addition of hot water from the water injection system. The use of hot water enhances the flow characteristics of the oil, reducing energy requirements for pumping from the well head to the CPF. Hot water can be added at the wellpads, either through the use of artificial lift jet pumps, or through a surface connection. The water addition concept does not require any additional equipment or equipment capacity at the CPF and is able to make use of ullage in systems.

Electrically heat tracing the flowlines is technically feasible and a proven technique but was not taken further due to the additional cost, when compared with the continuous hot water circulation option.

Continuous hot water circulation was chosen as the wax management method as the benefits extend beyond just wax management, and increase the operational flexibility of the facilities, covering start-up and turndown operations. Hot water injection is required for reservoir injection to avoid wax blockages in the reservoir pores, hence hot water circulation is able to make use of existing equipment already installed. In addition, it allows the use of artificial lift jet pumps, which defers the Capital Expenditure (CAPEX) commitment required for installing ESP/PCPs until after FO.

At the CPF to prevent wax deposition a combination of insulation and heat tracing will be used for equipment, piping, instrumentation, and tanks. Water circulation would not be feasible, due to the requirement to separate the oil and water.

5.21.6.3 Process Heat Recovery

Throughout the facility there is a requirement to add heat to stabilise the crude and to prevent wax formation. The options available for heat generation have been reviewed, with a combination of WHRUs and fired heaters selected. Waste heat recovery is the practice of capturing hot flue gases exiting the gas turbines and utilising its energy for other industrial processes including the generation of heat. Essentially, this process reuses heat energy that would otherwise be expelled and wasted.

The Project has adopted WHRUs as an integral part of meeting its heat demand needs and each of the two GTGs has a WHRU attached to recover waste heat. Where there is a deficit or back-up heat requirement to cover interruptions in the GTG operations, this will be made up by utilising Fired Heaters with power supplied from the grid connection.

In addition to the WHRU, two cross exchangers are provided on the oil rundown line from the stabiliser to recover heat into the make-up water and produced water streams, to reduce the required injection water heat duty. This option was selected to optimise heat recovery, which is particularly important when the facility becomes fuel gas deficient.

5.21.6.4 Excess Gas Management

Throughout the FEED, developing a suitable gas management strategy was an important area of the study. This is because during the early years of operation, the gas produced from the reservoirs is in excess of the heat and power demand for the facility, leading to excess gas. While later in field life, there is insufficient gas produced from the reservoir to meet the heat and power demands, meaning the facility becomes gas deficient.

The FEED gas management strategy consisted of the following:

- GTGs coupled with WHRUs and additional heat generated from fired heaters;
- Grid connection required from day 1 to cover interruptions in GTG supply (no installed spare) and provide continuous power import when gas deficient; and
- Excess gas flared, with flanged connection at fence line provided if an alternative feasible solution for use of gas could be developed later in the project development.

As part of the FEED Update project, the revised production profiles were used to determine the facility's heat and power requirements. The facility was shown to have excess gas in early years (YR 1-5) and become gas deficient in year 6 onwards (YR 6+). A Gas and GHG Emissions study was commissioned by the Operator that revisited the options available to dispose/manage excess gas and in parallel reviewed alternative options to power the facility with the aim of reducing the GHG emissions.

As part of this study, initial screening and subsequent detailed analysis resulted in the following feasible options:

- Gas injection: an assessment of injecting gas into different areas within the Ngamia reservoir was completed and concluded that it was feasible to inject circa 15 billion cubic feet (BCF) of gas into the reservoir. Additionally, gas injection negates the requirement for operational flaring.
- Power export: the use of rental gas engines was shown to be a cost effective and flexible option to generate and export power from the excess gas. However, uncertainties around the ability of the Kenyan grid to accept the power and the price that could be secured remain.
- Solar PV: a full-scale solar development to power the full facility is uneconomical, however it has been shown that a small scale ~5MW development could benefit the project, by providing power with low emissions, resulting in an estimated reduction in GHG emissions from the facility of ~0.8 $kgCO_2$/bbl.

Based on the above, gas injection is the recommended solution for managing excess gas and is included in the base case design for the FEED Update project.

An additional benefit of providing gas injection is the potential for the gas injection wells to provide gas to the CPF, when the facility becomes gas deficient. This option demonstrated a significant reduction in the required power import, which provided a significant reduction in the facility Operational Expenditure (OPEX).

5.21.6.5 Power Generation

Produced (associated) gas from the reservoir will be used to generate power and heat to support the needs of the CPF, CFA, wellpads, landfill and booster pumps at the make-up water pontoon at Turkwel Gorge Reservoir. The use of GTGs were found to provide the most cost-efficient solution to power generation with GTGs being more efficient at converting fuel burnt into MW power than steam turbines and for generating less emissions for the power they deliver. In addition, the power to heat ratio required by the facility is better suited to GTG rather than steam turbines.

A 100% grid power option was not considered practical from a security of supply perspective and the Project also aimed to maximise its utilisation of produced gas to deliver heat and power for use on its facilities.

5.21.6.6 Flare Selection

The main plant flare is to be used during abnormal events and will not routinely operate. The current design selected for the flare is a ground flare. Originally, the flare was designed as an elevated flare. Elevated flares are the simplest and most widely used relief system, offering safe and efficient combustion of waste gases with varying degrees of smokeless burning. Using steam injection and effective tip design, heavy hydrocarbons can be burnt smokeless. Ground flares are more suitable for "*clean*" gases (i.e., where toxic or malodorous concentrations are unlikely to be released through incomplete combustion or as combustion products).

The change from elevated flare to ground flare occurred as a result of noise mitigation modelling, as a ground flare offers lower noise characteristics (and with the use of acoustic abatement barriers) is believed to reduce the noise footprint and limit the extent beyond the CFA boundary. Additionally, a ground flare reduces the visual effect of a flame.

5.21.6.7 Produced Water Management

Water is reinjected into wells to maintain reservoir pressure over time and ensure oil recovery rates are maximised. All of the water that is produced with the well fluids will be treated, heated and re-injected to assist well fluids to flow. This means the design has adopted a minimum produced water discharge regime at surface or to land. Feasible alternatives for the management and disposal of produced water were evaluated in line with IFC guidelines for onshore developments and the main disposal alternatives may include:

- Injection into the reservoir to enhance oil recovery;
- Injection into a dedicated disposal well drilled to a suitable receiving subsurface geological formation;
- Irrigation, dust control, or use by other industry, may be appropriate to consider if the chemical nature of the produced water is compatible with these options; and
- Produced water discharges to surface waters or to land, which should be the last option considered and only if there is no other option available.

The option for treating, heating and injection of produced water into the reservoir is considered the best practicable environmental option enabling the production of oil from the reservoir under ongoing waterflood conditions and in turn reducing the amount of water required from an external water source over the life of the Project.

5.21.6.8 Waste Management

Given the volume of waste generated during construction and from the experience during E&A it was recognised that a bespoke waste management solution would need to be developed for the Project and waste could not be moved significant distances from the point of generation to existing facilities outside Turkana.

5.21.6.8.1 IWMF Location

A range of potential locations for new waste management facilities outside the South Lokichar Basin were considered along with the potential to co-share these with other users. On further review it became clear that the greatest volume of waste being generated was anticipated during construction of the CFA and associated infrastructure, and hence the proximity to this location was a key driver to minimise OPEX of the facilities.

Further consideration as to the possibility of using the Project as an “anchor client” for building a waste management business in Turkana was evaluated but given the lack of other industrial clients in the area and the low volumes of arisings from Lokichar Town, it was decided the facilities would be located in the CFA and for the Project use only.

5.21.6.8.2 IWMF Treatment Methods

Waste management has been integral to project planning. The Operator has progressively carried out studies to establish a waste management strategy and identify the requirements and constraints for developing dedicated waste facilities for the Project.

The latest concept level assessments considered waste management options in line with the evolution of FEED requirements and considered further options to reduce, reclaim and reuse and recycle waste to minimise the amounts of residue for incineration and landfill, to meet the aspirations of the Operator and NEMA in effective implementation of the waste hierarchy.

The Operator has undertaken a best practicable environmental option study to determine the most appropriate technology to pre-treat or treat the various waste streams; and has utilised the best available industry information to compile an inventory of anticipated waste types and volumes during the three key phases of the Project (drilling, construction and operations).

The latest option selection considered the best-case recycling scenario but had to rationalise the approach considering the availability of certain industries within Kenya to process some of the produced waste streams and the technical, environmental and economical practicability of some of the proposed treatment methods. The approach was rationalised considering the potential of certain waste streams to be recycled within Kenya and the practicability of the proposed waste management methods.

Waste oil is recovery and reclamation is widely practiced in Europe however it is likely that such infrastructure does not exist within Kenya. It has been assumed that waste oils have to be moved further down the waste hierarchy into energy from waste or treatment steps. This has also been assumed for most specialist chemicals, and waste batteries.

In some cases, certain technologies overlap in their treatment capabilities, and it was necessary to identify the most appropriate technology for the requirements of the Project:

- Incineration vs pyrolysis: Even though pyrolysis can potentially produce more useful outputs compared to incineration, in the form of liquid and gas fuel, it is not proven to be effective in the treatment of mixed waste streams and therefore poses a significant operability risk. In all three project phases, there is a requirement to thermally treat a wide range of waste types, which would render pyrolysis unsuitable. On the contrary, incineration is a proven, robust technology that has the capacity to effectively handle mixed feedstock. Incineration is the recommended thermal technology for the treatment of the identified wastes prior to disposal and this will be confirmed by the front-end engineering design of the waste treatment technologies.
- Composting vs anaerobic digestion: putrescible waste (i.e., food waste) cannot be composted without the regular supply of green material, so composting is not considered a feasible option for the drilling and operational phases of the project, with anaerobic digestion being the recommended treatment method.
- Wastewater treatment: the exact treatment process will be selected in the detailed design stage; however, sewage and process effluent wastewaters will be treated separately.

5.21.6.8.3 Landfill Location

Due to the land requirements for the landfill site, it could not be co-located within the CFA. Preliminary work was carried out on five potential locations outside the immediate CFA boundary giving due consideration to local factors including:

- Proximity to centres of population;
- Distance from places of waste generation;

- Ease of access;
- Security issues;
- Natural topography and landscape;
- Proximity to protected areas;
- Geology; and
- Land availability.

Other factors taken into consideration came through using best practice guidance provided by the WBG EHS Guidelines for Waste Management Facilities and landfill siting criteria and included considerations such as:

- Gently sloped topography which facilitates leachate drainage;
- No areas inside the landfill within a 10-year groundwater recharge area for water supplies;
- No protected forest within 500 m of development;
- No environmentally sensitive/endangered species, wetlands, important biodiversity areas etc. within the development area;
- No open areas susceptible to high winds;
- No major utility lines crossing the area;
- No residential development within 250 m of the perimeter;
- No visibility of cell development from residential areas within 1 km (or use of shielding as necessary);
- No perennial stream within 300 m downgradient of landfill;
- No siting within 3 km of airports (catering for jet aircraft) or 1.6 km (for piston aircraft). Between 3 and 8 km of a jet airport, express permission must be sought from the aviation authority;
- No siting within a floodplain subject to 10-year floods;
- If located within 100-year floodplain the site must be designed against washout (this was interpreted as perennial river floodplains and not applicable to flash flooding or transient water courses);
- Avoid siting within 1 km of socio-politically sensitive sites (memorial sites, churches, schools, hospitals); and
- Avoid access roads that pass sensitive sites.

The Ngamia area was preferred due to its proximity to the CFA and the Ngamia and Amosing wellpads. This area is where most of the waste associated with the Project will originate (primarily during construction). This location will significantly reduce waste related vehicle journey distance, time, road traffic volume and transport emissions when compared to locating the landfill nearer to the northern wellfields.

6.0 ESIA BASELINE

6.1 Introduction

It is an essential component of the ESIA process to establish and review the existing environmental and socioeconomic conditions in the Project AoI and its surrounds. As part of this process, receptors and resources sensitive to potential impacts are identified.

As part of the impact assessment, these established baseline conditions are compared against the extent and magnitude of potential environmental and social changes caused by the Project. The baseline conditions also allow for any future changes to be monitored and managed.

Baseline studies, conducted by the Golder Associates (Golder) Team, commenced in October 2015 and concluded for the purposes of this ESIA in May 2021.

The environmental and social baseline is characterised by the following technical areas:

- Geology, Geohazards and Seismicity;
- Soils;
- Weather and Climate;
- Air Quality;
- Noise and Vibration;
- Water Quality;
- Water Quantity;
- Biodiversity;
- Ecosystem Services;
- Landscape and Visual;
- Social; and
- Cultural Heritage.

The AoI[1] for the Project is presented in Section 3. This is defined based on the administrative boundaries (location and/or sub-locations) within which the Project could have an influence, including the water source for the Project, the Turkwel Gorge Reservoir. Baseline data has been gathered from across the full AoI, including West Pokot, where relevant, to inform the impact analyses.

The route, design and construction of the water pipeline is outside the scope of this ESIA; it will be subject to a separate ESIA to meet NEMA requirements and Project standards and will be separately permitted.

[1] referred to on occasion in this document as the Potential AoI, although this is the same as the AoI.

6.2 Geology, Geohazards and Seismicity

For the purposes of this baseline report on geology, geohazards and seismicity, regional information on Kenya and more specific data relating to Turkana and West Pokot are presented. The soil baseline conditions are discussed in Section 6.3.

The AoI for the geology and geohazard assessment comprises the areas of potential direct and indirect change during operations and construction of the Project. This mainly comprises an area that encompasses the principal development locations and their immediate surroundings and is shown on Figure 6.2-3. Geohazards located outside this AoI still have the potential to influence the Project and therefore some baseline information for geohazards (and the geology associated with those geohazards) has been collated for a wider regional setting.

6.2.1 Secondary Baseline Data

The following summary of the geological setting of the region is based on secondary information only. These secondary information sources include the following:

- Geology of the Loperot Area (Ministry of Natural Resources Geological Survey of Kenya Report No. 74, 1966);
- Conceptual Hydrology of the Lake Turkana Basin (Mike Price, June 2016);
- South Lockichar Geological Summary (TKBV, January 2016);
- LLCOP – FEED Phase 1 Geohazard Desktop Study (Wood Group, 2018);
- 1:10,000,000-scale geological map of Kenya (Commission for the Geological Map of the World (CGMW), 2016);
- 1:2,00,000-scale mapping of the geology of Kenya (Mines and Geology Department of Kenya, 2004); and
- Scoping Visit field report (Golder, 2018a).

Unless specifically referenced, the information presented in this baseline has been collated from a combination of these sources.

6.2.2 Regional Geological and Tectonic Setting

The East African Rift System (EARS) is a zone of crustal extension where the Eastern African continent being pulled apart and split into the Nubian and Somalia Plates as it separates from the Arabian plate. It extends over 3,000 km from Mozambique to the Afar depression. The crustal extension causes an elongated system of normal faults; the surface expression of which is a series of basins (rift valleys) that are separated from each other by uplifted sections that form escarpments.

As it extends southwards, the EARS splits into eastern (active) and western (passive) branches. The Kenya Rift is part of the active eastern branch of the EARS. The rifting at the Kenya Rift started from Turkana and extended southwards towards Magadi to Mozambique. In the area of Lake Turkana, the Kenya Rift is also referred to as the Turkana Rift. The Lokichar Basin has formed within the EARS. The main active rift in the area is the Suguta Valley. A dramatic increase in topographic elevation around the boundary between the Turkana and Samburu counties marks the eastern edge of the EARS.

The 1:10,000,000-scale geological map of Kenya with an overlay of the potential AoI is presented in Figure 6.2-1 (background mapping from CGMW, 2016). Larger scale (1:2,00,000) mapping of the geology of Kenya is presented in Figure 6.2-2 (Mines and Geology Department of Kenya, 2004). This scale of mapping highlights the complexity of the geology.

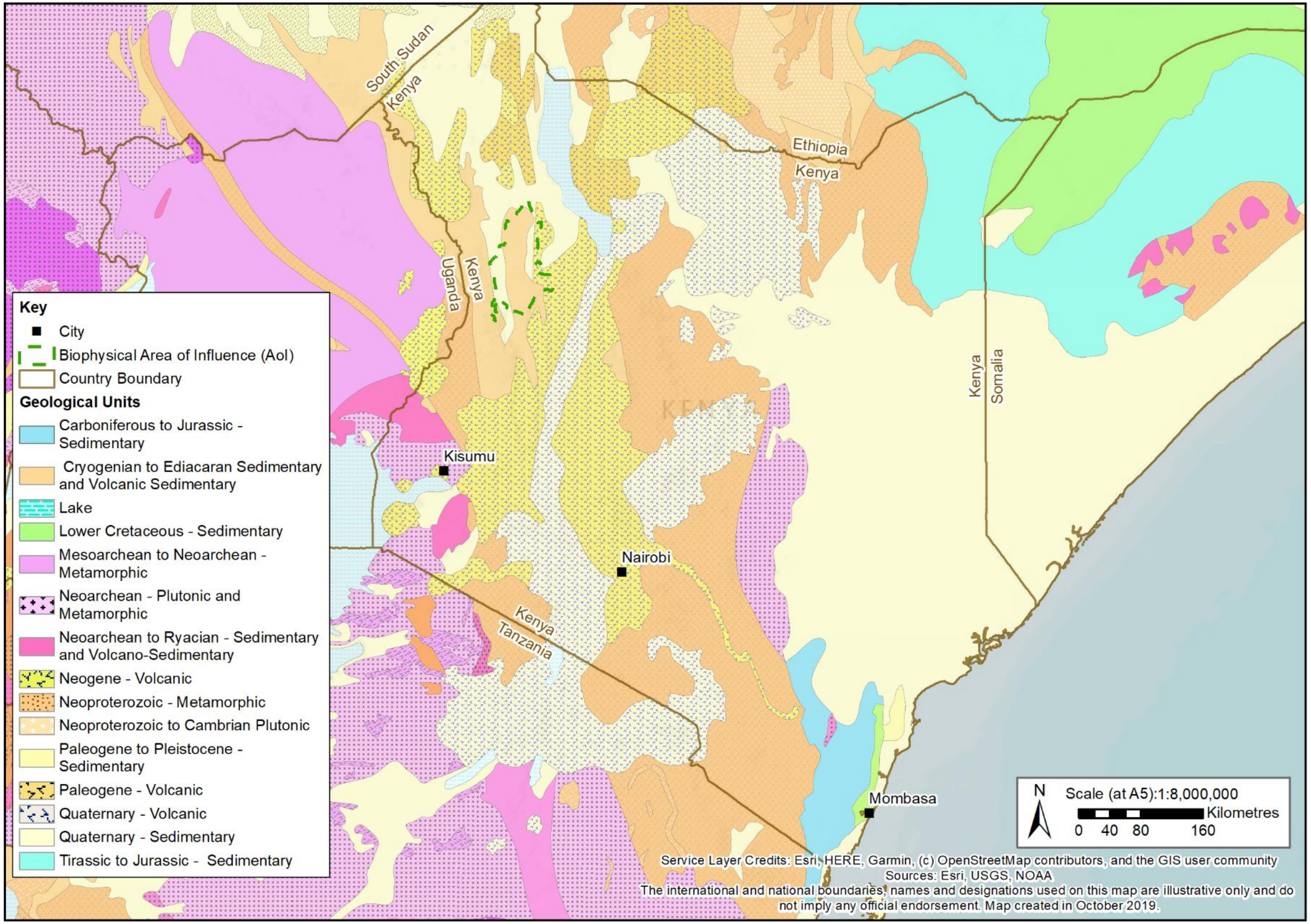

Figure 6.2-1: General Geology of Kenya (1:10,000,000 Scale)

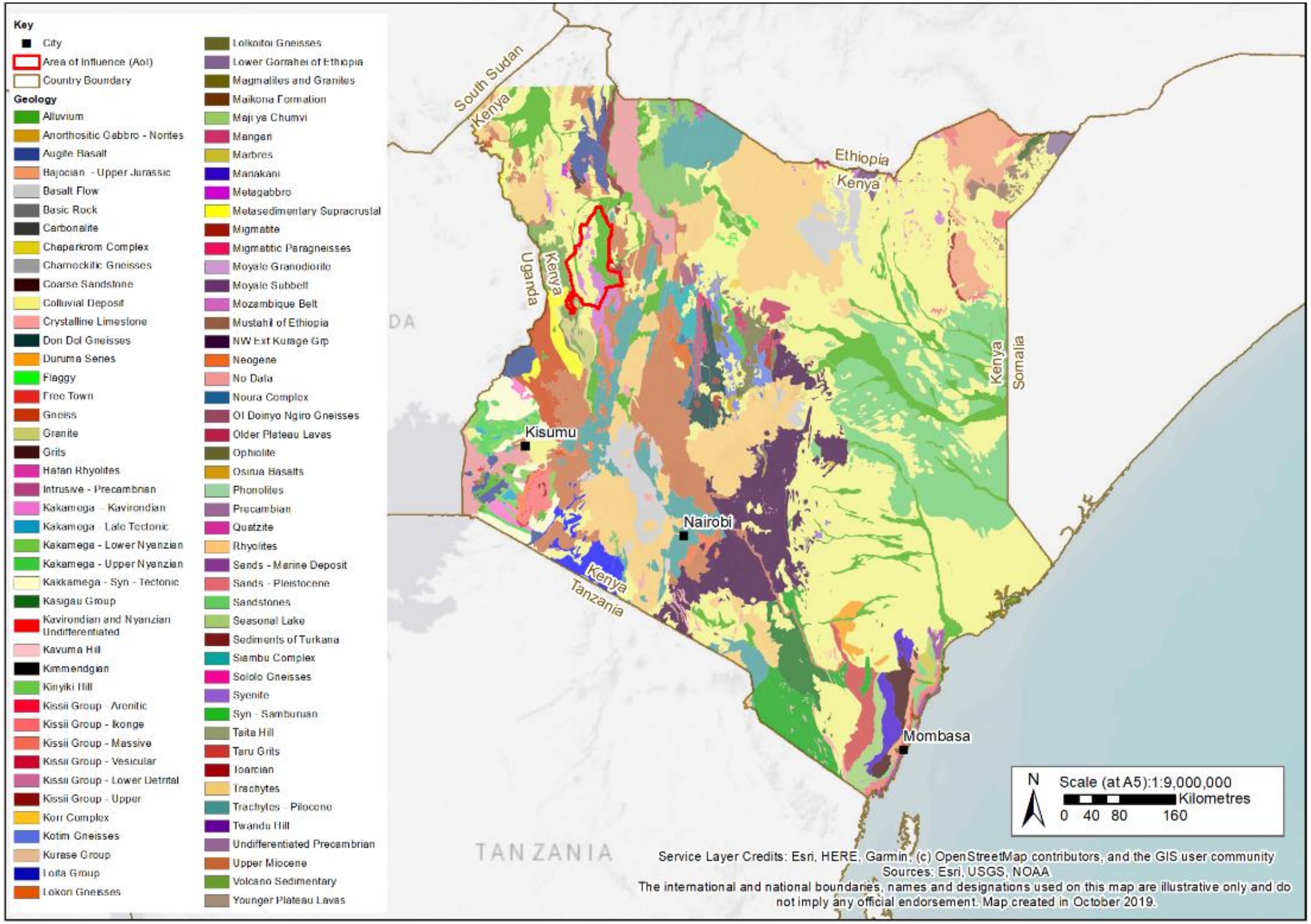

Figure 6.2-2: 1:2,000,000 Scale Geology of Kenya

The mapped rock formations in Kenya can be grouped into five major geological successions (Wood Group, 2018):

- The Archean (Nyanzian and Kavirondian);
- The Proterozoic (Mozambique Belt and Bukoban);
- Palaeozoic/Mesozoic sediments;
- Tertiary/Quaternary volcanics; and
- Tertiary/Quaternary sediments.

The mapped surface geology comprises a mixture of the older Archean and Proterozoic basement rocks, and the Tertiary and Quaternary sediments and volcanic rocks that are typically mapped in the northwest of Kenya.

The basement rocks are of Precambrian age and comprise gneisses, schists and granulites that were predominantly sedimentary grits, sandstones, limestones and shales before being subject to periods of intense heat and pressure around the beginning of the Cambrian Period that lead to their metamorphosis. In some areas there are considerable developments of migmatites (a rock that has a banded appearance and comprises a mixture of granitic material and high-grade metamorphic material), which have arisen by the injection of granitic magma into the gneisses and schists, or by their permeation by granitic fluids. Several granites of northern and north-western Kenya are the products of granitisation of meta-sediments. Pegmatites of various types are frequently associated with the Basement System rocks, particularly where metasomatic action has been prominent. The metamorphic and granitic rocks are intensely folded giving them a banded appearance.

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 to west across Africa with the Anza Graben running north-west to south-east 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 to 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 sedimentary deposits that were deposited by rivers or in ephemeral lakes. Unconsolidated alluvial material is also present in the valleys.

6.2.3 Geology of the AoI

An extract of the geology of Turkana County taken from the 1:2,000,000 scale geology of Kenya (Mines and Geology Department of Kenya, 2004) is shown in Figure 6.2-3. The geology in the AoI largely comprises Tertiary and Quaternary sediments and volcanic rocks.

The AoI is located within a basin that has been formed by rifting of basement rocks and is now partially infilled with superficial (drift) deposits. The South Lokichar Basin is a north-north-west to south-south-east 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 folded gneisses and migmatites. 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 Turkana Grits are highly fractured and jointed. 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 South Lokichar Basin, and that 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. The exposed strata are mainly divided into two main strata, comprising loose sand and medium dense sand, and one sub-stratum of slightly cemented sand.

The mapped geology within the AoI between Lokichar and the Turkwel Gorge Reservoir comprises outcrops of basement rocks between areas of Quaternary Colluvium. The terrain in the section of the AoI near the Turkwel Gorge Reservoir is particularly steep. Near the location for the proposed Project infrastructure, the area is mapped as Alluvium. The geology underlying the Colluvium and Alluvium is likely to comprise Archaean basement rock or Tertiary volcanics. The mapped geology correlates well with the observations made during scoping fieldwork (Golder, 2018a) in which the following observations on the surface geology were recorded:

- Between the Turkwel Gorge Dam and the Turkwel Gorge Reservoir tailrace the surface geology is dominated by gneissic rocks that form the hills on the west side of the fault that bounds the Turkwel valley;
- In the area between the Turkwel Gorge Reservoir outfall and the Malmalte River the geology comprises Quaternary red brown lateritic soils overlying gneiss;
- At the Malmalte River, the shallow geology dominated by Quaternary Alluvium comprising fine sands and silts. There are occasional outcrops of gneiss; and
- The A1 south of Lokichar traverses Quaternary Alluvium, followed by a section across shallow bedrock and outcrops of gneiss and amphibolite.

The most significant faults in the area are those related to the Kenya Rift, including the Lokichar Fault and faults bounding the Suguta Valley, which is located near the boundary between Turkana County and Samburu County (Wood Group, 2018). From the Wood Group (2018) work, the Lokichar Fault was determined to be inactive. The closest active rift is the Sugata Valley. The work as part of the Geohazard Desk Study (Wood Group, 2018) observed and mapped up to 20 active and potentially active faults, mainly in the Turkana province and at the borders of the Suguta (Rift) valley. The major faults shown on small scale mapping are present (see Figure 6.2-3). The strata exposed by the Lokichar Fault are mainly Precambrian basement and relatively shallow alluvium in the local low-lying or lugga areas. These alluvial deposits generally vary between 0.2 m and 2 m, with some thicker deposits (> 3 m) within the largest luggas. These alluvial deposits comprise sands, gravels and weathered gneiss.

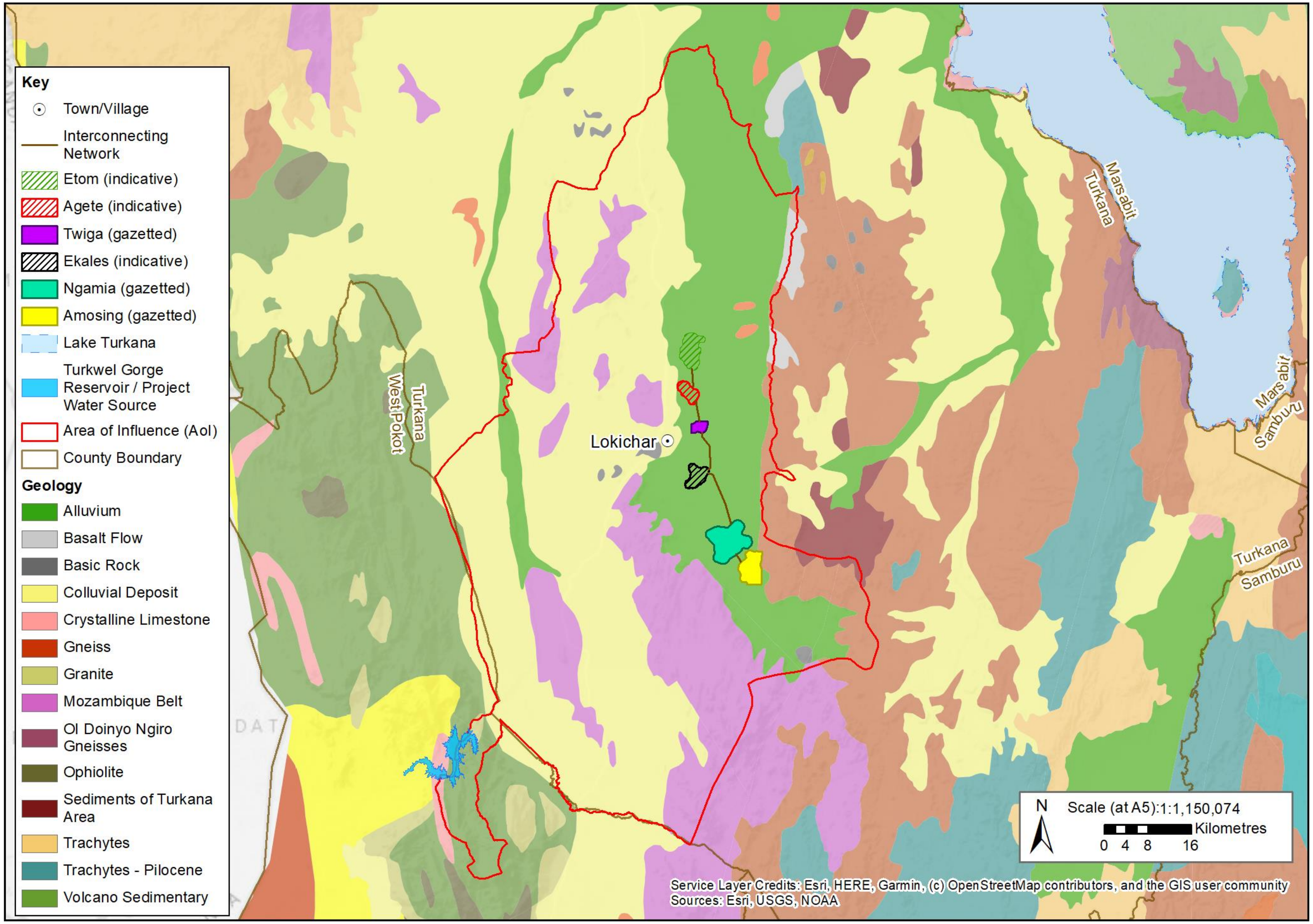

Figure 6.2-3: Geology in Turkana County, Including AoI

6.2.4 Seismicity and Volcanicity

Turkana, and Kenya as a whole, is vulnerable to seismic activity and volcanicity associated with the presence of the EARS, which runs north to south through Kenya. The overall earthquake hazard level in Kenya is considered low compared to neighbouring countries. The highest hazard levels within Kenya are in the north-west and south-west of Kenya (GSDRC, 2013).

In Turkana and West Pokot, the natural earthquake hazard is rated by WHO (2010) as low to medium with Peak Ground Acceleration (PGA) in the region of 0.2 metre per second squared (m/s^2) - 2.4 m/s^2 (see Figure 6.2-4). A map showing the intensity of earthquakes (United Nations Office for the Coordination of Humanitarian Affairs, [OCHA] 2007) is shown in Figure 6.2-5. The map indicates the intensity of earthquakes in the region of South Lokichar is degree VI (strong) on a scale of I (instrumental) to XII (catastrophic).

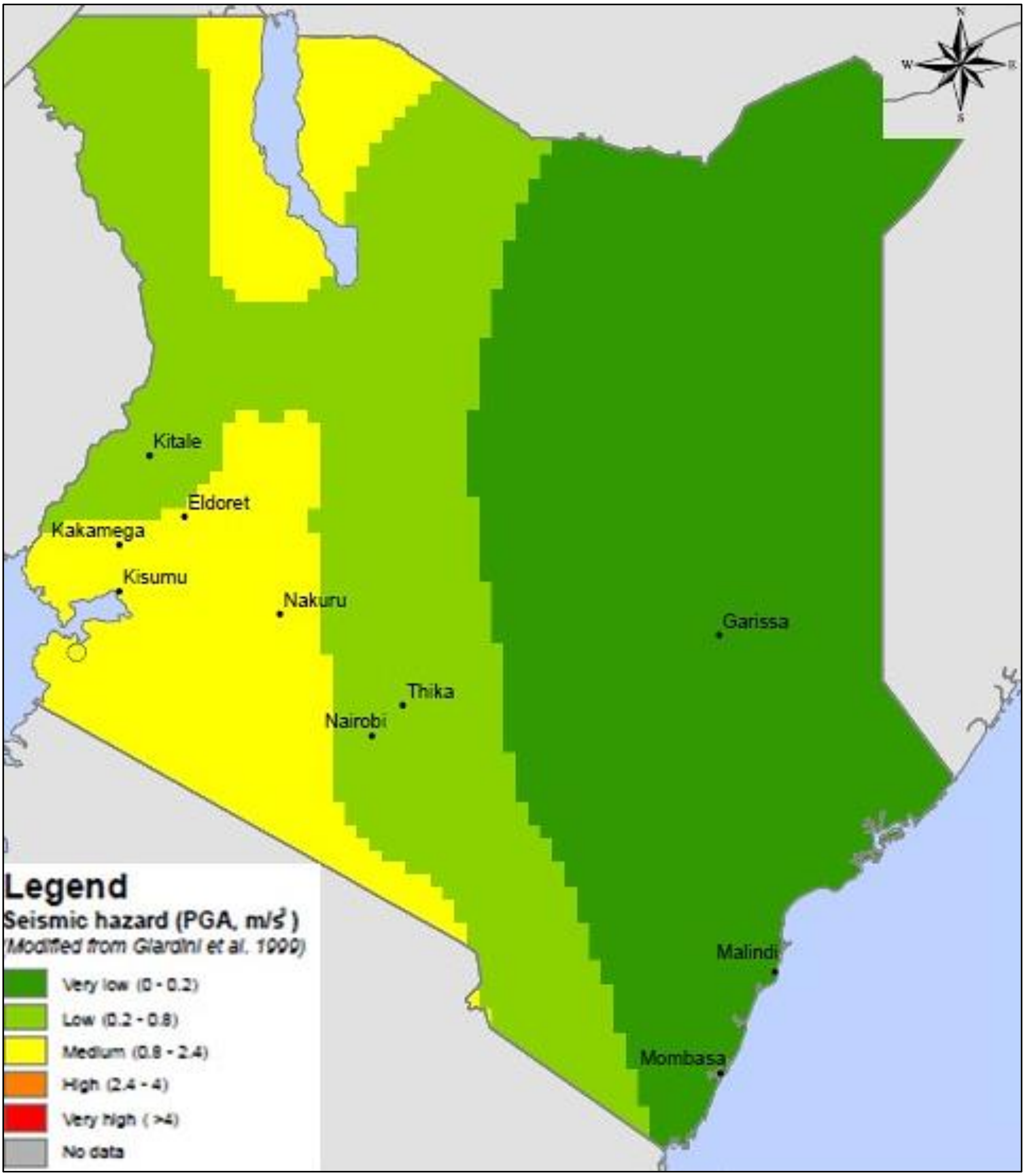

Figure 6.2-4: Seismic Hazard Rating Zones for Kenya

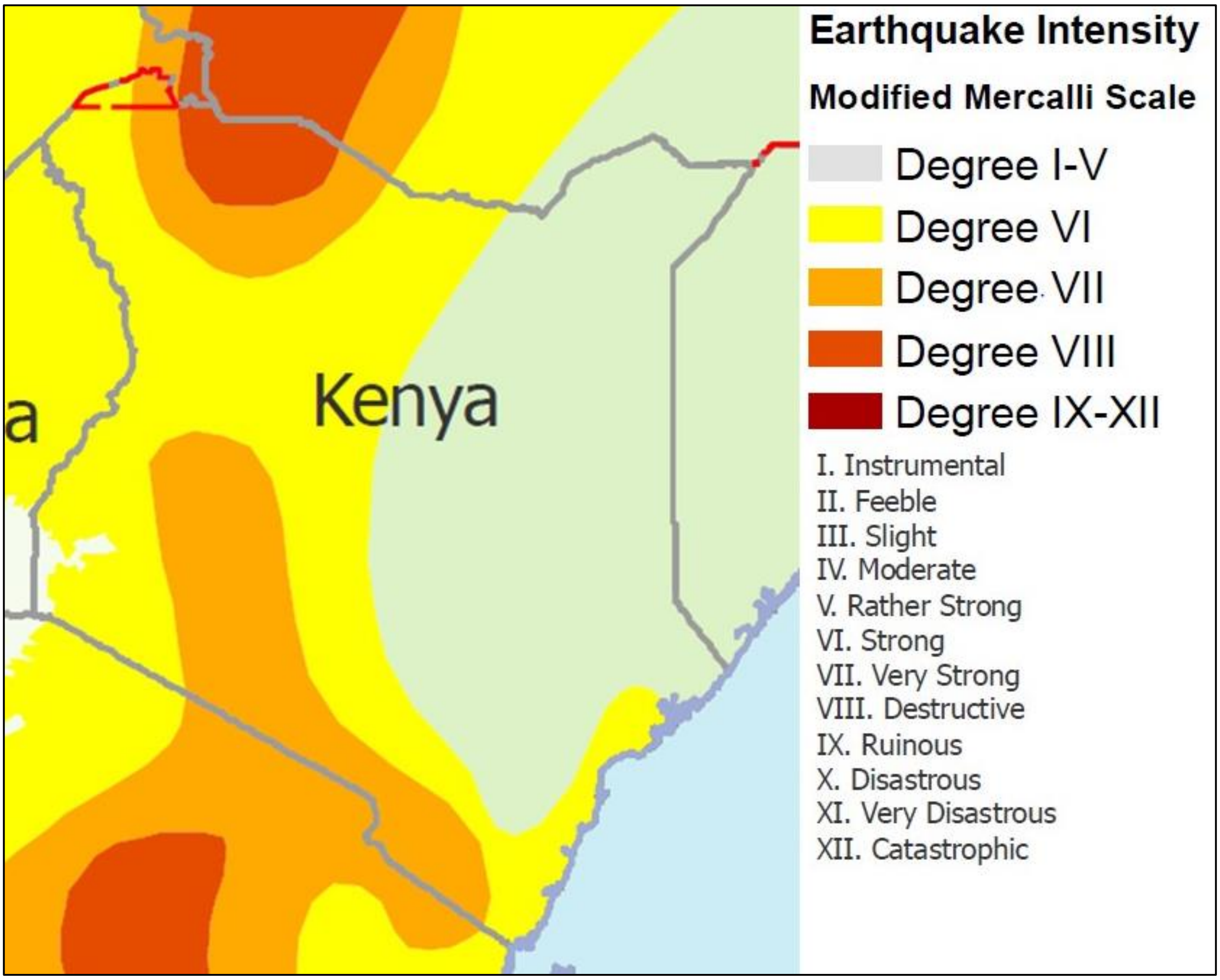

Figure 6.2-5: Earthquake Intensity Mapping for Kenya

A map showing earthquakes in Kenya recorded in the past 100 years (United States Geological Service [USGS], 2019) is shown in Figure 6.2-6. The closest earthquakes to South Lokichar and West Pokot range from a magnitude 3.9 in October 1998 to two magnitude 5.2 earthquakes in January 2012. Earthquakes are relatively infrequent, but high magnitude events do occur and an event of magnitude 7 was recorded with an epicentre approximately 300 km south of South Lokichar.

Active volcanoes are mapped along the eastern side of the EARS (see Figure 6.2-7) (Global Volcanism Program, 2013). The Geohazard Desk Study (Wood Group, 2018) identified no active volcanicity in South Lokichar. The closest volcanoes are Emuruangogolak (located in the Sugata Basin), Namaruna (located to the east of the AoI), and "*The Barrier*" (located on the southern shore of Lake Turkana). Emuruangogolak last erupted in 1910 and The Barrier last erupted in 1921. Both are shield volcanoes associated with the rift zone and had effusive basaltic, non-explosive eruptions. Namaruna is also a shield volcano and the last eruption was dated to 6,550 BC (+/- 1000 years).

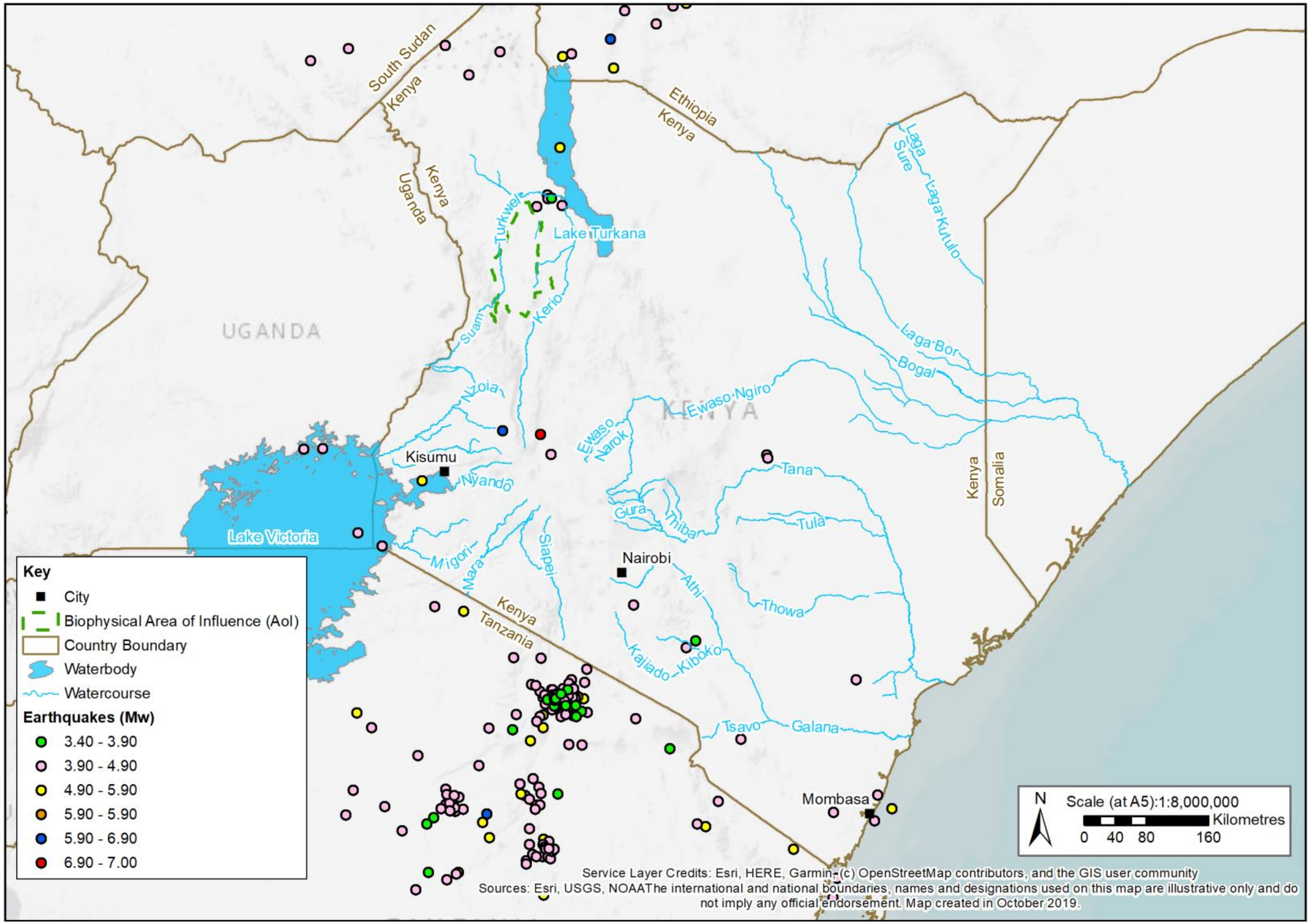

Figure 6.2-6: Earthquake Locations and Magnitude 1919-2019

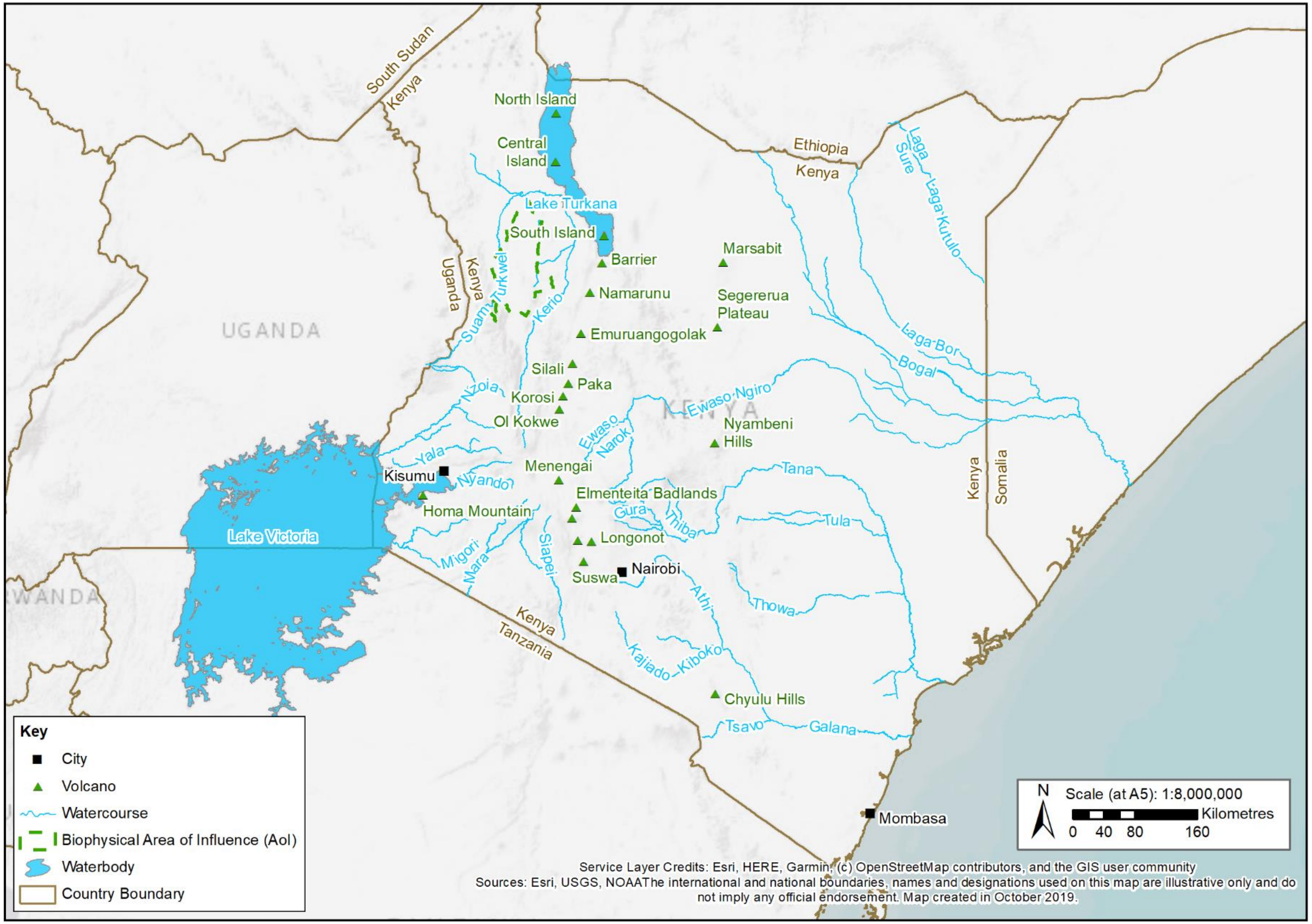

Figure 6.2-7: Active Volcanoes

The Geohazard Desk Study (Wood Group, 2018) covered the northern section of the proposed oil pipeline, which is also of relevance to the South Lokichar Basin area. It is stated in that report that no pyroclastic fall deposits have been observed.

6.2.5 Geohazards

Based on secondary research, the following summarises the key geohazards in the AoI:

- Landslides and slope instability can be caused by steep sloping topography (Wood Group, 2018);
- The majority of the landslides in Kenya are reportedly triggered by water and/or human activities, with slope saturation by water being the primary cause (Wood Group, 2018);
- There is no indication of significant active landslides in the AoI;
- Soils are locally saline, contain few rocks or stones, and are moderately susceptible to sheet and rill and gulley erosion from flood events and locally moderately susceptible to wind erosion; and
- The primary geohazards in the area are related to the coarse-textured soils. In low-lying areas that are prone to annual or periodic flood events, road washouts or undercutting of the Project infrastructure is possible.

6.3 Soils

This section presents the available baseline information on soil characteristics within the AoI.

6.3.1 Secondary Data Gathering

Publicly available digital soil survey inventory data was used to identify soils within the AoI. The soils baseline was developed to generate a baseline soil map, which delineates soil types and assemblages based on pedogenic and morphological similarities that relate to soil characteristics. Soil data from the following sources were used to develop the soil maps:

- KENSOTER Soils GIS dataset 1:1 million scale (Kenya Soil Survey, 1996); and
- Kenyan Soils (Infonet Biodivision, 2019).

Soil taxonomic classes in the AoI are presented on Figure 6.3-1 generated from data presented at 1:800,00 scale. The main soil types include Eutric and Calcaric Regosols. These relatively young soils account for approximately 85% of the soils mapped within the AoI. Eutric Fluvisols (alluvial soils) are the second most common soil accounting for approximately 5% of the soils in the AoI; these are associated with the Turkwel and Malmalte watercourses. Other soils include Haplic Lixisols, Humic and Eutric Cambisols, Calcic Solonchaks and Calcic Solonetz.

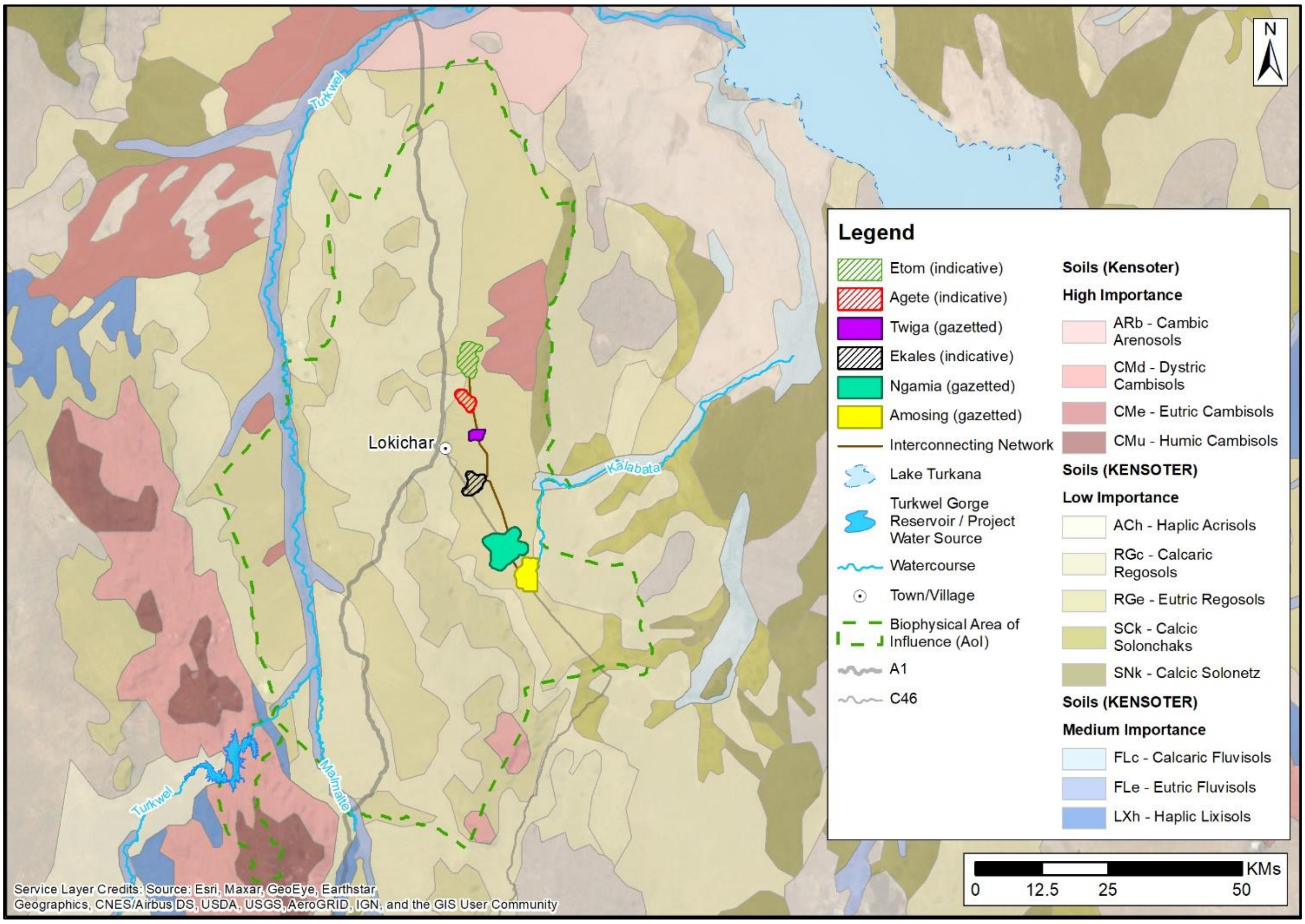

Figure 6.3-1: Soil Taxonomic Classes (KENSOTER) in the AoI

Table 6.3-1: Soil Types Encountered within the AoI

Reference Soil Group		Parent Material	Principal Soil Qualifiers		Agricultural Limitation	
Name	Description		Name	Description	Rating	Rationale
Cambisols	Soils (often young) with at least the beginnings of horizon differentiation in the subsoil, evident from changes in structure, colour, clay content or carbonate content.	Medium and fine-textured materials derived from a wide range of rocks.	Calcaric[1]	Containing calcaric material between 20 and 100 cm of soil surface	Moderate	Low organic matter, low water holding capacity
			Dystric[2]	Effective base saturation < 50%	Low	Low organic matter
			Eutric[4]	Effective base saturation ≥ 50%	Low	Low organic matter
			Humic[3]	Containing >1% organic carbon in the top 50 cm of soil	Low	Rich in organic matter
Fluvisols	Poorly developed young soils developed from fluviatile, marine and lacustrine sediments	Fluvial, lacustrine, marine	Eutric[4]	Effective base saturation ≥ 50%	Low	Potential for flooding
Regosols	Soils with no soil development	Range of unconsolidated materials	Calcaric	Containing calcaric material between 20 and 100 cm of soil surface	Moderate	Low organic matter, low water holding capacity
			Eutric	Effective base saturation ≥ 50%	Moderate	Low organic matter, low water holding capacity
Lixosols	Clay enriched subsoil from migration from upper horizons, low activity clay, high base status	Range of materials, including unconsolidated chemically weathered soils, fine textured	Haplic[5]	Undifferentiated horizon, only has the features of the reference soil group	Low to moderate	Degraded topsoil
Solonchaks	Soils with a high concentration of soluble salts at some point in the year	Any unconsolidated material	Calcic	Calcium carbonate equivalent of >15% in fine earth fraction	Moderate	Excessive accumulation of salts

Reference Soil Group		Parent Material	Principal Soil Qualifiers		Agricultural Limitation	
Name	Description		Name	Description	Rating	Rationale
Solonetz	Soils with a high content of exchangeable Na and/ or Mg ions	Unconsolidated materials, mostly fine- textured sediments	Calcic	Calcium carbonate equivalent of >15% in fine earth fraction,	Moderate	Shallow or no surface horizon,
Arenosols	Sandy soil that is relatively young or has little profile development	Range of unconsolidated materials, including calcareous or siliceous rocks and sands.	Cambic	Very fine sand with evidence of alteration (e.g., redder hue) relative to over- and underlying layers.	Moderate	Low organic matter, low water holding capacity

a) *Calcaric (calcareous) soil material shows strong effervescence with 10% HCl in most of the fine earth. It applies to material which contains more than 2% calcium carbonate equivalent (http://www.fao.org/3/W8594E/w8594e0b.htm).*

b) *Dystric Cambisol is a soil in the Cambisol order having a base saturation of less than 50 percent (by NH4OAc) at least in some part of the B horizon (http://www.fao.org/soils-portal/data-hub/soil-classification/)*

c) *Humic Cambisol is a soil in the Cambisol order that has an umbric A horizon which is thicker than 25 cm when a cambic B horizon is lacking (http://www.fao.org/soils-portal/data-hub/soil-classification/)*

d) *Eutric Cambisol is a soil in the Cambisol order that does not meet criteria for other subgroups including Gelic, Gleyic, Vertic, Calcic, Humic, Ferralic or Chromic (http://www.fao.org/soils-portal/data-hub/soil-classification/)*

e) *The "Haplic" qualifier suggests that there are no particular soil features that deserve to be separately classified.*

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

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

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

Soil data was gathered by Worley Parsons in 2014 (locations shown in Figure 6.3-2) as part of an infrastructure siting exercise, which shows that soil local to the AoI is derived from tertiary volcanic and sedimentary materials, alluvial deposits and windblown sands. Soils are generally clay loam to loamy sand textured and include neutral, calcareous, saline and sodic soil reaction.

The Worley Parsons investigation included drilling and test pitting (Drawing 6.3-1), with soil samples taken and sent for laboratory analysis. Particle size analysis and chemical analysis were conducted on samples that were taken mostly within the upper 3 metres below ground level (mbgl) (some only in upper 0 to 1.5 m), which are indicative of the soil horizons. Table 6.3-2 below presents the results.

Table 6.3-2: Secondary Soil Data Analysis

Location	UTM Northing	UTM Easting	Pit Id	Depth (m)	Description	Particle Size Distribution (PSD) (%)				Chemical Analysis	
						Clay	Silt	Sand	Gravel		
Amosing Area	810800	237990	AMO_3	0 to 1.5	Light brown silty gravelly fine to medium grained sand. Alluvium	11	11	67	22	No sample	
	809606	238199	AWE5	0 to 3	Brown gravelly silty fine grain sand. Alluvium	16	16	17	11	No sample	
	809606	236999	AWE7	0 to 3	Reddish brown gravelly medium to coarse grained sand. Alluvium	12.6	5.2	80.5	1.7	Total Carbon (%): Organic Carbon (%): Inorganic Carbon (%): Total Alkalinity (mg/kg): Carbonate (mg/kg): Chloride (mg/kg): Sulphate (mg/kg): pH:	0.27 0.07 0.20 440 <50 <50 <50 7.9
	810806	235799	AWE10	0 to 3	Brown gravelly silty fine to medium grained sand. Alluvium	21	21	77	2	No sample	
	810806	241199	AUL2	0 to 3	Brown slightly gravelly silty fine-grained sand. Alluvium.	17.4	11.3	69.4	1.9	Total Carbon (%): Organic Carbon (%): Inorganic Carbon (%): Total Alkalinity (mg/kg): Carbonate (mg/kg): Chloride (mg/kg): Sulphate (mg/kg):	0.35 0.10 0.24 800 <50 60 100

Location	UTM Northing	UTM Easting	Pit Id	Depth (m)	Description	Particle Size Distribution (PSD) (%)				Chemical Analysis	
						Clay	Silt	Sand	Gravel		
										pH:	8.3
	810206	239999	AUL4	0 to 3	Reddish brown gravelly silty fine to medium grained sand. Alluvium.	14.9	4.3	54.5	26.3	No sample	
	812606	239399	AUL7	0 to 3	Brown slightly gravelly silty fine-grained sand. Alluvium.	8.4	7.7	80.9	2.9	No sample	
	811406	238799	AUL8	0 to 3	Brown gravelly silty fine to medium grained sand. Alluvium.	15	15	77	8	Total Carbon (%): Organic Carbon (%): Inorganic Carbon (%): Total Alkalinity (mg/kg): Carbonate (mg/kg): Chloride (mg/kg): Sulphate (mg/kg): pH:	0.18 0.12 0.06 360 <50 <50 <50 7.9
	813206	237599	AUL13	0 to 3	Brown silty gravelly medium grained sand. Alluvium.	18	18	80	2	No sample	
	812006	236999	AUL15	0 to 3	Brown silty gravelly fine to medium grained sand. Alluvium.	13	13	83	4	Total Carbon (%): Organic Carbon (%): Inorganic Carbon (%): Total Alkalinity (mg/kg): Carbonate (mg/kg): Chloride (mg/kg): Sulphate (mg/kg):	0.15 0.09 0.06 400 <50 120 70

Location	UTM Northing	UTM Easting	Pit Id	Depth (m)	Description	Particle Size Distribution (PSD) (%)				Chemical Analysis	
						Clay	Silt	Sand	Gravel		
										pH:	7.8
	813806	236399	AUL20	0 to 3	Brown slightly gravelly silty fine to medium grained sand. Alluvium.	18	18	79	3	Total Carbon (%): Organic Carbon (%): Inorganic Carbon (%): Total Alkalinity (mg/kg): Carbonate (mg/kg): Chloride (mg/kg): Sulphate (mg/kg): pH:	0.16 0.07 0.10 1,320 <50 130 570 8.5
	813806	234599	AUL22	0 to 3	Brown gravelly silty fine-grained sand. Alluvium.	24	24	73	3	Total Carbon (%): Organic Carbon (%): Inorganic Carbon (%): Total Alkalinity (mg/kg): Carbonate (mg/kg): Chloride (mg/kg): Sulphate (mg/kg): pH:	0.15 0.10 0.06 440 <50 <50 50 8.0
	815006	233999	AUL24	0 to 3	Brown slightly silty gravelly medium to coarse grained sand. Alluvium.	10	10	85	5	No sample	

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

Source: Worley Parsons (2014)

The results presented in Table 6.3-2 for both the Amosing and Ngamia areas can be summarised as follows:

- Soil materials are alluvial in nature suggesting that they were deposited in moving water.
- The PSD results show that the superficial samples are predominantly light brown sands with varying amounts of gravel. Sand is the dominant particle size at all test pits across both Amosing and Ngamia wellpads and access roads. This coincides with the naturally sandy characteristics of soil which are typical of this region;
- Alkalinity values across six sites fell within the same order of magnitude with results ranging from 360 mg/kg to 800 mg/kg, with the exception of the test pit at Amosing wellpad pit AUL20 which recorded an alkalinity result of 1,320 mg/kg;
- Carbonate levels were less than the limit of detection (50 mg/kg) in each of the test pits;
- Four samples had results over the detection limit for chloride (50 mg/kg), theses samples ranged from 60 mg/kg to 340 mg/kg; and
- Five samples had results over the detection limit for sulphate (50 mg/kg), theses samples ranged from 50 mg/kg to 570 mg/kg.

The pH results for all seven samples ranged from 7.8 to 8.3 indicating a tendency towards alkalinity for soils across all test pits presented. The laboratory results are consistent with the soil taxonomic classes mapped in Section 6.3.1.

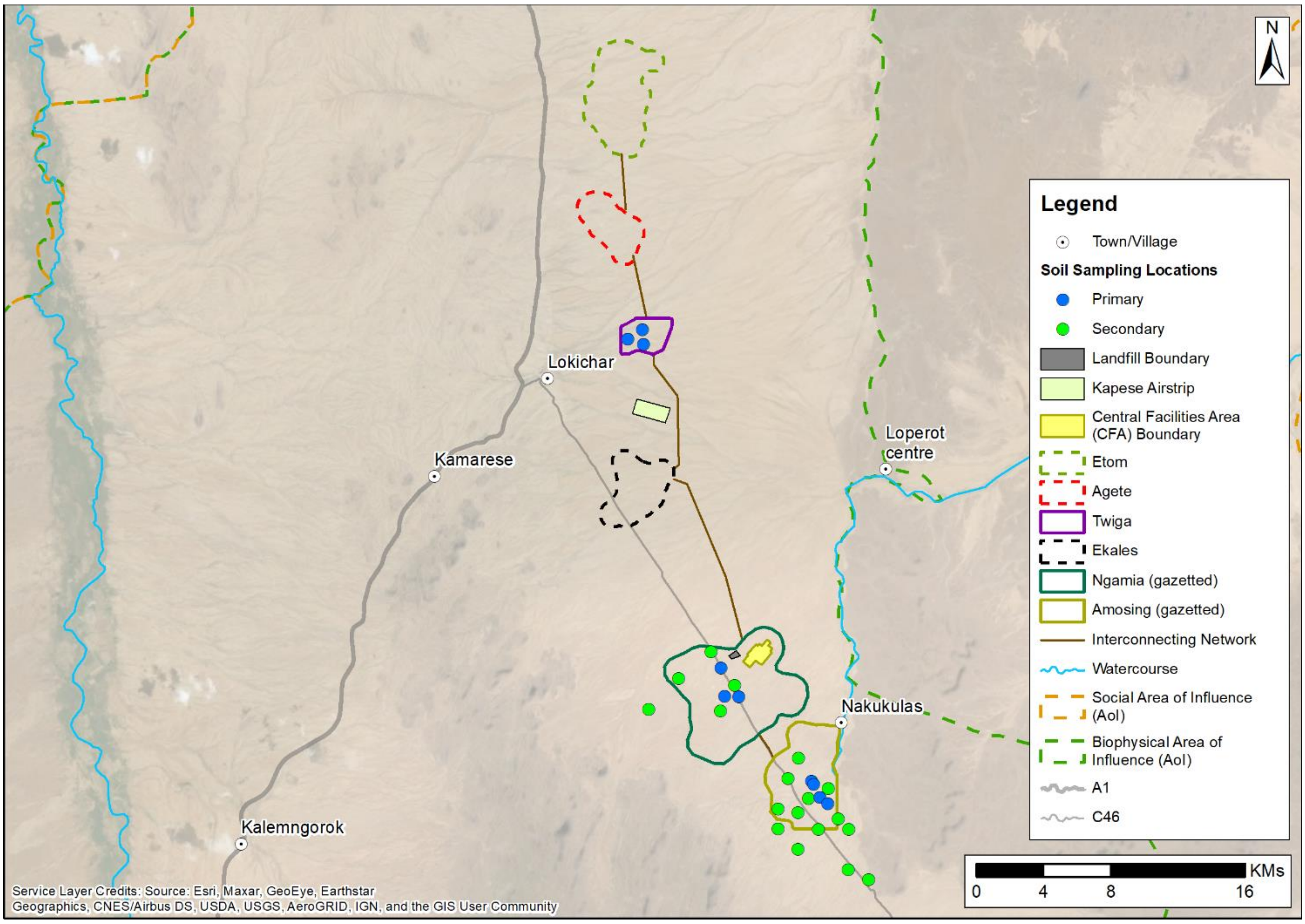

Figure 6.3-2: Primary and Secondary Soil Sampling Locations

6.3.2 Primary Data Gathering

In addition, as part of the baseline water studies, infiltration tests were completed. Primary soil data gathering was completed on behalf of Golder by SGS Kenya Ltd. in March 2019.

6.3.2.1 Methods

Infiltration Tests

Infiltration tests[1] were carried out by the Golder team around the Ngamia and Amosing areas between 29 and 31 May 2016 (full description in Section 6.8 Water Quality).

Soil Tests

Soil samples were gathered by SGS Kenya Ltd. in March 2019. The SGS investigation comprised the collection of surface soil samples (topsoil) at several Golder specified locations (locations shown in Figure 6.3-2). Particle size analysis and chemical analysis was conducted on samples taken from within the upper 0 to 1 m mbgl, which are indicative of the topsoil horizon. Specific determinands included:

- Total Organic Carbon (percent by weight (w/w %));
- pH (in potassium chloride (KCl) solution);
- Electrical Conductivity (deciSiemens per meter (dS/m));
- Hydrocarbons (benzene, toluene, ethylene, xylenes (sum), total petroleum hydrocarbons (TPH) C6 – C44);
- Metals (Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), Aluminium (Al), Iron (Fe), Manganese (Mn), Barium (Ba), Lead (Pb), Silicon (Si); and
- PSD.

6.3.3 Results

Infiltration Tests

Results of the infiltration tests in the Ngamia area show that the hydraulic conductivity of the area is between 8 – 9 x 10^{-5} m/s, which is indicative of medium to coarse sandy material. Results from Test 3 (Amosing area) revealed a lower hydraulic conductivity of 2.6 x 10^{-5} m/s, which is more indicative of sandy loam, fine sand soils (Stibinger, 2014).

Soil Analysis

Table 6.3-3 below presents the results from the full analysis completed.

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

Table 6.3-3: Primary Soil Data Analysis

Location	Sample ID	UTM Easting	UTM Northing	Depth (m)	Description and Textural Class	Particle Size Distribution (%)			Chemical Analysis	
						Clay	Sand	Silt		
Ngamia Area	Golder soil 1	806413	244840	0.20-0.50	Subsoil Sandy	Nil	92.5	7.5	Benzene (µg/kg)	<10
									Toluene (µg/kg)	<10
									Ethylbenzene (µg/kg)	<10
									Xylenes (sum) (µg/kg)	<20
									TPH C6 - C44 (mg/kg)	<1.0
									Calcium (mg/kg)	3,218
									Magnesium (mg/kg)	3,193
									Sodium (mg/kg)	210
									Potassium (mg/kg)	3,152
									Aluminium (mg/kg)	13,620
									Iron (mg/kg)	17,610
									Manganese (Mn)(mg/kg)	410
									Barium (mg/kg)	96
									Lead (mg/kg)	31
									Silica (mg/kg)	570
									Organic Carbon (%)	0.05
									pH	7.11
	Golder soil 2	807260	244816	0.0-0.05	Surface soil Sandy	Nil	100.0	Nil	Benzene (µg/kg)	<10
									Toluene (µg/kg)	<10
									Ethylbenzene (µg/kg)	<10
									Xylenes (sum) (µg/kg)	<20
									TPH C6 - C44 (mg/kg)	<1.0
									Calcium (mg/kg)	4,126

Location	Sample ID	UTM Easting	UTM Northing	Depth (m)	Description and Textural Class	Particle Size Distribution (%)			Chemical Analysis	
						Clay	Sand	Silt		
									Magnesium (mg/kg)	2,985
									Sodium (mg/kg)	148
									Potassium (mg/kg)	2,396
									Aluminium (mg/kg)	9477
									Iron (mg/kg)	20,502
									Manganese (Mn) (mg/kg)	299
									Barium (mg/kg)	106
									Lead (mg/kg)	41
									Silica (mg/kg)	706
									Organic Carbon (%)	0.03
									pH	7.89
	Golder soil 3	806202	246529	0.0-0.05	Surface soil Sandy	Nil	92.5	7.5	Benzene (µg/kg)	<10
									Toluene (µg/kg)	<10
									Ethylbenzene (µg/kg)	<10
									Xylenes (sum) (µg/kg)	<20
									TPH C6 - C44 (mg/kg)	<1.0
									Calcium (mg/kg)	3,479
									Magnesium (mg/kg)	2,239
									Sodium (mg/kg)	232
									Potassium (mg/kg)	1,772
									Aluminium (mg/kg)	7,868
									Iron (mg/kg)	14,119
									Manganese (Mn) (mg/kg)	281
									Barium (mg/kg)	78
									Lead (mg/kg)	32

Location	Sample ID	UTM Easting	UTM Northing	Depth (m)	Description and Textural Class	Particle Size Distribution (%)			Chemical Analysis	
						Clay	Sand	Silt		
									Silica (mg/kg)	606
									Organic Carbon (%)	0.04
									pH	7.65
Amosing Area	Golder soil 4	811605	239850	0.20-0.50	Subsoil Loamy Sand	Nil	80.1	19.9	Benzene (µg/kg)	<10
									Toluene (µg/kg)	<10
									Ethylbenzene (µg/kg)	<10
									Xylenes (sum) (µg/kg)	<20
									TPH C6 - C44 (mg/kg)	<1.0
									Calcium (mg/kg)	4,960
									Magnesium (mg/kg)	4,766
									Sodium (mg/kg)	430
									Potassium (mg/kg)	3,840
									Aluminium (mg/kg)	21,966
									Iron (mg/kg)	24,251
									Manganese (Mn) (mg/kg)	517
									Barium (mg/kg)	133
									Lead (mg/kg)	84
									Silica (mg/kg)	449
									Organic Carbon (%)	0.05
									pH	7.52
	Golder soil 5	811716	239641	0.0-0.05	Surface soil Sandy	Nil	97.5	2.5	Benzene (µg/kg)	<10
									Toluene (µg/kg)	<10
									Ethylbenzene (µg/kg)	<10
									Xylenes (sum) (µg/kg)	<20

Location	Sample ID	UTM Easting	UTM Northing	Depth (m)	Description and Textural Class	Particle Size Distribution (%)			Chemical Analysis	
						Clay	Sand	Silt		
									TPH C6 - C44 (mg/kg)	<1.0
									Calcium (mg/kg)	6,099
									Magnesium (mg/kg)	2,552
									Sodium (mg/kg)	247
									Potassium (mg/kg)	1,553
									Aluminium (mg/kg)	5,513
									Iron (mg/kg)	13,474
									Manganese (Mn) (mg/kg)	212
									Barium (mg/kg)	84
									Lead (mg/kg)	48
									Silica (mg/kg)	316
									Organic Carbon (%)	0.01
									pH	7.63
	Golder soil 6	812091	238889	0.0-0.05	Surface soil Sandy	Nil	85.1	14.9	Benzene (µg/kg)	<10
									Toluene (µg/kg)	<10
									Ethylbenzene (µg/kg)	<10
									Xylenes (sum) (µg/kg)	<20
									TPH C6 - C44 (mg/kg)	<1.0
									Calcium (mg/kg)	4,693
									Magnesium (mg/kg)	4,834
									Sodium (mg/kg)	274
									Potassium (mg/kg)	4,402
									Aluminium (mg/kg)	16,339
									Iron (mg/kg)	21,470
									Manganese (Mn) (mg/kg)	514

Location	Sample ID	UTM Easting	UTM Northing	Depth (m)	Description and Textural Class	Particle Size Distribution (%)			Chemical Analysis	
						Clay	Sand	Silt		
									Barium (mg/kg)	164
									Lead (mg/kg)	66
									Silica (mg/kg)	815
									Organic Carbon (%)	0.03
									pH	7.41
	Golder soil 7	812571	238513	0.0-0.05	Surface soil Loamy Sand	Nil	77.5	22.5	Benzene (µg/kg)	<10
									Toluene (µg/kg)	<10
									Ethylbenzene (µg/kg)	<10
									Xylenes (sum) (µg/kg)	<20
									TPH C6 - C44 (mg/kg)	<1.0
									Calcium (mg/kg)	5,837
									Magnesium (mg/kg)	5,014
									Sodium (mg/kg)	375
									Potassium (mg/kg)	5,015
									Aluminium (mg/kg)	17,481
									Iron (mg/kg)	23,172
									Manganese (Mn) (mg/kg)	540
									Barium (mg/kg)	199
									Lead (mg/kg)	52
									Silica (mg/kg)	1,691
									Organic Carbon (%)	0.04
									pH	7.03
Twiga Area	Golder soil 8	801550	265694	0.20-0.50	Subsoil Loamy Sand	Nil	80.0	20.0	Benzene (µg/kg)	<10
									Toluene (µg/kg)	<10

Location	Sample ID	UTM Easting	UTM Northing	Depth (m)	Description and Textural Class	Particle Size Distribution (%)			Chemical Analysis	
						Clay	Sand	Silt		
									Ethylbenzene (µg/kg)	<10
									Xylenes (sum) (µg/kg)	<20
									TPH C6 - C44 (mg/kg)	<1.0
									Calcium (mg/kg)	4,204
									Magnesium (mg/kg)	4,138
									Sodium (mg/kg)	289
									Potassium (mg/kg)	3,680
									Aluminium (mg/kg)	17,360
									Iron (mg/kg)	21,234
									Manganese (Mn) (mg/kg)	472
									Barium (mg/kg)	95
									Lead (mg/kg)	55
									Silica (mg/kg)	458
									Organic Carbon (%)	0.05
									pH	7.18
	Golder soil 9	801486	266557	0.0-0.05	Surface soil Sandy Loam	Nil	52.5	47.5	Benzene (µg/kg)	<10
									Toluene (µg/kg)	<10
									Ethylbenzene (µg/kg)	<10
									Xylenes (sum) (µg/kg)	<20
									TPH C6 - C44 (mg/kg)	<1.0
									Calcium (mg/kg)	19,972
									Magnesium (mg/kg)	8,712
									Sodium (mg/kg)	612
									Potassium (mg/kg)	10,345
									Aluminium (mg/kg)	34,444

Location	Sample ID	UTM Easting	UTM Northing	Depth (m)	Description and Textural Class	Particle Size Distribution (%)			Chemical Analysis	
						Clay	Sand	Silt		
									Iron (mg/kg)	38,790
									Manganese (Mn) (mg/kg)	910
									Barium (mg/kg)	311
									Lead (mg/kg)	95
									Silica (mg/kg)	2,470
									Organic Carbon (%)	0.08
									pH	7.77
	Golder soil 10	800603	265988	0.0-0.05	Surface soil Sandy	Nil	95.0	5.0	Benzene (µg/kg)	<10
									Toluene (µg/kg)	<10
									Ethylbenzene (µg/kg)	<10
									Xylenes (sum) (µg/kg)	<20
									TPH C6 - C44 (mg/kg)	<1.0
									Calcium (mg/kg)	2,839
									Magnesium (mg/kg)	2,157
									Sodium (mg/kg)	209
									Potassium (mg/kg)	1,454
									Aluminium (mg/kg)	7,412
									Iron (mg/kg)	9,883
									Manganese (Mn) (mg/kg)	253
									Barium (mg/kg)	53
									Lead (mg/kg)	20
									Silica (mg/kg)	551
									Organic Carbon (%)	0.02
									pH	7.77

The results presented in Table 6.3-3 can be summarised as follows:

- The PSD results were conducted for every Ngamia, Amosing and Twiga test pit. Results highlight that these soils are generally sandy to loamy sand in texture, with sand being the dominant particle size at all test pits. Particularly sandy topsoil was observed at Ngamia. This coincides with the dominantly sandy characteristics of soil which are typical of this region;
- No elevated hydrocarbon concentrations were identified in any of the 10 topsoil samples, with results below their respective limits of detection;
- Low organic carbon levels were identified in the soil results, ranging from 0.01% to 0.08%; and
- The pH results for all 10 samples ranged from 7.03 to 7.89 indicating a slight tendency towards alkalinity for soils across the sample locations. These values are slightly lower than those identified in Table 6.3-2 (Worley Parsons 2014).

6.3.4 Discussion

Based on the available data sources presented above, the following characterisation can be defined for soil in the AoI:

- The area is characterised by typical desert-like sandy soils with some, minimal areas of clay loam;
- Sand is the dominant particle size at all test pits, which coincides with the dominantly sandy characteristics of soil which are typical of this region;
- Results from infiltration tests undertaken near to the Ngamia area are indicative of a fine- to medium-sandy soils, whilst results from the infiltration test undertaken near the Amosing and Twiga areas are indicative of a loamy sand to sandy soils.
- Chemical analysis show that total carbon, organic carbon and inorganic carbon values are low across areas all test pits, which reflects the naturally very low soil organic matter content of soils in the region.

Given the uniformity of Regosols across the proposed wellfield areas, it is considered that the secondary and primary soil analysis data that has been captured for Twiga, Amosing and Ngamia is sufficiently representative to provide an accurate characterisation of the soils in these areas. The scope and scale of primary and secondary soil analysis are considered to be proportionate to the potential sensitivity of the receptor and likely environmental impacts and are, therefore, sufficient for the purposes of impact assessment.

6.4 Weather and Climate

The meteorological conditions were determined with a focus on the AoI through on-site monitoring (primary data) at Kapese and Ngamia and with reference to existing meteorological data from the wider region (secondary data) at Lodwar as well as Mesoscale Model Interface Program (MMIF) Modelled Data, generated for the global dataset.

6.4.1 Secondary Data

Table 6.4-1 presents station details, parameters and the period of record for the meteorological stations used as secondary data, to develop the baseline characterisation of meteorology for the Project. Secondary data were analysed and applied as regional reference for the primary data (see Section 6.4.2) gathered within the potential AoI. Figure 6.4-1 illustrates the locations of the meteorological stations presented in Table 6.4-1.

Historical data from Lodwar meteorological station were used from 1978 to 2018. Meteorological parameters measured at Lodwar included precipitation, minimum and maximum temperature, wind speed and wind direction. Lodwar meteorological station is situated approximately 85 km north of Lokichar and is the only source of secondary data within the Turkana region.

The station is operated on a part-time basis and the data availability is greatly reduced when compared with a meteorological station that is reporting once per hour. This is particularly important for rainfall which is presented as the total as rainfall data for part-time stations may not report correct annual totals. Therefore, Lodwar meteorological data should only be regarded as providing a general regional context, and rainfall totals as representing the minimum amount of rainfall recorded given that there is missing data.

The MMIF converts prognostic meteorological model output fields to the parameters and formats required for direct input into dispersion models. Data is generated for a specific location based on global datasets. This data has been acquired for the use in ESIA modelling, however, is presented here as a reference point of comparison with regional and local data. The MMIF data is based on five-years of surface and profile meteorological data (2014 to 2018) which was provided using Weather Research and Forecasting (WRF) data.

Table 6.4-1: Secondary Data Station Details

Name	Station Type	Coordinates		Elevation (masl)	Parameter used	Period of record used
		Latitude	Longitude			
Lodwar	Meteorological Station	3.12	35.61	523	Daily maximum temperature	2008-2013
					Daily minimum temperature	2008-2013
					Daily total precipitation 1	1978-1988, 2004-2015
					Total annual precipitation	2016-2018
					Daily average wind speed	2008-2013
					Daily average wind direction	2008-2013
MMIF Version 3.4		2.23	35.77	n/a	Hourly total precipitation	2014 - 2018

Name	Station Type	Coordinates		Elevation (masl)	Parameter used	Period of record used
		Latitude	Longitude			
	Modelled Meteorological Data				Hourly average temperature	2014 - 2018
					Hourly average relative humidity	2014 - 2018
					Hourly average wind speed	2014 - 2018
					Hourly average wind direction	2014 - 2018

Note: [1]1973-1977 and 1989-2003 rainfall data excluded due to missing data.

6.4.2 Primary Data

6.4.2.1 Meteorological Station Setup

The following two meteorological stations were supplied by Campbell Scientific and installed by a contractor (employed by the Operator) between December 2015 and January 2016 within the AoI:

- Kapese meteorological station located at Kapese Integrated Support Base accommodation unit, situated at an altitude of approximately 700 metres above sea level (masl); and
- Ngamia meteorological station at Ngamia 8 wellpad, situated at an altitude of approximately 730 masl.

The meteorological stations comprise a general research-grade station mounted on a 10 m mast. Figure 6.4-1 shows the location of the on-site meteorological stations in relation to the secondary data locations from the wider region. Figure 6.4-2 presents a photograph of the meteorological station located at Ngamia 8. The sensors installed and meteorological parameters recorded on an hourly basis at each on-site station are presented in Table 6.4-2

Table 6.4-2: Kapese and Ngamia Meteorological Station Details

Component	Model name	Meteorological Parameter Measured	Unit
Temperature and relative humidity probe (air)	CS215-L	Average air temperature	Degrees Celsius (°C)
		Relative humidity	Percentage (%)
Barometer	Vaisala PTB110	Barometric pressure	Millibars (mbar)
n/a (calculated)	n/a	Evapotranspiration	Millimetres (mm)
Rain gauge	n/a	Precipitation	Millimetres (mm)
n/a (calculated)	n/a	Calculated clear sky solar radiation	Megajoules per metre squared (MJ/m^2)
Pyranometer	Li-200R M200	Solar radiation (total)	Megajoules per metre squared (MJ/m^2)
		Solar radiation (average)	Watts per metre squared (W/m^2)

Component	Model name	Meteorological Parameter Measured	Unit
Temperature probe (soil at 1.5m)	107-L	Soil temperature at 1.5 m depth	Degrees Celsius (°C)
Temperature probe (soil at 0.5m)	107-L	Soil temperature at 0.5 m depth	Degrees Celsius (°C)
Wind direction and speed	05103-L RM Young	Wind direction	Degrees Celsius (°)
		Wind direction standard deviation	Degrees Celsius (°)
		Maximum wind speed	Metres per second (m/s)
		Average wind speed	Metres per second (m/s)

The Operator provided the primary meteorological data. A detailed description of calibration procedures, data logging frequency, quality assurance and control plans, as well as inspection and maintenance plans are described in the Operator’s Quality Assurance/Quality Control and Maintenance Plan (TKBV, 2016b).

All sensor calibrations expired on 01 October 2017 (TKBV, 2016b). Recalibration was completed by a qualified engineer on 22 September 2018 on all sensors producing data which is reported in this baseline. All sensors were found to be in calibration which validates the monitoring data included in this assessment.

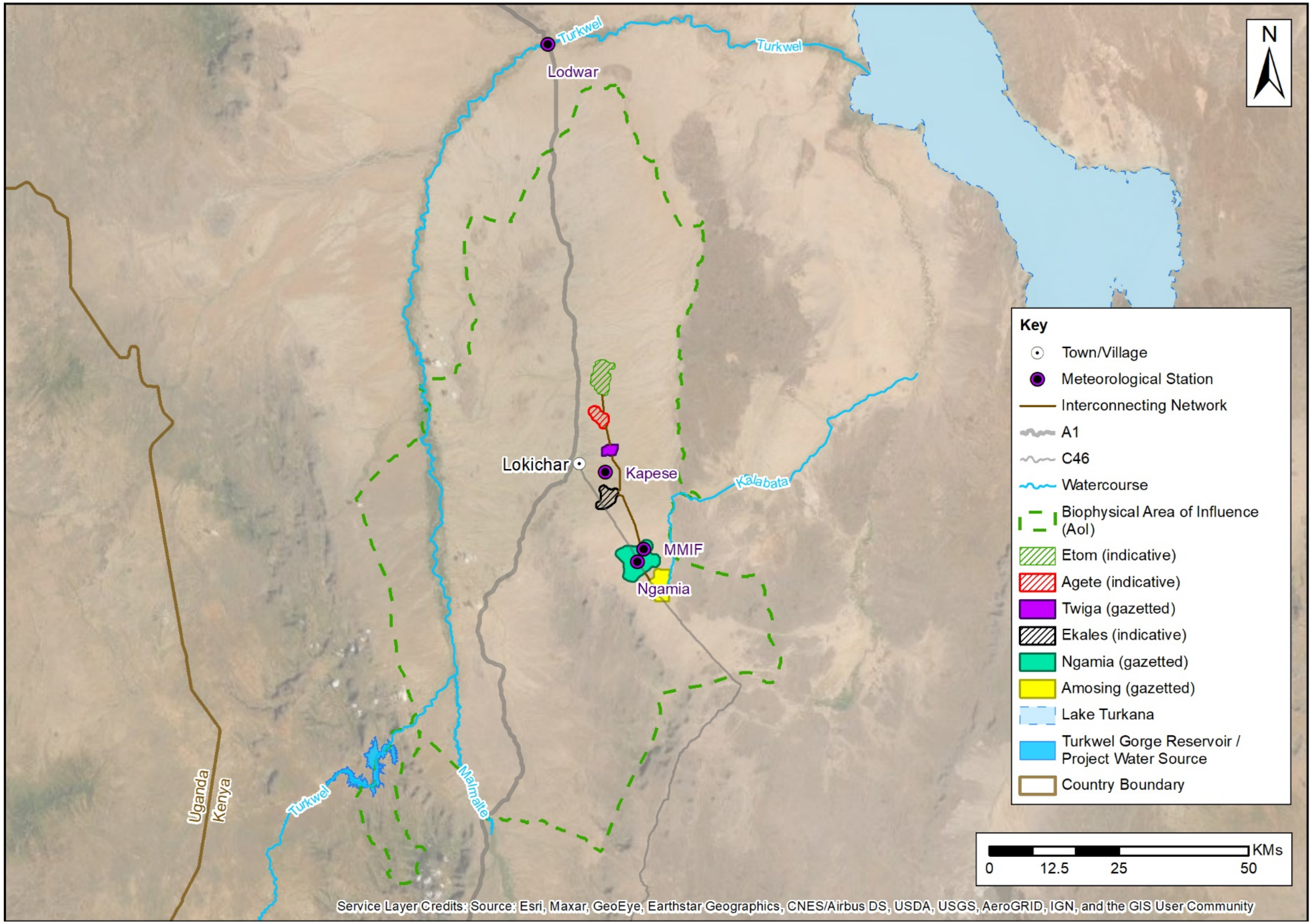

Figure 6.4-1: Kapese and Ngamia Met Station, in Relation to Secondary Data Sources

Figure 6.4-2: Ngamia Meteorological Station

6.4.2.2 Method

The following key meteorological parameters have been considered in this assessment to describe meteorological baseline conditions in the AoI:

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

For all parameters, except for total precipitation and wind direction, monthly averages as well as monthly minimum and maximum values (based on hourly data) were calculated and plotted. For total precipitation, the monthly total sum was calculated and plotted. Only months with less than 35% of missing data were included in the analysis. Wind direction was plotted in conjunction with wind speed as wind roses covering all available data in the entire period of data analysis. Total annual precipitation and average annual temperatures were calculated for years with less than 35% of missing data to further characterise the primary data in its regional context. Results are tabulated in Annex I.

For Kapese meteorological station quality assured hourly data was provided by the Operator and analysed for the period of 01 December 2015 to 31 December 2018, with the exception of rainfall data, for which quality assured data was provided from 01 January 2016 to 31 December 2018. The months of January to July 2017 were excluded from the analysis due to missing data from all sensors. For total annual precipitation and average annual temperatures, the year of 2017 was excluded based on professional judgement, given there was >35% of the data in 2017 which could not be validated.

For Ngamia meteorological station quality assured hourly data was provided by the Operator and analysed for the period of 22 January 2016 to 31 December 2018. The months of January 2016, April to September 2017 and May to September 2018 were excluded from the analysis due to missing data. For total annual precipitation and average annual temperatures, the years of 2017 and 2018 were excluded based on professional judgement, given there was >35% of the data which could not be validated.

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

6.4.3 Results

6.4.3.1.1 Ambient Air Temperature

Over the course of the monitoring period, monthly average temperatures at Kapese meteorological station varied between 27.5°C in June and 31.0°C in February. The lowest temperature recorded was 19.7°C in June and December. The highest temperature recorded was 39.2°C in March.

Monthly average temperatures at Ngamia meteorological station varied between 28.1°C in May and 31.0°C in February. The lowest temperature recorded was 15.7°C in April. The highest temperature recorded was 40.1°C in March.

Figure 6.4-3 displays the monthly average ambient temperature as well as the minimum and maximum temperature range recorded in each month for Kapese and Ngamia meteorological stations. Also shown in Figure 6.4-3 are the MMIF modelled monthly average ambient temperatures as well as the minimum and maximum temperatures modelled in each month (based on hourly data) and Lodwar (based on daily data).

As shown in Figure 6.4-3 monthly average, minimum and maximum temperatures are relatively stable lacking strong seasonal variations. Temperatures appear slightly decreased in May, June, July and August compared to the remainder of the year. Temperatures ranges measured at Kapese, Ngamia and Lodwar are very similar. Modelled MMIF temperature data matches closely the primary monitoring data and follows the same annual pattern.

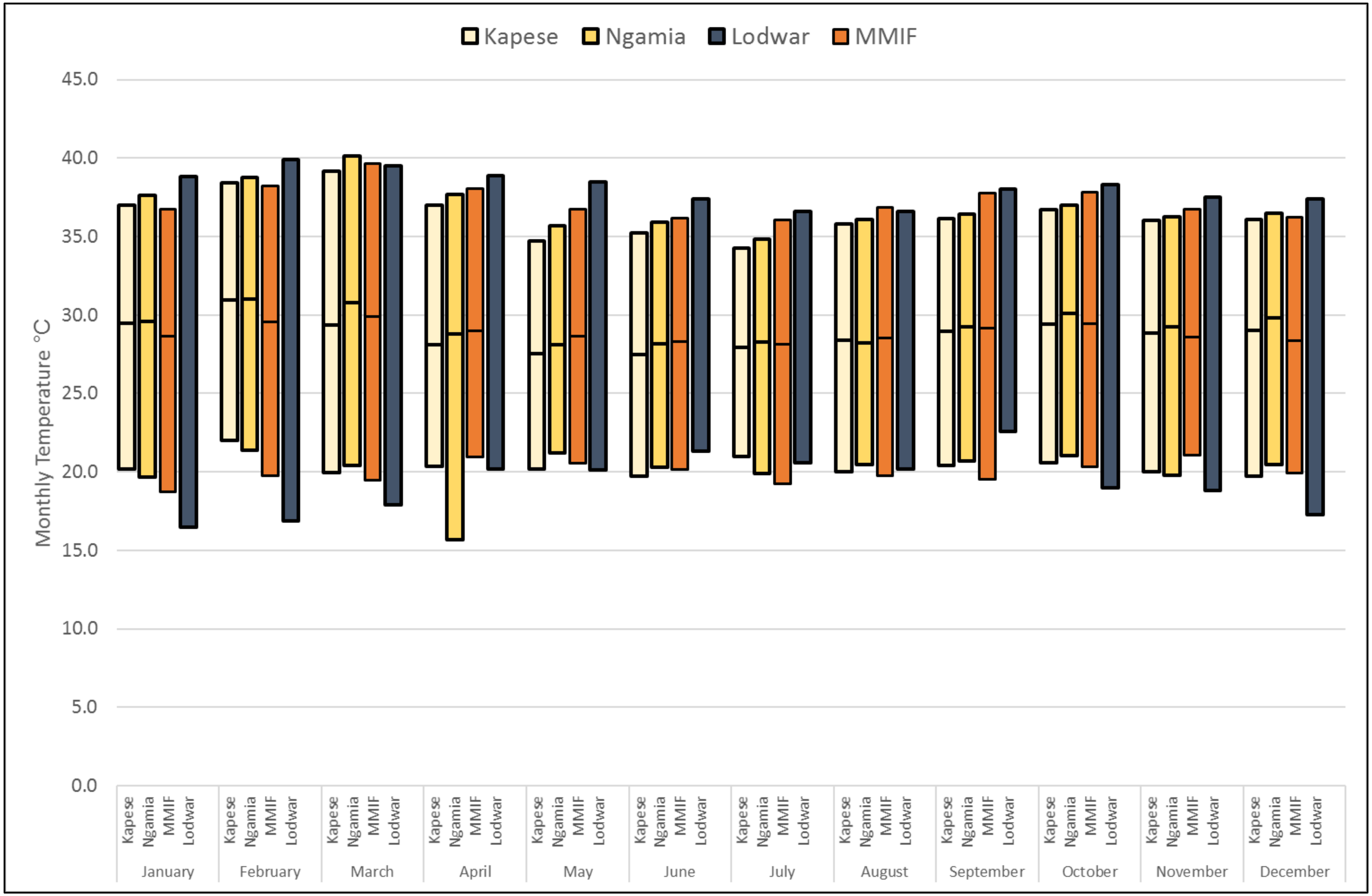

Figure 6.4-3: Average, Minimum and Maximum Monthly Temperature

6.4.3.1.2 Relative Humidity

Over the monitoring period monthly average relative humidity at Kapese meteorological station varied between 30.5% in February and 59.9% in May. The lowest relative humidity recorded was 9.6% in February. The highest relative humidity recorded was 99.4% in June.

Monthly average relative humidity at Ngamia meteorological station varied between 29.1% in January and 59.8% in May. The lowest relative humidity recorded was 9.5% in January. The highest relative humidity recorded was 98.8% in November.

Figure 6.4-4 displays the monthly average relative humidity as well as the minimum and maximum relative humidity recorded in each month for Kapese and Ngamia meteorological stations. Also shown in Figure 6.4-4 are MMIF modelled monthly average, minimum and maximum relative humidity.

As shown in Figure 6.4-4 monthly average, minimum and maximum relative humidity is very similar at Kapese and Ngamia meteorological stations. Both stations show increased relative humidity in April and May and decreased relative humidity from January to March. Modelled MMIF relative humidity data generally matches the primary monitoring data well and follows the same annual pattern.

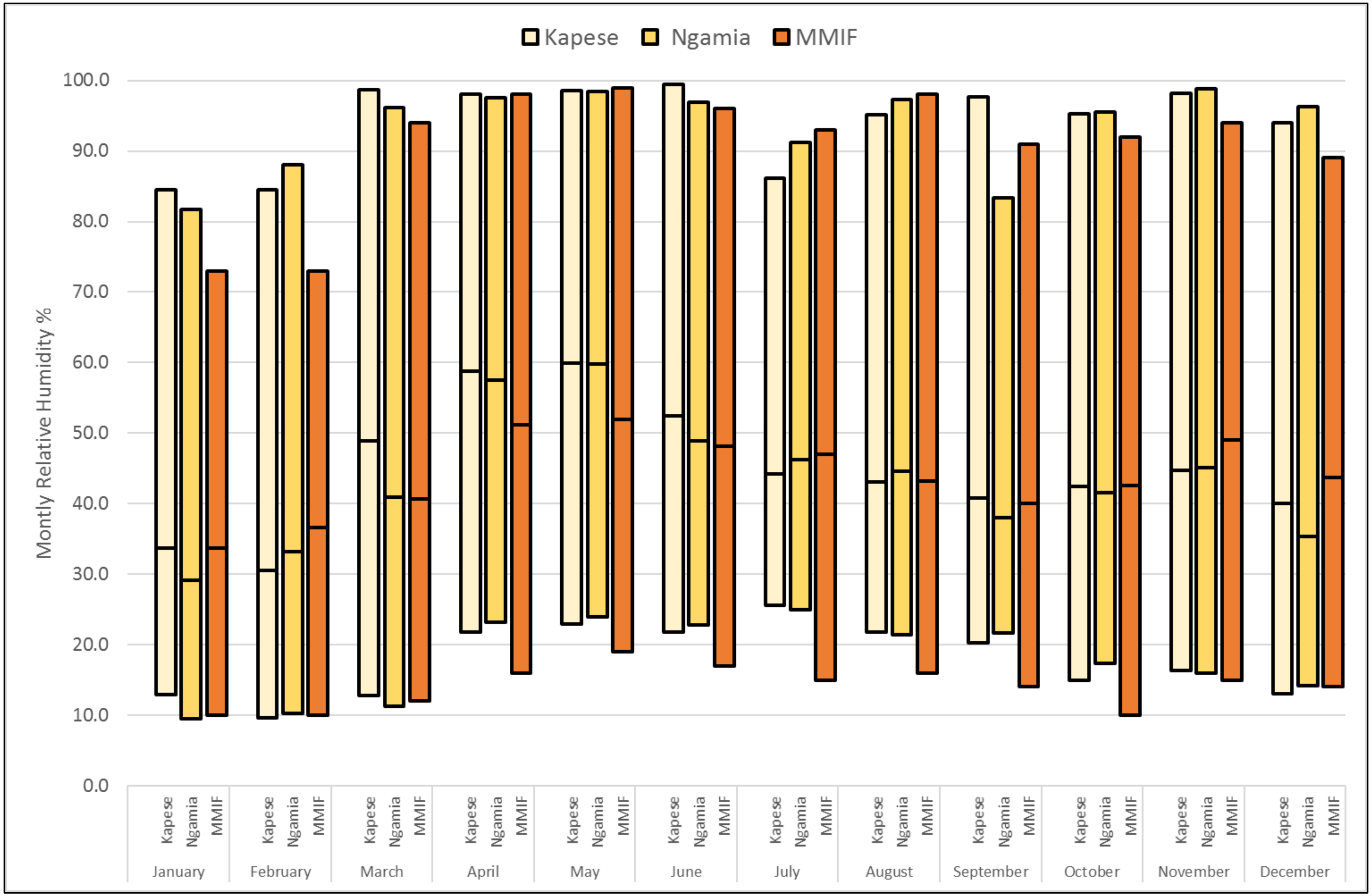

Figure 6.4-4: Minimum and Maximum Monthly Relative Humidity

6.4.3.1.3 Total Precipitation

Over the monitoring period average monthly total precipitation at Kapese meteorological station varied between 0.9 mm in February and 90.4 mm in May. The maximum daily precipitation was 59.2 mm, recorded on 04 June 2018 and the maximum intensity precipitation (1-hour total) was 34.4 mm/hr, recorded on 12 May 2016 at 03:00 am.

Average monthly total precipitation at Ngamia met station varied between 4.0 mm in September and 110.6 mm in May. The maximum daily precipitation was 44.2 mm, recorded on 07 November 2017 and the maximum intensity precipitation (1-hour total) was 39.8 mm/hr, recorded on 21 June 2016 at 15.00.

Figure 6.4-5 displays the monthly average and maximum total precipitation recorded in each month for Kapese and Ngamia meteorological stations. Also shown in Figure 6.4-5 are MMIF modelled monthly average and maximum total rainfall and monthly average as well as maximum total precipitation at Lodwar meteorological station. Maximum values are only provided where more than one month of data is available.

As shown in Figure 6.4-5 monthly total precipitation varies over the year, within years and between locations. Total precipitation at Kapese and Ngamia follow similar patterns with a distinct peak around April and May. Maximum daily and intensity precipitation events also mostly occur around this time. Modelled MMIF data shows much higher amounts of rainfall than any of the other stations, both as monthly average and as monthly maximum, however, this follows a similar annual pattern. Lodwar monthly total rainfall averaged over 34 years indicates a similar peak in precipitation as Kapese and Ngamia. The maximum monthly total precipitation at this station as compared to the average shows the variability in monthly rainfall at Lodwar on a year-to-year basis. The maximum daily precipitation at Lodwar was 182.9 mm on 21 June 1991, decreasing in the month of June.

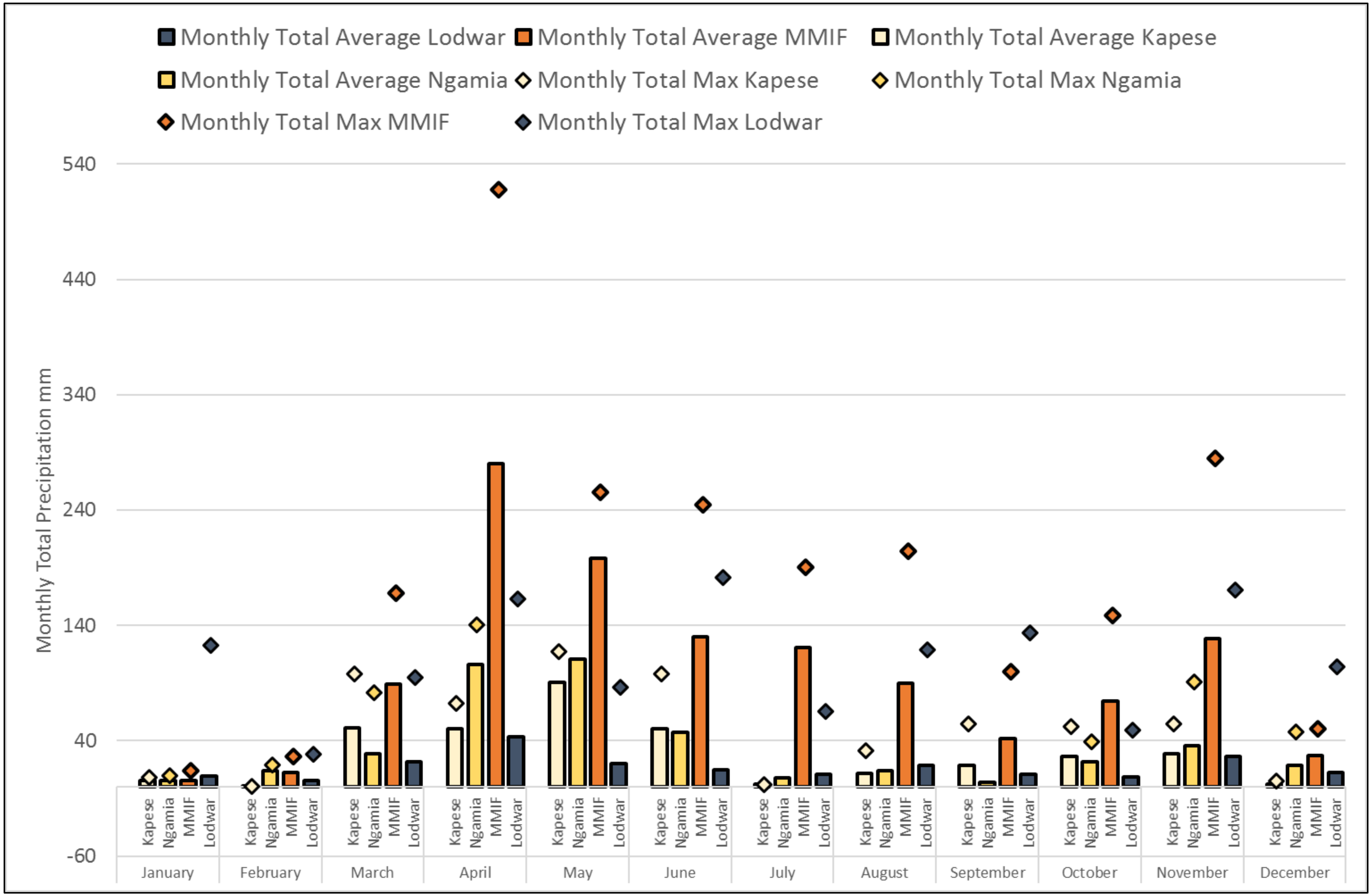

Figure 6.4-5: Average and Maximum Monthly Total Precipitation

6.4.3.1.4 Wind Speed

Over the monitoring period monthly average wind speed at Kapese meteorological station varied between 2.0 m/s in May and 3.1 m/s in February. The highest average wind speed recorded was 8.7 m/s in April.

Monthly average wind speed at Ngamia meteorological station varied between 1.8 m/s in May and 2.9 m/s in February and December. The highest average wind speed recorded was 7.4 m/s in March.

Figure 6.4-6 displays the monthly average wind speed as well as the minimum and maximum wind speed recorded in each month for Kapese and Ngamia meteorological stations. Also shown in Figure 6.4-6 are MMIF modelled monthly average, minimum and maximum wind speed and monthly average, minimum and maximum wind speed for Lodwar (based on daily data).

According to the Quality Assurance/Quality Control and Maintenance Plan (TKBV, 2016b) wind speed data for Kapese and Ngamia is removed if it is not between 0.5 and 50 m/s as one of the quality assurance clauses to filter out erroneous values. The same wind speed threshold (i.e. removal of data outside of the 0.5 to 50 m/s range) was applied to the MMIF modelled wind data to make the calculated average wind speeds at all three stations comparable. Minimum wind speed at Lodwar is based on daily rather than hourly averages and is slightly higher for this reason.

As shown in Figure 6.4-6 both Kapese and Ngamia meteorological station data show low average wind speeds of approximately 3 m/s or less throughout the year. Maximum average wind speeds are slightly higher at Kapese than at Ngamia.

MMIF modelled monthly average wind speeds are higher (approximately double) and maximum monthly wind speeds are markedly higher compared to Kapese and Ngamia. Average and maximum monthly wind speeds at Lodwar are very similar to Kapese and Ngamia throughout the year.

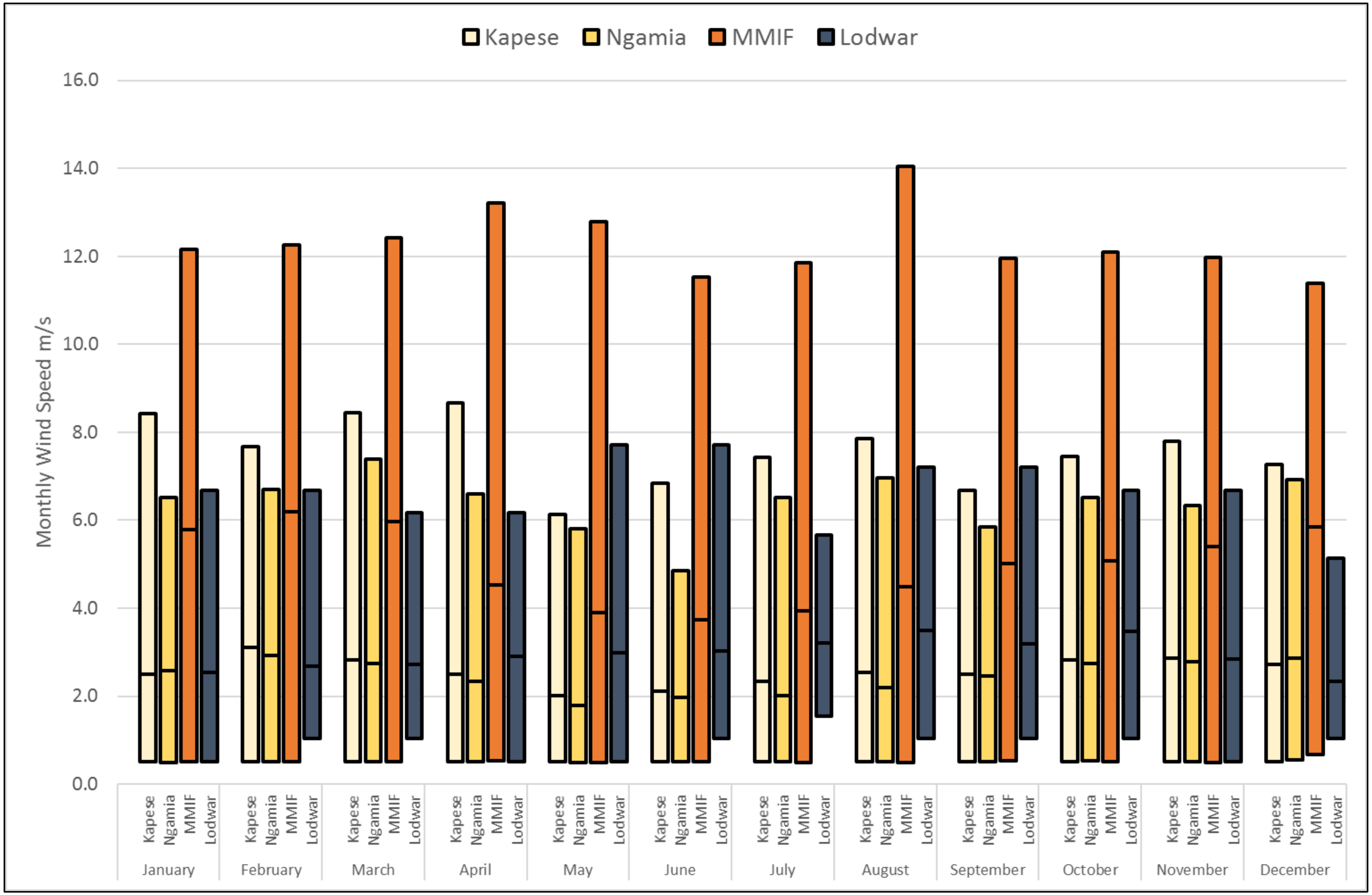

Figure 6.4-6: Average, Minimum and Maximum Monthly Wind Speed

6.4.3.1.5 Wind Direction

Figure 6.4-7 displays the annual windroses for Kapese, Ngamia and Lodwar meteorological stations as well as the annual windrose based on MMIF modelled data. The windrose for Kapese and Ngamia is based on all available wind speed and direction data within the respective monitoring periods. The MMIF windrose is based on five years modelled wind speed and direction data (2014 to 2018). The windrose for Lodwar is based on six years wind speed and direction data (2009 to 2013). At Kapese and Ngamia, winds blow predominantly from north to south-easterly directions. While the prevailing wind direction at Kapese is from the east-north-east, winds from the north-east and south-east or south-south-east prevail at Ngamia. Easterly winds prevail at Lodwar meteorological station. Easterly winds also prevail in the windrose based on modelled MMIF data; however, wind speeds are higher overall.

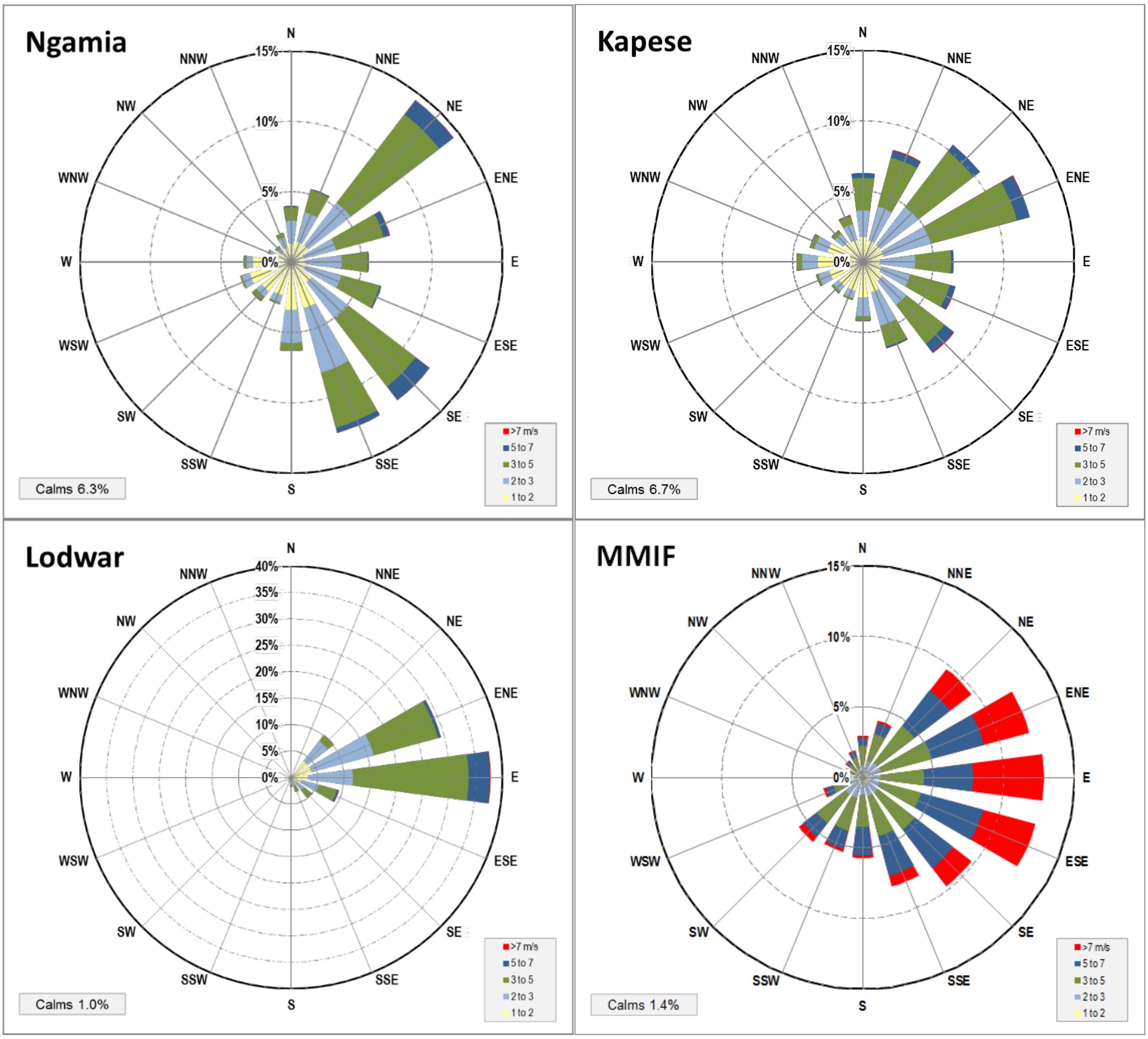

Figure 6.4-7: Windroses for Kapese, Ngamia, and Lodwar

6.4.4 Regional Context and Trends

Figure 6.4-8 displays the annual total precipitation recorded at Lodwar meteorological station between 1973 and 2018, Kapese met station in 2016 and 2018 and Ngamia met station in 2016[1]. Total annual precipitation at both Kapese and Ngamia meteorological stations in 2016 was slightly above the average annual precipitation for Lodwar between 1978 and 2014, however, within the range of typical inter-annual variations. In 2018, Kapese meteorological station data indicates a wet year in comparison to Lodwar averages, however total annual precipitation at Kapese does not exceed historic maximum values recorded at Lodwar. As detailed in Chapter 6.0, annual rainfall totals for Lodwar represent the minimum amount of rainfall recorded given that there may be missing data.

MMIF modelled data assumes markedly higher rainfall than recorded at Kapese, Ngamia and Lodwar meteorological stations. Due to the warm desert climate at the AoI, the MMIF modelled rainfall may over-estimate actual rainfall in the area.

The county of Turkana generally received a higher than normal rainfall during the 2018 long rains season. The north-western, south-western and northern parts of the county received over 350% of the normal rainfall while the rest of the county received between 140-200% of normal rainfall (KFSSG and CSG, 2018). The second half of 2018 however, was reported to be dry in Turkana. The cumulative rainfall received by Turkana for the period commencing August 2018 to January 2019 was lower than the 12-year long term average cumulative rainfall for the same period by 66.3 mm, i.e. Turkana only received 36% of the rainfall normally received from August 2018 to January 2019 (NDMA, 2019a).

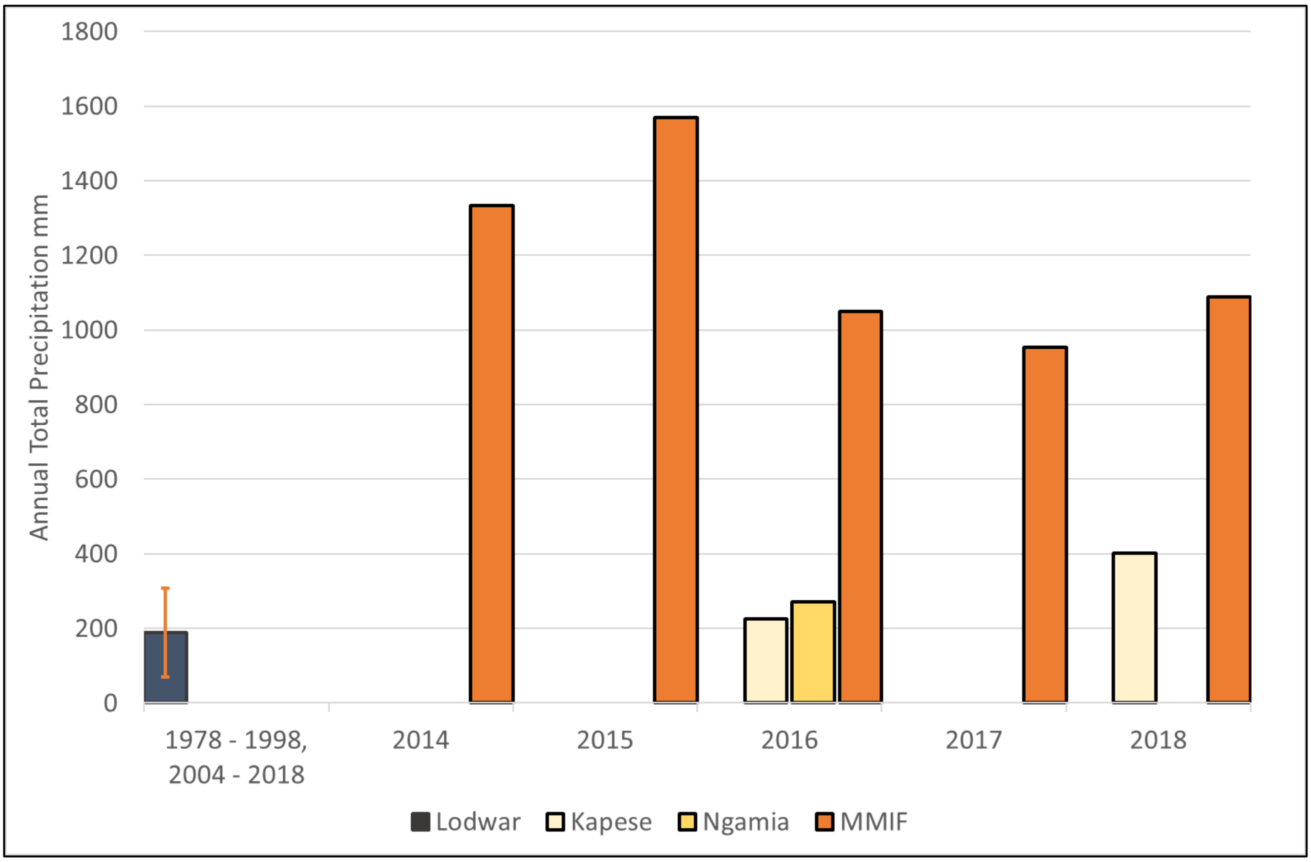

Figure 6.4-8: Total Annual Precipitation for Lodwar, Kapese and Ngami and MMIF Modelled Data

[1] annual figures only included where less than 35% of annual data was missing

Figure 6.4-9 displays the average annual temperature and standard deviation reported for Lodwar meteorological station for the time period 1990 to 2014 (Ashrae Handbook 2017) in comparison with annual temperatures at Kapese meteorological station in 2016 and 2018 and Ngamia meteorological station in 2016[2]. Also displayed is the MMIF predicted annual average temperature for 2014 to 2018. Annual average temperatures at Kapese and Ngamia in 2016 are comparable with the average annual temperature recorded at Lodwar between 1990 and 2014. Kapese meteorological station data indicates that 2018 was a slightly cooler year than 2016, however well within the standard deviation of the Lodwar average annual temperature 1990 to 2014. MMIF modelled data is also comparable with the data recorded at the meteorological stations at Kapese, Ngamia and Lodwar.

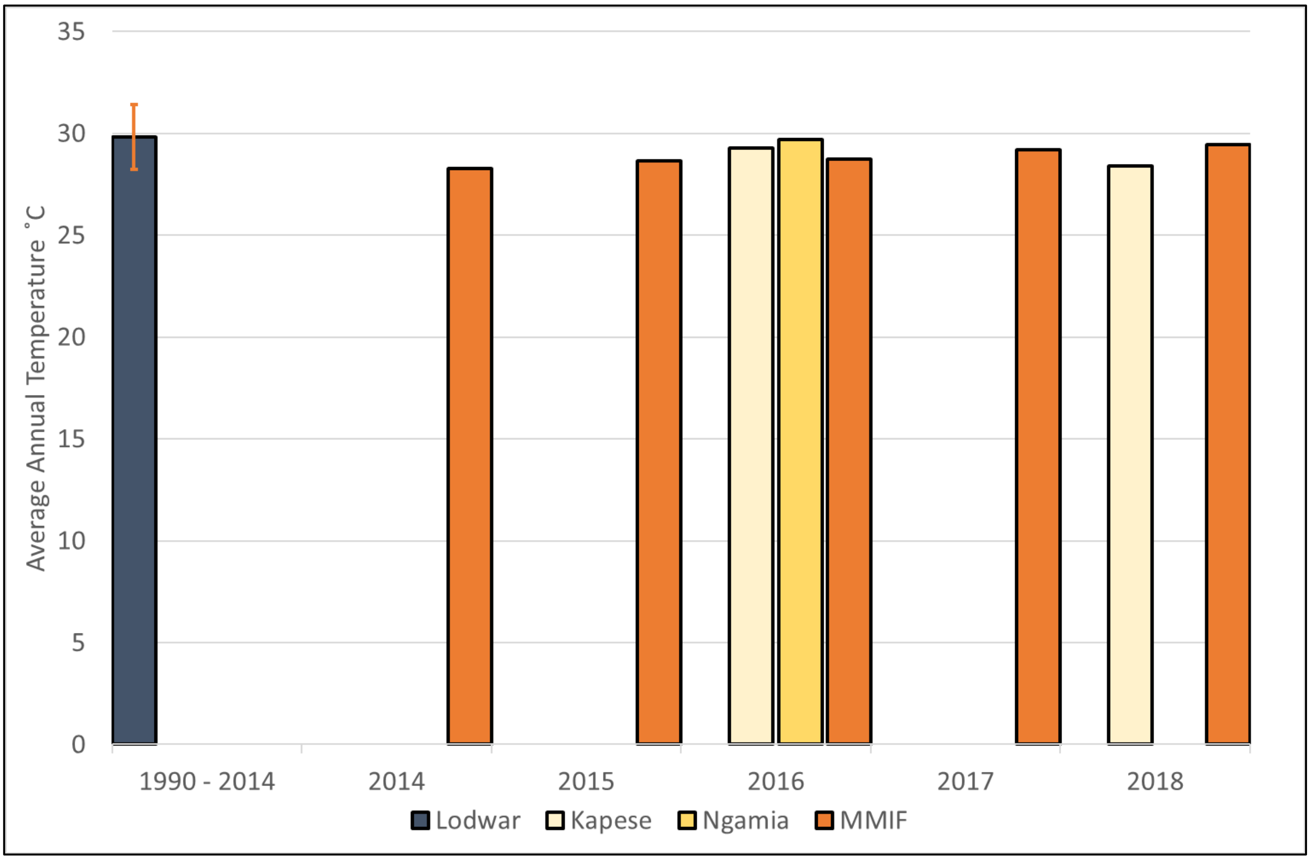

Figure 6.4-9: Annual Average Temperatures at Lodwar, Kapese and Ngamia and MMIF Modelled Data

6.4.5 Discussion - Baseline Data Gathering

The equatorial conditions in Turkana means that there is a very little annual variation in temperature. This is reflected in the high (>20°C) and stable monthly average, maximum and minimum temperatures recorded by the on-site meteorological stations in Kapese and Ngamia which are in good agreement with temperature measurements at Lodwar meteorological station as well as the MMIF modelled data (Figure 6.4-3). The warm desert climate in the AoI is also reflected in fairly low relative humidity encountered in Kapese and Ngamia during the majority of the year (Figure 6.4-4).

Most areas of equatorial eastern Africa have a double rain season between March and May and October to December as the inter-tropical convergence zone (ITCZ) passes over (Camberlin and Ookala, 2003; UK Met

[2] annual figures were only calculated for Kapese and Ngamia where less than 35% of annual data was missing

Office, 2011). The National Drought Management Authority (NDMA, 2019a) classifies the seasons in Kenya as follows:

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

Despite the generally dry conditions the ‘long rains’ of the rain season in April to June are well reflected in the peak in total precipitation and relative humidity occurring at Kapese and Ngamia as well as Lodwar during this time period (Figure 6.4-9 and Figure 6.4-9). The ‘long rains’ season coincides with the recorded maximum daily precipitation events at Kapese and Lodwar and the 1-hour intensity precipitation events at Kapese and Ngamia. There is also a secondary peak in precipitation in November during the short rains season at Kapese, Ngamia and Lodwar. The short rains season coincides with the recorded maximum daily precipitation event at Ngamia. The monthly maximum total precipitation compared to the monthly average received at Lodwar over a time period of 34 years indicates significant annual variation in the amount of rainfall received by the area. While the MMIF modelled data shows a similar annual precipitation pattern as Kapese, Ngamia and Lodwar, the modelled rainfall quantities are higher than those observed at the meteorological stations.

Average and maximum monthly wind speeds at Kapese and Ngamia are low (<3.5 m/s and <9 m/s, respectively) and do not exhibit any distinct seasonal variation. Average and maximum wind speeds at Lodwar are comparable to Kapese and Ngamia. A previous meteorological study based on Lodwar meteorological data (1957 – 2014, mixed averaging periods of 1 to12 hours) concluded that the wind climate at Lodwar is dominated by generally light easterly winds which are less than 4 m/s for approximately 50% of the time (HR Wallingford 2014). Based on the daily wind speed data 2008 to 2013 analysed for this assessment, wind speed is less than 4 m/s for approximately 33% of the time and less than 5 m/s for approximately 50% of the time. As the averaging periods of the wind speed data are different in both assessments the analyses results are not directly comparable. Results however indicate a similar wind speed regime found in both studies. Modelled MMIF data shows higher average wind speeds, and higher maximum wind speeds throughout the year.

Over equatorial eastern Africa two distinct monsoons are observed, the north-east and south-east monsoons (Okoola, 1999; UK Met Office, 2011). The north-east monsoons dominate during the Southern Hemisphere summer (December to February), while the south-east monsoons are observed during the Northern Hemisphere summer (June to August). Wind roses for Kapese, Ngamia and Lodwar as well as MMIF modelled data all indicate a prevalence of easterly winds (Figure 6.4-7). A slight shift in prevailing wind direction from east-north-east at Kapese to north-east at Ngamia may be related to local topography and the high grounds located approximately 10 km to the east of Ngamia. The Lodwar windrose is in agreement with a previous meteorological study that concluded that the prevailing wind direction at Lodwar is easterly or north-easterly, with winds from these directions occurring for over 75% of the time (HR Wallingford, 2014).

In summary, the data provided by the on-site meteorological stations reflect the local warm desert climate and is in general agreement with the secondary data from Lodwar meteorological station. Modelled MMIF data is in generally agreement with the meteorological station data however, the modelled data indicates higher precipitation than recorded at Kapese, Ngamia and Lodwar met stations throughout the year. Also, MMIF modelled monthly wind speeds are higher compared to wind speeds recorded at Kapese, Ngamia and Lodwar. The differences in actual monitoring data compared to MMIF modelled data may be the result of localised effects caused for example by local terrain, local land use or building structures in the surroundings of the meteorological stations.

6.4.6 Climate Change

6.4.6.1 Current Trends

6.4.6.1.1 Ambient Air Temperature

In Kenya, the mean annual temperature has increased by 1.0˚C since 1960 with an average rate of 0.21˚C per decade (McSweeney et al., 2010a). The decline of the Lewis Glacier on Mount Kenya which lost 40% of its mass since 1963 (MENR, 2002) is a visible indicator of the warming trend. Daily temperature observations indicate increasing trends in the frequency of hot days and hot nights with hot days or nights defined by the temperature exceeded on 10% of days or nights in the current climate of that region. Between 1960 and 2003, the number of hot days has increased in Kenya by 57 i.e. an additional 15.6% of days. Over the same time period, the number of hot nights increased by 113, i.e. an additional 31% of nights. Meanwhile the frequency of cold days and cold nights has significantly decreased by 16 (4.4%) and 42 (11.5%), respectively. Cold days or nights are defined as the temperature below which 10% of days or nights are recorded in current climate of that region or season (McSweeney et al., 2010a).

6.4.6.1.2 Precipitation

Parry et al. (2012) report changes in rainfall patterns being noticed in Kenya since the 1960 however, observations of rainfall across Kenya since 1960 do not show statistically significant trends (McSweeney et al., 2010a). Recent trends in precipitation patterns however indicate an increase in proportion of rainfall occurring in heavy events (McSweeney et al., 2010a). Further observations indicate a potential shift in monsoon patterns with a decline of rainfall during the spring long rains season and an increase of rainfall during the autumn short rains season (MENR, 2002).

6.4.6.1.3 Future Climate Projections

Future climate projection figures presented in this section are based on the UNDP Climate Change Country Profile for Kenya (McSweeney et al., 2010b). Existing climate data has been used to generate a series of country-level studies of climate observations and the multi-model projections made available through the World Climate Research Programme Coupled Model Intercomparison Experiment, Phase 3 (WCRP CMIP3). The methodology underlying the analysis for each country profile is detailed in McSweeney et al. (2010b). The climate model projections are based on the Intergovernmental Panel on Climate Change (IPCC) Special Report on Emissions Scenarios (SRES). All projections detailed below represent anomalies relative to the mean climate of 1970 – 1990 (McSweeney et al., 2010a).

6.4.6.1.4 Ambient Air Temperature

The current trend in increasing annual mean temperatures is predicted to continue with a projected increase in Kenya of 1.0 ˚C to 2.8˚C by the 2060s and 1.3 ˚C to 4.5˚C by the 2090s. In the AoI, the projected median change in mean annual temperature under the SRES A2 scenario is 1.2˚C by the 2030s, 2.5 ˚C by the 2060s and 3.8 to 3.9 ˚C by the 2090s. (McSweeney et al., 2010a).

All projections indicate a further increase in the frequency of days and nights considered hot in the current climate coupled with a decrease in the frequency of days and nights considered cold in the current climate.

Cold days and nights are expected to progressively become less frequent and do not occur at all under the highest emissions scenarios by the 2090s (McSweeney et al., 2010a).

In the AoI, the projected annual median hot day frequency under the SRES A2 scenario is 29 to 36% by the 2060s and 45 to 61% by the 2090s. The projected annual median hot night frequency under the SRES A2 scenario is 52 to 54% by the 2060s and 86 to 89% by the 2090s. The projected median cold day frequency under the SRES A2 scenario is only 3% by the 2060s and only 1% by the 2090s for the AoI. The projected annual median cold night frequency is 0% by the 2060s (McSweeney et al., 2010a).

6.4.6.1.5 Precipitation

East Africa's seasonal rainfall can be strongly influenced by the El Niño-Southern Oscillation (ENSO), however model simulations show wide disagreements in projected changed in the amplitude of future events (Christensen et al., 2007). This contributes to the uncertainty in climate projections for Kenya, in particularly in the future inter-annual variability in the region (McSweeney et al., 2010a).

Projections reported by the UNDP Climate Change Country Profile for Kenya are consistent in indicating increases in annual rainfall in Kenya. The projected increase varies with a predicted maximum of +20 mm by the 2060s and plus (+)27 mm by the 2090s. In the AoI, the projected median change under the SRES A2 scenario in precipitation is 3 to 4 mm by the 2030s, 8 to 9 mm by the 2060s and 16 to 21 mm by the 2090s (McSweeney et al., 2010a).

Consistent with trends already observed in Kenya, models also project increases in the proportion of annual rainfall that falls in heavy rainfall events. In the AoI, the median projected change under the SRES A2 scenario in % rainfall falling in heavy events is 5 to 6% by the 2060s and 11 to 12% by the 2090s (McSweeney et al., 2010a).

In addition, 1-day and 5-day rainfall annual maxima increases by the 2090s of up to 25 mm in one-day events, and 32 mm in five-day events are projected by the models for Kenya (McSweeney et al., 2010a).

However, contrary to the results of the WCRP CMIP3 presented in the UNDP study, other studies indicate a decrease in future rainfall in Kenya. Funk et al. (2010) predict that large parts of Kenya will experience more than a 100 mm decline in long rains by 2025, linking the reduction in precipitation to changes in circulation patterns over the warming Indian Ocean.

6.4.6.1.6 Climate Change Summary

Current climate trends in Kenya show that average ambient air temperatures are increasing as are the number of hot days and nights occurring each year. Conversely, the number of cold days and cold nights are showing a declining trend. Based on the analysis presented in the UNPD Climate Change Country Profile for Kenya, climate model projections predict that these trends will continue and likely intensify over the coming decades in Kenya and in the AoI (McSweeney et al., 2010a).

Current climate trends in Kenya also indicate an increase in the proportion of rainfall occurring in heavy events (McSweeney et al., 2010a; Parry et al., 2012). Further observations indicate a potential shift in monsoon patterns with a decline of rainfall during the spring 'long rains' and an increase of rainfall during the autumn short rains season (MENR, 2002).

Uncertainty in precipitation projections for Kenya arises from the wide disagreement of different climate models in the projected change in amplitude of future El Niño events. The latter strongly influence the seasonal rainfall in East Africa (McSweeney et al., 2010a). Projections presented in the UNPD Climate Change Country Profile for Kenya consistently indicate an increase in total annual rainfall both over Kenya and the AoI. In addition, the proportion of rain falling in heavy rainfall events is predicted to increase (McSweeney et al., 2010a). However, other studies predict a potential decrease in future rainfall in Kenya. Funk et al. (2010) for example predict that large parts of Kenya will experience more than a 100 mm decline in long rains by 2025, linking the reduction in precipitation to changes in circulation patterns over the warming Indian Ocean.

In summary, temperature change predictions due to climate change across different analyses are considered consistent, but changes to rainfall patterns and total rainfall are more complex to predict. The reviewed literature as summarised above suggest that design criteria should consider an increase in temperatures over the lifetime of the Project in the order of 2.5˚C up to 2060 and an increase in heavy rainfall events, in the order of 33% increase in maximum daily rainfall events (20 mm increase on a maximum daily event of 59.2 mm).

6.5 Air Quality

Baseline data collection was focused on the South Lokichar Basin within the AoI of the Project.

Primary data collection has been completed at Kapese Camp (particulate matter), Lokichar town (diffusion tube and deposited dust), Amosing 5 wellpad (diffusion tube, deposited dust and particulates), Ngamia 5/6 wellpad (diffusion tube, deposited dust and particulates), Twiga wellpad (diffusion tube, deposited dust and particulates), a wellpad in the Ekales oilfield (diffusion tube, deposited dust and particulates) and Etom 3 wellpad (diffusion tube, deposited dust and particulates).

6.5.1 Key Pollutants

A summary for each key pollutant, data which has been collected during the baseline period, is described in the following sections along with details of the specific risks to human health and the environment (WHO, 2017). The following presents the potential effects of key pollutants and justification for their inclusion in the baseline.

6.5.1.1 Nitrogen Dioxide

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

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

6.5.1.2 Sulphur Dioxide

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

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

6.5.1.3 Ozone

Excessive or elevated ozone (O_3) levels in the air can have implications for human health. Ozone has the potential to cause breathing problems, trigger asthmatic attacks, reduce lung function, and cause lung diseases (WHO, 2005).

6.5.1.4 Volatile Organic Compounds

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

Benzene, toluene, ethylbenzene and xylene (BTEX) are the VOC species considered as a standard approach to ESIA baseline. There is only an air quality standard for total VOCs[2]. As there are no standards for the other VOCs, data is collected to provide a baseline against which any change can be monitored during operations.

[2] In previous versions of the NEMA Air Quality regulations there was an annual standard for Benzene but this is no longer applicable

6.5.1.5 *Deposited Dust*

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

6.5.1.6 *Particulate Matter (PM_{10} and $PM_{2.5}$)*

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

In developing countries, exposure to pollutants from indoor combustion of solid fuels on open fires or in traditional stoves increases the risk of acute lower respiratory tract infections and associated mortality amongst young children. Indoor air pollution from solid fuel use is also a major contributing factor in the development of chronic obstructive pulmonary disease and lung cancer among adults (WHO, 2018).

6.5.2 Secondary Data

There is no known air quality data for the AoI other than the data collected as part of the ESIA baseline primary data collection.

Due to the lack of industry and sparse populations in Turkana, anthropogenic sources of potential changes to air quality are minimal.

6.5.3 Primary Data

6.5.3.1 *Methods*

Golder monitored air quality at the following seven locations across the AoI:

- Twiga-1 wellpad;
- Lokichar town;
- Kapese Camp;
- Amosing 5 wellpad;
- Ngamia 5/6 wellpad;
- Ekales wellpad; and
- Etom 3 wellpad.

Monitoring could not be undertaken at the Agete oilfield as a secure location was not available to leave the equipment for the monitoring duration.

Data is reported for each individual station alongside the average for each of the locations. Figure 6.5-1 presents these locations.

Data was collected from November 2015 to September 2016, July 2017, December 2017, December 2018, March 2019, December 2021 to February 2021, and May 2021 (see Section 6.5.4 and Chapter 3) to include consideration of all seasonality (as detailed in Section 6.4.5).

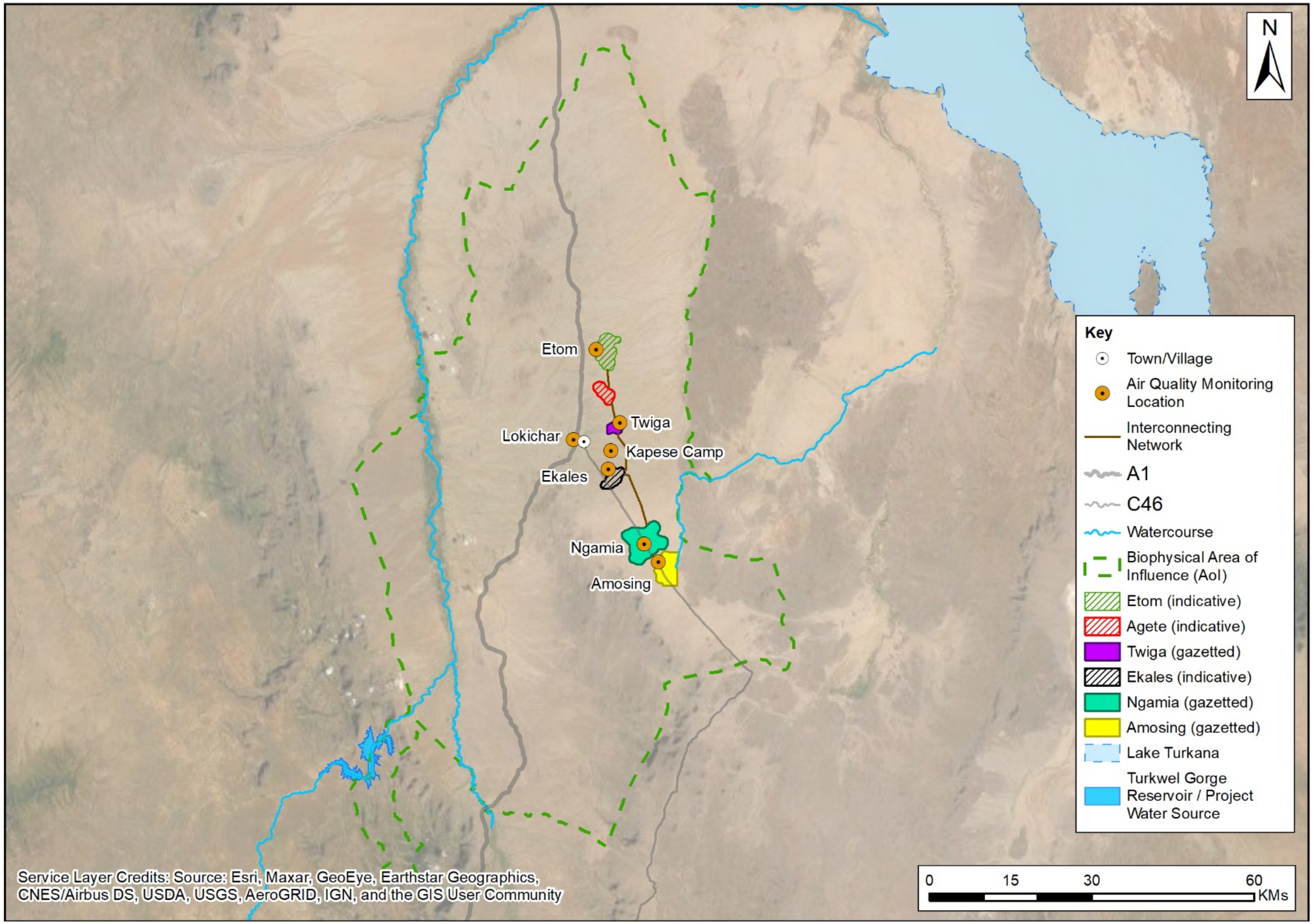

Figure 6.5-1: Air Quality Monitoring Locations

6.5.3.2 Diffusion Tubes

Substance specific diffusion tubes for NO_2, SO_2, O_3, and BTEX were deployed at the survey locations. The tubes were co-located with deposited dust gauges and placed at approximately 1.5 m above ground level to sample within the average breathing zone of humans. Monitoring at Ekales and Etom during 2020 – 2021 did not include the deployment of O_3 diffusion tubes. The existing baseline data characterises the ozone concentrations in the AoI and large differences are not anticipated between the existing and new monitoring locations due to the very low (below limit of detection) VOC levels identified throughout the AoI during the historic monitoring (ground level ozone is formed primarily from photochemical reactions between nitrogen oxides (NOx) and VOCs).

Passive diffusion tubes were exposed for approximately one-month intervals and samples were analysed by either SGS Kenya Limited, located in Nairobi or Gradko International, located in the UK, both of which are accredited laboratories. All results were provided in $\mu g/m^3$. All VOC results were reported as being below the limit of detection, this detection limit has been reported and used in this assessment.

6.5.3.3 Deposited Dust

Deposited dust samples were collected on a monthly basis alongside the passive air quality tubes using the Frisbee type deposit dust gauge collection method (Figure 6.5-2) at the monitoring locations. As no international statutory assessment standards are available for this commonly utilised monitoring technique, gauges were deployed in accordance with the manufacturer's recommendations.

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

Figure 6.5-2: Deposited Dust Gauge, Diffusion Tubes and Noise Equipment Set Up for Data Collection at Amosing

6.5.3.4 Particulate Matter

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

Particulate data collection was also undertaken using calibrated Airmetrics MiniVol portable air samplers to measure particle matter sizes 10 µm (PM_{10}) and 2.5 µm ($PM_{2.5}$). Typically, two individual units are run simultaneously to monitor both particle size fractions. At the end of the survey period, filters (which were pre-weighed prior to the monitoring period) were returned to the accredited laboratory for analysis of the mass fraction. The data covers a 24-hour monitoring period at Amosing, Ngamia and Kapese during December 2017 (although some data had to be disregarded due to an insufficient monitoring duration), Amosing, Ngamia and Twiga during December 2018 (although the Amosing and Ngamia data were disregarded due to a data error), Amosing and Ngamia during March 2019, and Ekales and Etom during December 2020.

OSIRIS monitoring could only be undertaken at one location, Kapese, due to unit power requirements. During the monitoring period Kapese was heavily influenced by elevated human activity and therefore the monitoring results are not considered to be representative of the wider Project background. The MiniVol monitoring data is considered to be representative of the wider Project background as the monitoring was undertaken at multiple locations with varying levels of anthropogenic activity.

Additional particulate data collection was planned for March 2021 but could not be undertaken due to COVID related travel restrictions.

6.5.4 Data Acquisition

Data capture was generally successful although some data gaps occurred. These gaps were short-duration and have not affected the overall objective of establishing a long-term average for the baseline.

6.5.5 Results

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

- The annual average concentration is taken as the mean of the monitored data;
- Hourly average concentration = the annual average concentration x 2;
- 24-hour average concentration = the hourly average concentration x 0.59;
- 8-hour average concentration = the hourly average concentration x 0.7;
- 15-minute average concentration = the hourly average concentration x 1.34; and
- 10-minute average concentration = the hourly average concentration x 1.65.

As an example, the monitored long-term average SO_2 concentration at Amosing for the monitoring period was 1.0 µg/m^3. The hourly average SO_2 concentration was estimated to be 2.0 µg/m^3 (i.e. 1.0 µg/m^3 x 2). Similarly, the SO_2 concentrations for the other average times were estimated as follows:

- 24-hour average concentration = 1.2 µg/m^3 (i.e. 2.0 µg/m^3 x 0.59); and
- 10-minute average concentration = 3.3 µg/m^3 (i.e. 2.0 µg/m^3 x 1.65).

Baseline average air quality concentrations for the monitored pollutants are provided for each of individual monitoring locations in Table 6.5-1 to Table 6.5-7. Concentrations in Table 6.5-8 are the average results from all monitoring locations which is deemed to be a representative baseline concentration for the AoI. Data is presented for the VOC species monitored and compared against the relevant Air Quality Standard (AQS) detailed in Annex I. The percentage of the AQS is calculated from the full results, which have been reported in this assessment to one decimal place.

Table 6.5-1: Baseline Average Air Quality Concentrations for Pollutants Monitored at Amosing

	Averaging Period	Concentration (µg/m^3, unless stated)	AQS (µg/m^3, unless stated)	Concentration as % of AQS
NO_2	Annual	0.6	40	1.6
	24-hour$^{(c)}$	0.8	188	0.4
	1-hour	1.3	200	0.6

	Averaging Period	Concentration (µg/m^3, unless stated)	AQS (µg/m^3, unless stated)	Concentration as % of AQS
SO_2	Annual	1.0	50	2.0
	24-hour[c]	1.2	20	5.8
	10-minute	3.3	500	0.7
O_3	Annual	29.8	- [a]	-
	8-hour	41.7	100	41.7
	1-hour	59.6	235	25.4
Benzene	Annual	2.1	- [a]	-
	24-hour[b] [c]	2.5	600	0.4
Toluene	Annual	2.3	- [a]	-
	24-hour[b] [c]	2.7	600	0.5
Ethylbenzene	Annual	2.5	- [a]	-
	24-hour[b] [c]	3.0	600	0.5
Xylene	Annual	2.4	- [a]	-
	24-hour[b] [c]	2.9	600	0.5
PM_{10} [d]	Annual	36.4	20	182.2
	24-hour	43	50	86
$PM_{2.5}$ [d]	Annual	17.8	10	178
	24-hour	21	25	84
Deposited Dust	24-hour	6.6	200 mg/m^2/day	3.3

a) No relevant AQS;
b) Total VOC AQS;
c) 3 exceedances of the AQS allowed; and
d) Monitored using the MiniVol sampler.

Table 6.5-2: Baseline Average Air Quality Concentrations for Pollutants Monitored at Ngamia

	Averaging Period	Concentration (µg/m^3, unless stated)	AQS (µg/m^3, unless stated)	Concentration as % of AQS
NO_2	Annual	0.9	40	2.2
	24-hour[c]	1.0	188	0.6
	1-hour	1.8	200	0.9
SO_2	Annual	1.1	50	2.3

	Averaging Period	Concentration (µg/m³, unless stated)	AQS (µg/m³, unless stated)	Concentration as % of AQS
	24-hour (c)	1.4	20	6.8
	10-minute	3.8	500	0.8
O_3	Annual	26.7	- (a)	-
	8-hour	37.4	100	37.4
	1-hour	53.4	235	22.7
Benzene	Annual	2.1	- (a)	-
	24-hour (b) (c)	2.5	600	0.4
Toluene	Annual	2.3	- (a)	-
	24-hour (b) (c)	2.7	600	0.5
Ethylbenzene	Annual	2.5	- (a)	-
	24-hour (b) (c)	3.0	600	0.5
Xylene	Annual	2.5	- (a)	-
	24-hour (b) (c)	2.9	600	0.5
PM_{10} (d)	Annual	26.3	20	131.4
	24-hour	31.0	50	62.0
$PM_{2.5}$ (d)	Annual	21.6	10	216.1
	24-hour	25.5	25	102.0
Deposited Dust	24-hour	93.1	200 mg/m²/day	46.5

a) No relevant AQS;
b) Total VOC AQS;
c) 3 exceedances of the AQS allowed; and
d) Monitored using the MiniVol sampler.

Table 6.5-3: Baseline Average Air Quality Concentrations for Pollutants Monitored at Twiga

	Averaging Period	Concentration (µg/m³, unless stated)	AQS (µg/m³, unless stated)	Concentration as % of AQS
NO_2	Annual	0.4	40	0.9
	24-hour (c)	0.4	188	0.2
	1-hour	0.7	200	0.4
SO_2	Annual	0.8	50	1.6
	24-hour (c)	0.9	20	4.6

	Averaging Period	Concentration (µg/m^3, unless stated)	AQS (µg/m^3, unless stated)	Concentration as % of AQS
	10-minute	2.6	500	0.5
O_3	Annual	36.3	- (a)	-
	8-hour	50.9	100	50.9
	1-hour	72.7	235	30.9
Benzene	Annual	2.2	- (a)	-
	24-hour(b) (c)	2.5	600	0.4
Toluene	Annual	2.3	- (a)	-
	24-hour(b) (c)	2.7	600	0.5
Ethylbenzene	Annual	2.5	- (a)	-
	24-hour(b) (c)	3.0	600	0.5
Xylene	Annual	2.5	- (a)	-
	24-hour(b) (c)	2.9	600	0.5
PM_{10}(d)	Annual	69.5	20	347.5
	24-hour	82.0	50	164.0
$PM_{2.5}$ (d)	Annual	34.7	10	347.5
	24-hour	41.0	25	164.0
Deposited Dust	24-hour	94.4	200 mg/m^2/day	47.2

a) No relevant AQS;
b) Total VOC AQS;
c) 3 exceedances of the AQS allowed; and
d) Monitored using the MiniVol sampler.

Table 6.5-4: Baseline Average Air Quality Concentrations for Pollutants Monitored at Lokichar

	Averaging Period	Concentration (µg/m^3, unless stated)	AQS (µg/m^3, unless stated)	Concentration as % of AQS
NO_2	Annual	2.0	40	5.0
	24-hour(c)	2.4	188	1.3
	1-hour	4.1	200	2.0
SO_2	Annual	1.3	50	2.7
	24-hour(c)	1.6	20	7.9
	10-minute	4.4	500	0.9

	Averaging Period	Concentration ($\mu g/m^3$, unless stated)	AQS ($\mu g/m^3$, unless stated)	Concentration as % of AQS
O_3	Annual	33.3	- (a)	-
	8-hour	46.6	100	46.6
	1-hour	66.6	235	28.3
Benzene	Annual	2.2	- (a)	-
	24-hour(b) (c)	2.5	600	0.4
Toluene	Annual	2.3	- (a)	-
	24-hour(b) (c)	2.7	600	0.5
Ethylbenzene	Annual	2.5	- (a)	-
	24-hour(b) (c)	3.0	600	0.5
Xylene	Annual	2.5	- (a)	-
	24-hour(b) (c)	2.9	600	0.5
PM_{10}(d)	Annual	-	20	-
	24-hour	-	50	-
$PM_{2.5}$(d)	Annual	-	10	-
	24-hour	-	25	-
TSP	Annual	34.5	140	24.6
	24-hour	40.7	200	20.3
Deposited Dust	24-hour	210.9	200 $mg/m^2/day$	105.4

a) *No relevant AQS;*
b) *Total VOC AQS;*
c) *3 exceedances of the AQS allowed; and*
d) *No PM10 or PM2.5 monitoring was undertaken at this location.*

Table 6.5-5: Baseline Average Air Quality Concentrations for Pollutants Monitored at Kapese Camp

	Averaging Period	Concentration ($\mu g/m^3$, unless stated)	AQS ($\mu g/m^3$, unless stated)	Concentration as % of AQS
NO_2	Annual	1.0	40	2.4
	24-hour(c)	1.1	188	0.6
	1-hour	1.9	200	0.9
SO_2	Annual	0.6	50	1.2

	Averaging Period	Concentration (μg/m³, unless stated)	AQS (μg/m³, unless stated)	Concentration as % of AQS
	24-hour (c)	0.7	20	3.6
	10-minute	2.0	500	0.4
O_3	Annual	28.4	- (a)	-
	8-hour	46.6	100	39.7
	1-hour	66.6	235	24.1
Benzene	Annual	2.2	- (a)	-
	24-hour (b) (c)	2.5	600	0.4
Toluene	Annual	2.3	- (a)	-
	24-hour (b) (c)	2.7	600	0.5
Ethylbenzene	Annual	2.5	- (a)	-
	24-hour (b) (c)	3.0	600	0.5
Xylene	Annual	2.5	- (a)	-
	24-hour (b) (c)	2.9	600	0.5
PM_{10} (d)	Annual	21.7	20	108.6
	24-hour	25.6	50	51.2
$PM_{2.5}$ (d)	Annual	5.0	10	49.9
	24-hour	5.9	25	23.6
Deposited Dust	24-hour	152.1	200 mg/m²/day	76.1

a) No relevant AQS;
b) Total VOC AQS; and
c) 3 exceedances of the AQS allowed; and
d) Monitored using the Osiris air monitoring device.

Table 6.5-6: Average Air Quality Concentrations for Pollutants Monitored at Ekales

	Averaging Period	Concentration (μg/m³, unless stated)	AQS (μg/m³, unless stated)	Concentration as % of AQS
NO_2	Annual	0.8	40	2.1
	24-hour (c)	1.0	188	0.5
	1-hour	1.7	200	0.8

	Averaging Period	Concentration (µg/m³, unless stated)	AQS (µg/m³, unless stated)	Concentration as % of AQS
SO_2	Annual	0.7	50	1.4
	24-hour[(c)]	0.8	20	4.1
	10-minute	2.3	500	0.5
O_3 [(d)]	Annual	-	- [(a)]	-
	8-hour	-	100	-
	1-hour	-	235	-
Benzene	Annual	0.5	- [(a)]	-
	24-hour[(b) (c)]	0.6	600	0.1
Toluene	Annual	1.6	- [(a)]	-
	24-hour[(b) (c)]	1.9	600	0.3
Ethylbenzene	Annual	0.9	- [(a)]	-
	24-hour[(b) (c)]	1.0	600	0.2
Xylene	Annual	0.9	- [(a)]	-
	24-hour[(b) (c)]	1.1	600	0.2
PM_{10}[(e)]	Annual	58.5	20	292.4
	24-hour	69	50	138
$PM_{2.5}$[(e)]	Annual	11.9	10	118.6
	24-hour	14	25	56
Deposited Dust	24-hour	79.2	200 mg/m²/day	39.6

a) *No relevant AQS;*
b) *Total VOC AQS;*
c) *3 exceedances of the AQS allowed;*
d) *No O3 sampling undertaken at this location; and*
e) *Monitored using the MiniVol sampler.*
f) *anomalous result removed from the dataset*

Table 6.5-7: Average Air Quality Concentrations for Pollutants Monitored at Etom

	Averaging Period	Concentration (µg/m³, unless stated)	AQS (µg/m³, unless stated)	Concentration as % of AQS
NO_2	Annual	1.0	40	2.6

	Averaging Period	Concentration ($\mu g/m^3$, unless stated)	AQS ($\mu g/m^3$, unless stated)	Concentration as % of AQS
	24-hour(c)	1.2	188	0.6
	1-hour	2.1	200	1.0
SO_2	Annual	0.7	50	1.4
	24-hour(c)	0.8	20	4.1
	10-minute	2.3	500	0.5
O_3(d)	Annual	-	- (a)	-
	8-hour	-	100	-
	1-hour	-	235	-
Benzene	Annual	0.2	- (a)	-
	24-hour(b) (c)	0.3	600	0.0
Toluene	Annual	0.2	- (a)	-
	24-hour(b) (c)	0.2	600	0.0
Ethylbenzene	Annual	0.2	- (a)	-
	24-hour(b) (c)	0.2	600	0.0
Xylene	Annual	0.2	- (a)	-
	24-hour(b) (c)	0.2	600	0.0
PM_{10}(e)	Annual	11.9	20	59.3
	24-hour	14	50	28
$PM_{2.5}$(e)	Annual	11.9	10	118.6
	24-hour	14	25	56
Deposited Dust	24-hour	64.1	200 mg/m^2/day	32

a) No relevant AQS;
b) Total VOC AQS; and
c) 3 exceedances of the AQS allowed;
d) No O_3 sampling undertaken at this location; and
e) Monitored using the MiniVol sampler.

Table 6.5-8: Baseline Average Air Quality Concentrations for Pollutants at All Monitoring Locations

	Averaging Period	Concentration ($\mu g/m^3$, unless stated)	AQS ($\mu g/m^3$, unless stated)	Concentration as % of AQS
NO_2	Annual	1.0	40	2.4
	24-hour(c)	1.1	188	0.6
	1-hour	1.9	200	1.0
SO_2	Annual	0.9	50	1.8
	24-hour(c)	1.1	20	5.3
	10-minute	3.0	500	0.6
O_3	Annual	30.9	- (a)	
	8-hour	43.3	100	43.3
	1-hour	61.8	235	26.3
Benzene	Annual	1.6	- (a)	-
	24-hour(b) (c)	1.9	600	0.3
Toluene	Annual	1.9	- (a)	
	24-hour(b) (c)	2.2	600	0.4
Ethylbenzene	Annual	1.9	- (a)	
	24-hour(b) (c)	2.3	600	0.0
Xylene	Annual	1.9	- (a)	
	24-hour(b) (c)	2.3	600	0.4
PM_{10} (d)	Annual	40.5	20	202.5
	24-hour	47.8	50	95.6
$PM_{2.5}$ (d)	Annual	22.4	10	223.7
	24-hour	26.4	25	105.6
Deposited Dust	24-hour	131	200 mg/m^2/day	65.5

a) *No relevant AQS;*
b) *Total VOC AQS;*
c) *3 exceedances of the AQS allowed; and*
d) *Osiris data for Kapese not included in calculations due to high levels of human activity in the area during monitoring.*

6.5.6 Discussion

6.5.6.1 NO_2

Concentrations at all the monitoring locations are low, compared to the AQS. Average concentrations are comparable, with annual average concentrations ranging from 0.4 µg/m^3 at Twiga to 2.0 µg/m^3 at Lokichar. The average of the monitoring locations is 1.0 µg/m^3. The maximum concentration observed at any of the stations is 5.9 µg/m^3 at Lokichar and the minimum concentration observed was 0.1 µg/m^3.

The average concentrations observed at all stations are less than 5% of the standard for any of the relevant averaging periods, with the exception of the annual average at Lokichar which is 5.1% of the standard. A plot of the data is included as Figure 6.5-3.

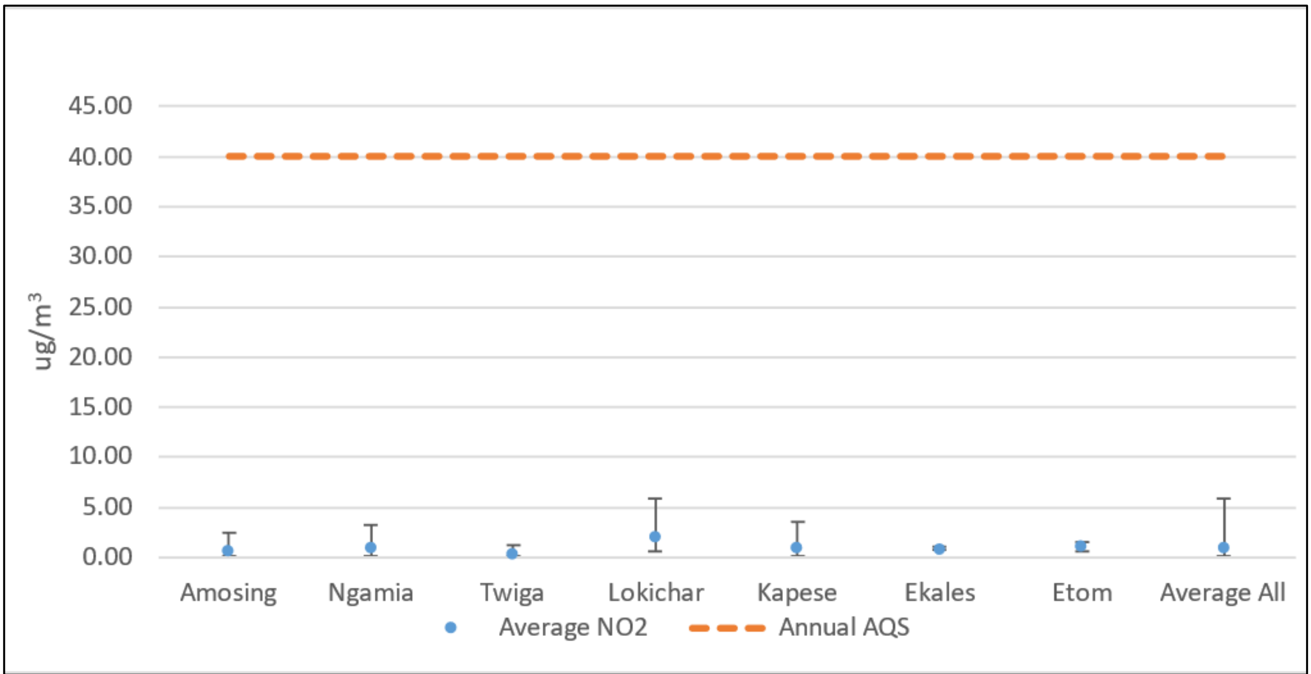

Figure 6.5-3: Annual Average Monitored NO_2 Concentrations (µg/m^3)

6.5.6.2 SO_2

Concentrations at all the monitored locations are low, compared to the AQS. Average concentrations are all comparable, with an annual average concentration ranging from of 0.6 µg/m^3 at Kapese to 1.3 µg/m^3 at Lokichar. The average of the monitoring locations is 0.9 µg/m^3. The maximum concentration observed at any station is 8.1 µg/m^3 at Lokichar and the minimum concentration was 0.3 µg/m^3.

The average concentrations observed at all stations are less than 8% of the standard for any of the relevant averaging periods. A plot of the data is included as Figure 6.5-4.

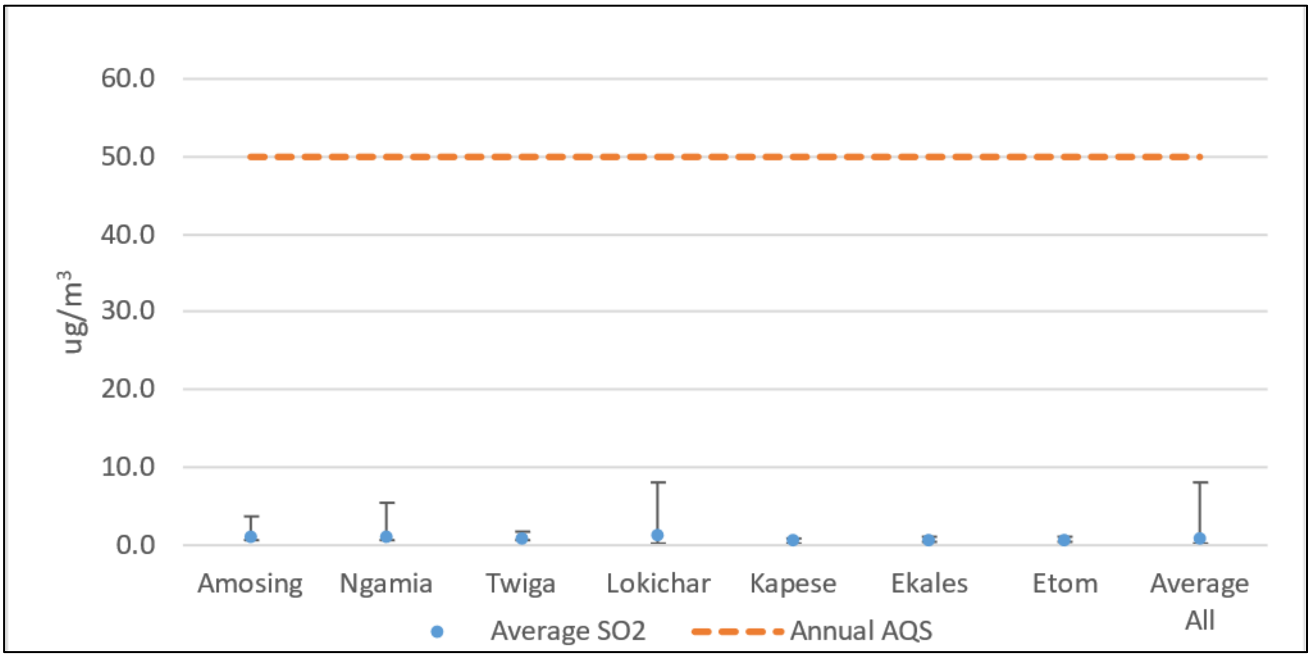

Figure 6.5-4: Annual Average Monitored SO_2 Concentrations (µg/m^3)

6.5.6.3 O_3

Concentrations are comparable at all monitoring locations, with annual average concentrations[3] ranging from 26.7 µg/m^3 at Ngamia to 36.4 µg/m^3 at Twiga. The average of the monitoring locations is 30.9 µg/m^3. The maximum concentration observed at any station is 74.5 µg/m^3 at Twiga and the minimum concentration is 2.5 µg/m^3 at Amosing.

The average concentrations observed at all stations are less than 51% of the standard for any of the relevant averaging periods. A plot of the data is included as Figure 6.5-5.

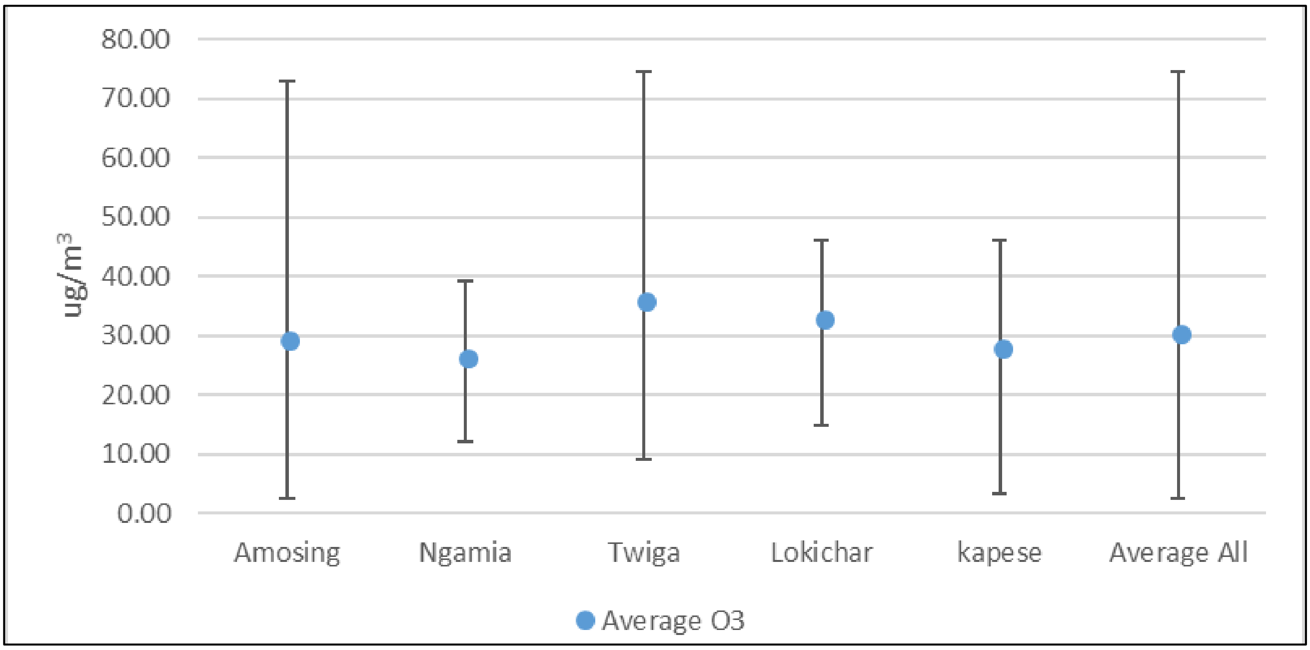

Figure 6.5-5: Annual Average Monitored O_3 Concentrations (µg/m^3)

[3] For O_3, there is no annual AQS. AQSs for O_3 are for 8hr and 1hr periods only.

6.5.6.4 BTEX VOCs

There are no AQS values for annual BTEX concentrations. There is a Kenyan AQS for 24-hour Total VOCs of 600 µg/m^3, which is the closest applicable standard, but this would include all VOC species cumulatively and is applicable for a different averaging period than presented for the baseline. Although there is no relevant annual AQS for BTEX, the baseline data will allow for a comparison to be made with the operational phase of the Project.

6.5.6.5 Benzene

Concentrations are comparable at all monitoring locations, with annual average concentrations all below the lower limit of detection for the analysis method used. When using the lower limit of detection concentration, the average concentrations observed at all stations are less than 0.5% of the 24-hour total VOC standard. A plot of the data is included as Figure 6.5-6.

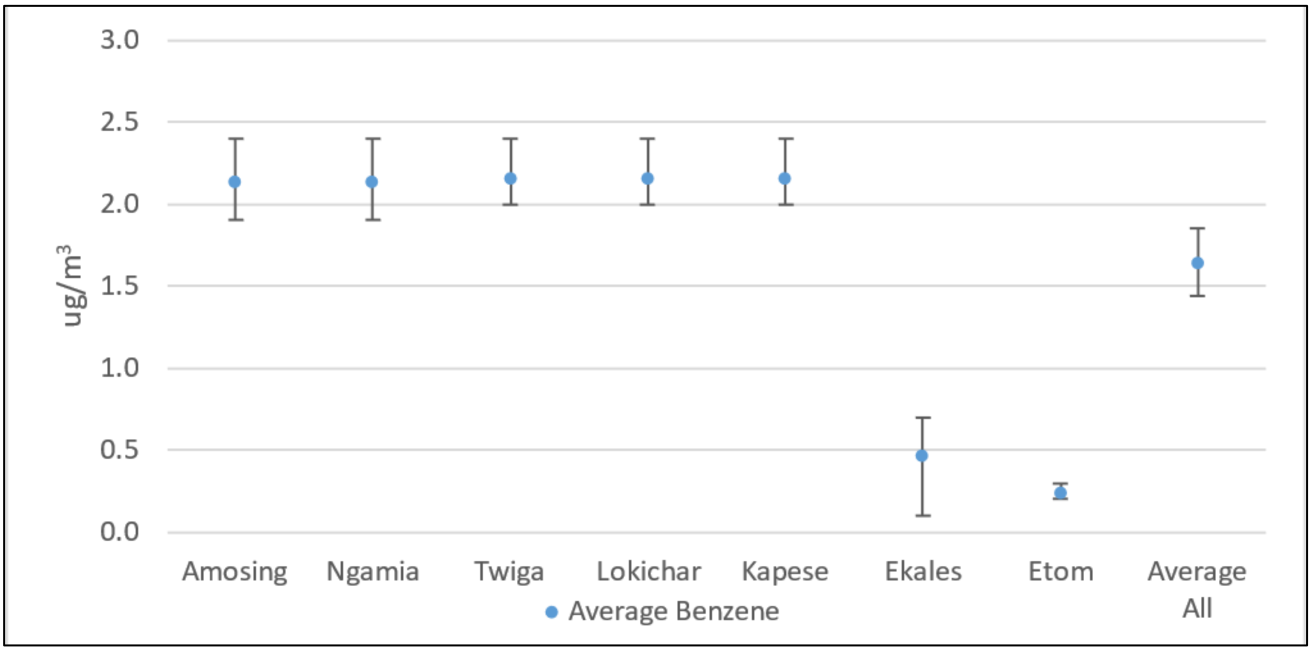

Figure 6.5-6: Annual Average Monitored Benzene Concentrations (µg/m^3)

6.5.6.6 Toluene

Concentrations are comparable at all monitoring locations, with annual average concentrations all below the lower limit of detection for the analysis method used. Annual average concentrations are equal to or less than 0.5% of the 24-hour total VOC standard. A plot of the data is included as Figure 6.5-7.

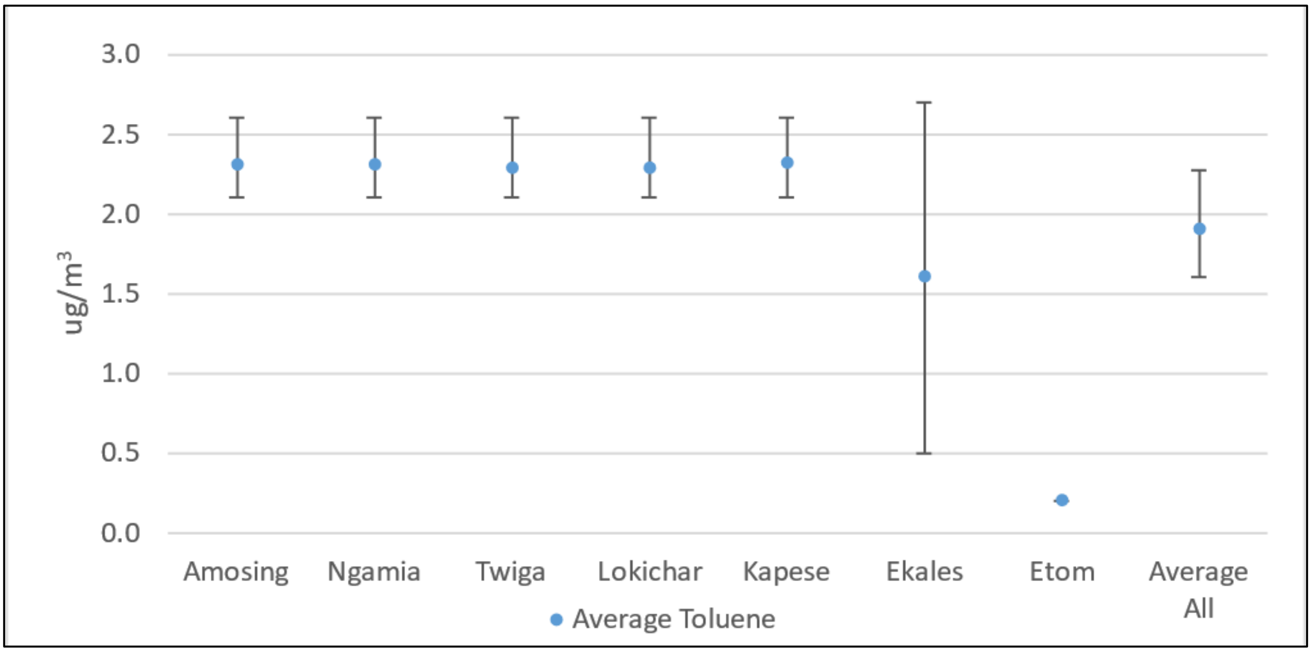

Figure 6.5-7: Annual Average Monitored Toluene Concentrations (µg/m^3)

6.5.6.7 Ethylbenzene

Concentrations are comparable at all monitoring locations, with annual average concentrations all below the lower limit of detection for the analysis method used. Annual average concentrations are equal to or less than 0.5% of the 24-hour total VOC standard. A plot of the data is included as Figure 6.5-8.

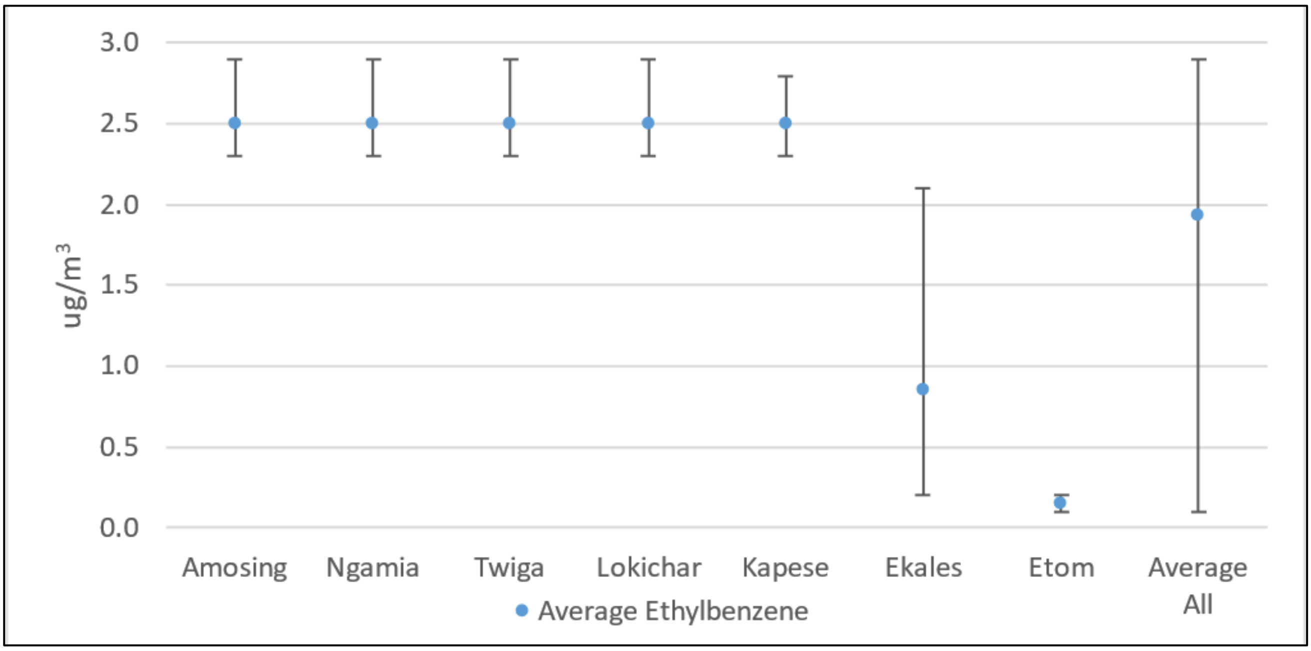

Figure 6.5-8: Annual Average Monitored Ethylbenzene Concentrations (µg/m^3)

6.5.6.8 Xylene

Concentrations are comparable at all monitoring locations, with annual average concentrations all below the lower limit of detection for the analysis method used. Annual average concentrations are less than 0.5% of the 24-hour total VOC standard. A plot of the data is included as Figure 6.5-9.

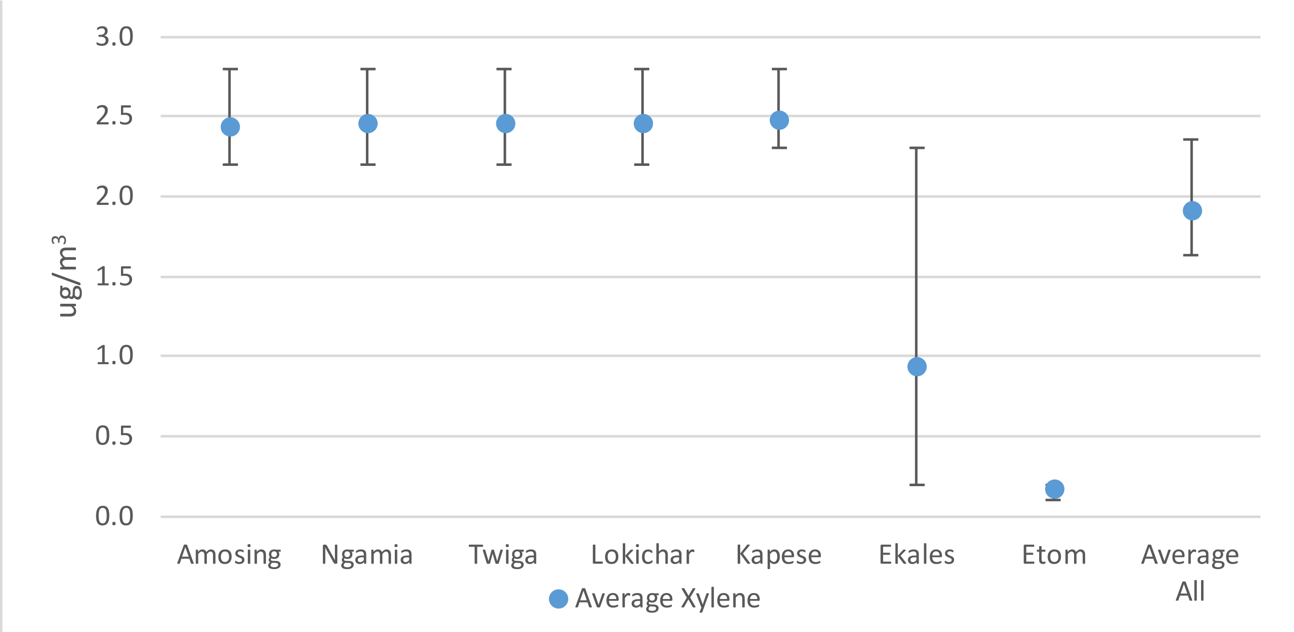

Figure 6.5-9: Annual Average Monitored Xylene Concentrations (µg/m^3)

6.5.6.9 Total Suspended Particles/Total Particulate Matter

Concentrations were observed at the Kapese Camp with an average concentration of 34.5 µg/m^3. The maximum concentration observed is 1,718 µg/m^3 but the high concentrations are generally discrete events, which could include meteorological events (such as dust storms) and/or vehicle movements, which do not occur over extended time periods.

The average concentration is less than 30% of the standard for any of the relevant averaging periods. The minimum concentration recorded was 0.1 µg/m^3. A plot of the data is included as Figure 6.5-10.

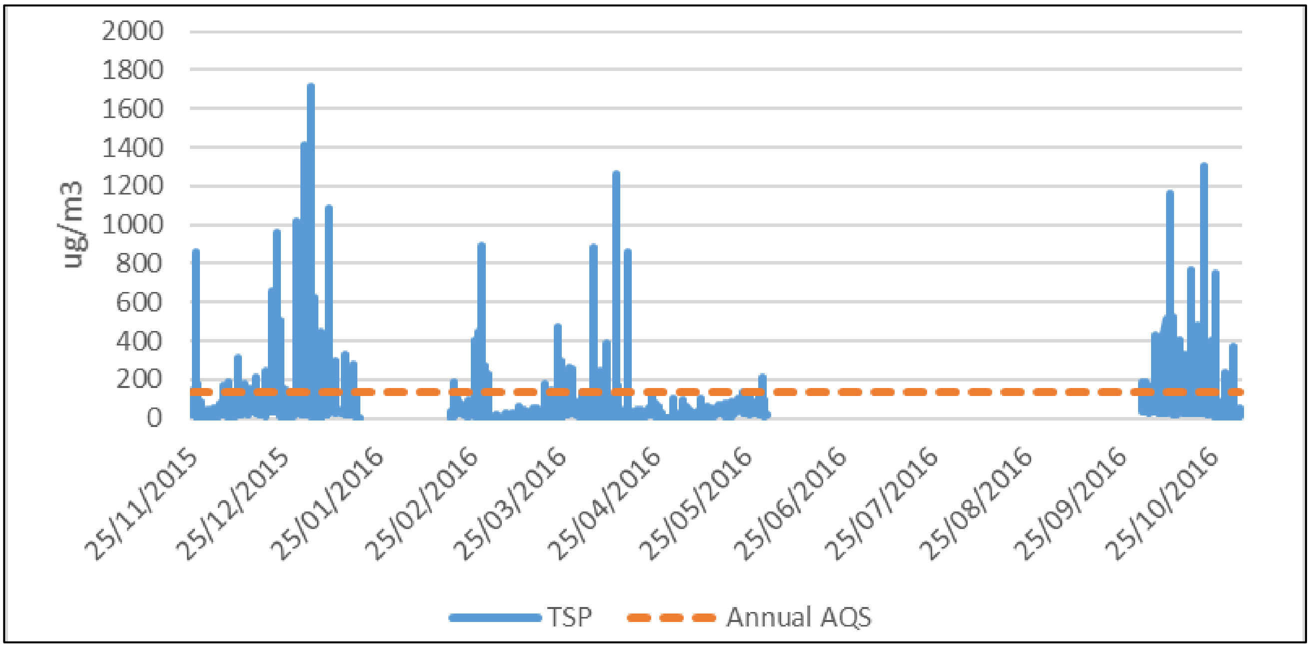

Figure 6.5-10: OSIRIS Monitored Total Suspended Particles (TSP) Concentrations at Kapese (µg/m^3)

6.5.6.10 PM_{10}

Data was collected with an OSIRIS monitor at the Kapese Camp with an observed annual average concentration of 21.7 µg/m^3. The maximum concentration recorded was 967 µg/m^3. The annual average concentration is approximately 109% of the AQS, although the 24-hour averaging period is approximately 50% of the AQS. The minimum concentration recorded was 0.1 µg/m^3. A plot of the data is included as Figure 6.5-11.

Concentrations were recorded for 24-hour periods using MiniVol samplers at the monitoring locations and an average concentration of 47.8 µg/m^3 was observed. The maximum concentration observed was 82 µg/m^3 at Twiga during December 2018. The annual average concentration is approximately 203% of the AQS, although the 24-hour averaging period is approximately 96% of the AQS. The minimum concentration observed was 14 µg/m^3 at Etom during December 2020. A plot of the data is included as Figure 6.5-12.

With regard to the baseline for the annual average concentration being greater than the AQS (20 µg/m^3), the AQS is the IFC Guideline value, which is most stringent. The IFC also has interim targets 1, 2 and 3, which have standards of 70, 50 and 30 µg/m^3 respectively. These targets are seen as incremental steps in a progressive reduction of air pollution and are intended for use in areas where pollution is high (WHO, 2005). 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.

Elevated particle concentrations are likely to be related to the naturally arid dusty environment and meteorological events, such as periods of high wind speeds or periods of low precipitation. They could also be related to elevated source conditions in the area, including burning and exhaust emissions. During the 2015 to 2017 monitoring periods, Kapese camp was well established and contained multiple potential emissions sources. Similarly, during the later monitoring periods, the EOPS development was operational and was therefore a potential PM emission source.

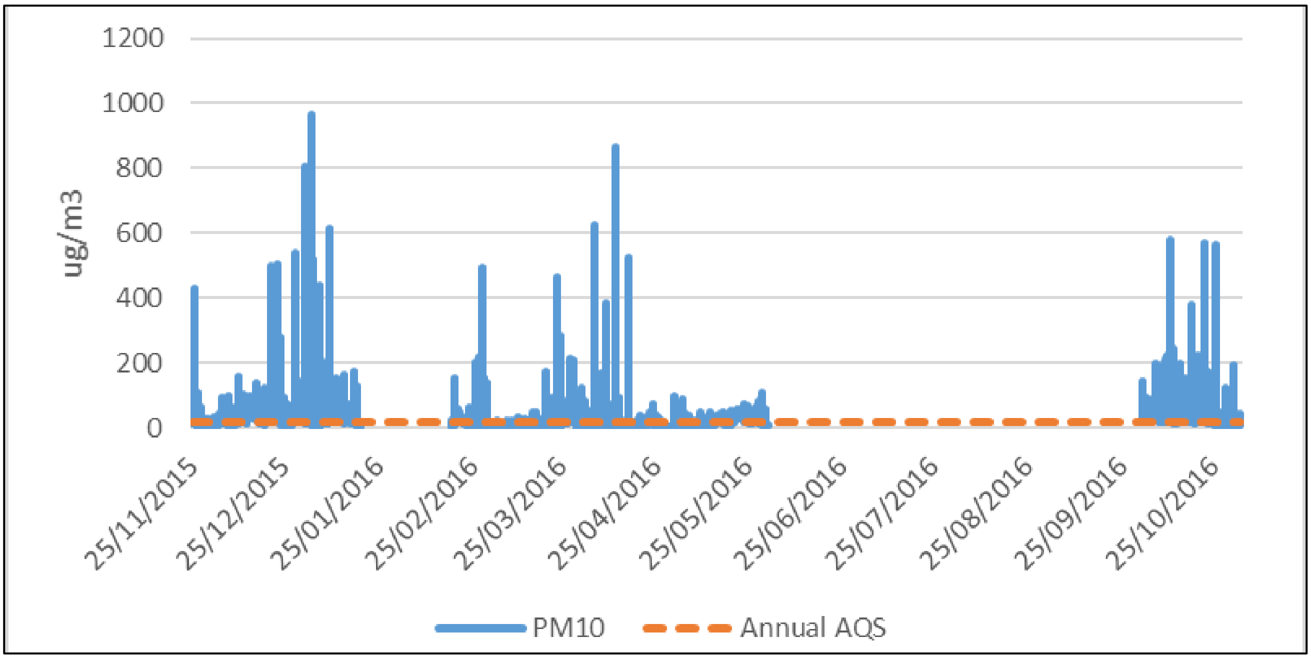

Figure 6.5-11: OSIRIS Monitored PM_{10} Concentrations at Kapese (µg/m^3)

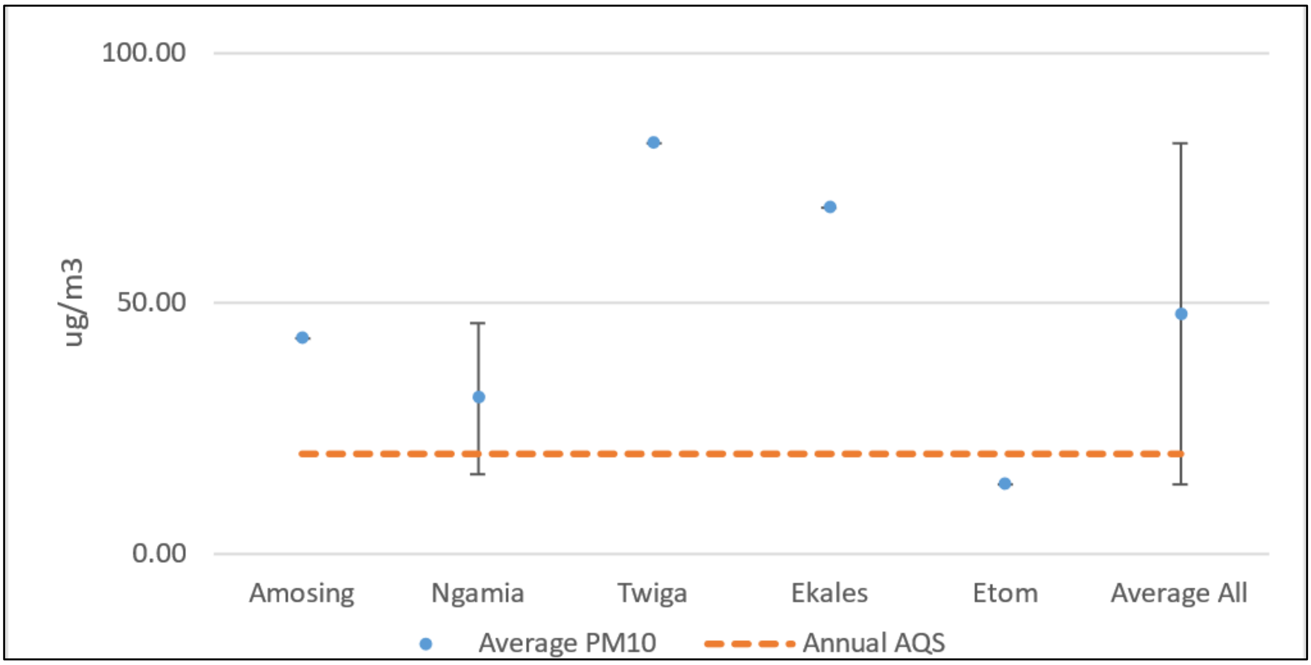

Figure 6.5-12: Annual Average MiniVol Monitored PM_{10} Concentrations (µg/m^3)

6.5.6.11 $PM_{2.5}$

Data was collected with an OSIRIS monitor at the Kapese Camp with an observed annual average concentration of 5.0 µg/m^3. The maximum concentration observed was 208 µg/m^3. The annual average concentration is approximately 50% of the AQS, although the 24-hour averaging period is approximately 24% of the AQS. The minimum concentration recorded was 0.03 µg/m^3. A plot of the data is included as Figure 6.5-13.

Data was collected for 24-hour periods using MiniVol samplers at the monitoring locations with an observed average concentration of 26.4 µg/m^3. The maximum concentration recorded is 42 µg/m^3 at Amosing during December 2017 and Ngamia during March 2019. The annual average concentration is approximately 224% of the AQS, although the 24-hour averaging period was approximately 106% of the AQS. The minimum concentration observed is 0 µg/m^3 at Amosing during March 2019. A plot of the data is included as Figure 6.5-14.

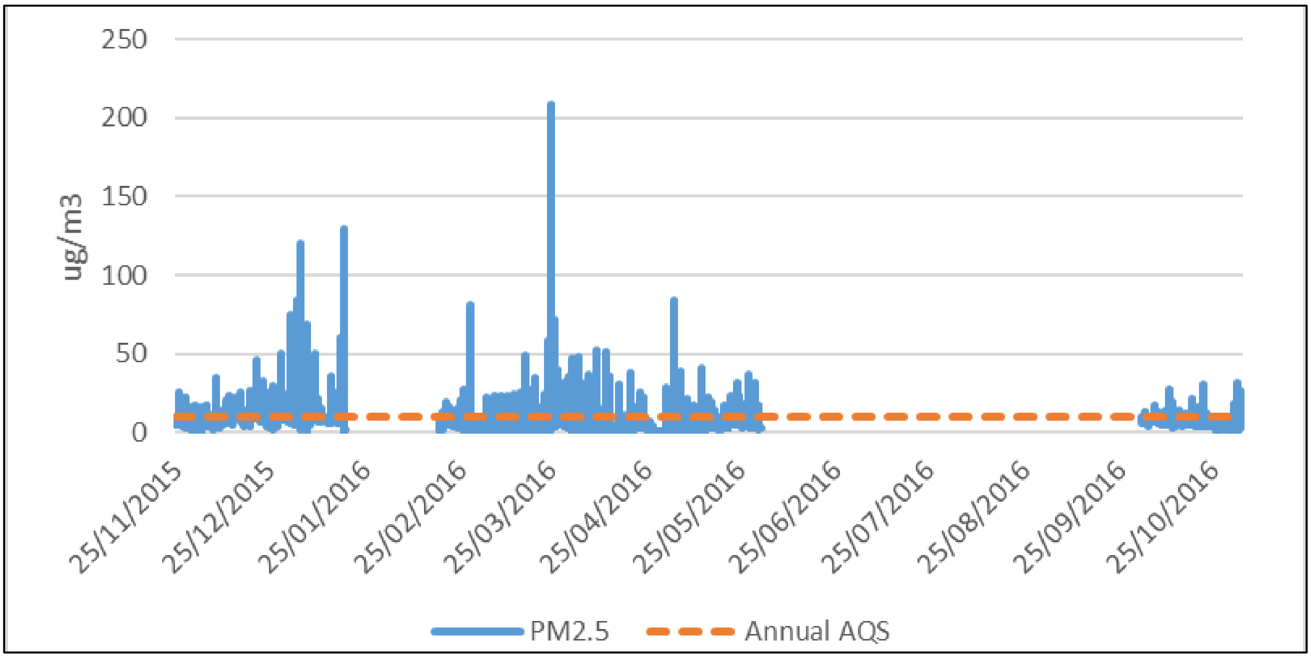

Figure 6.5-13: OSIRIS Monitored $PM_{2.5}$ Concentrations at Kapese (µg/m³)

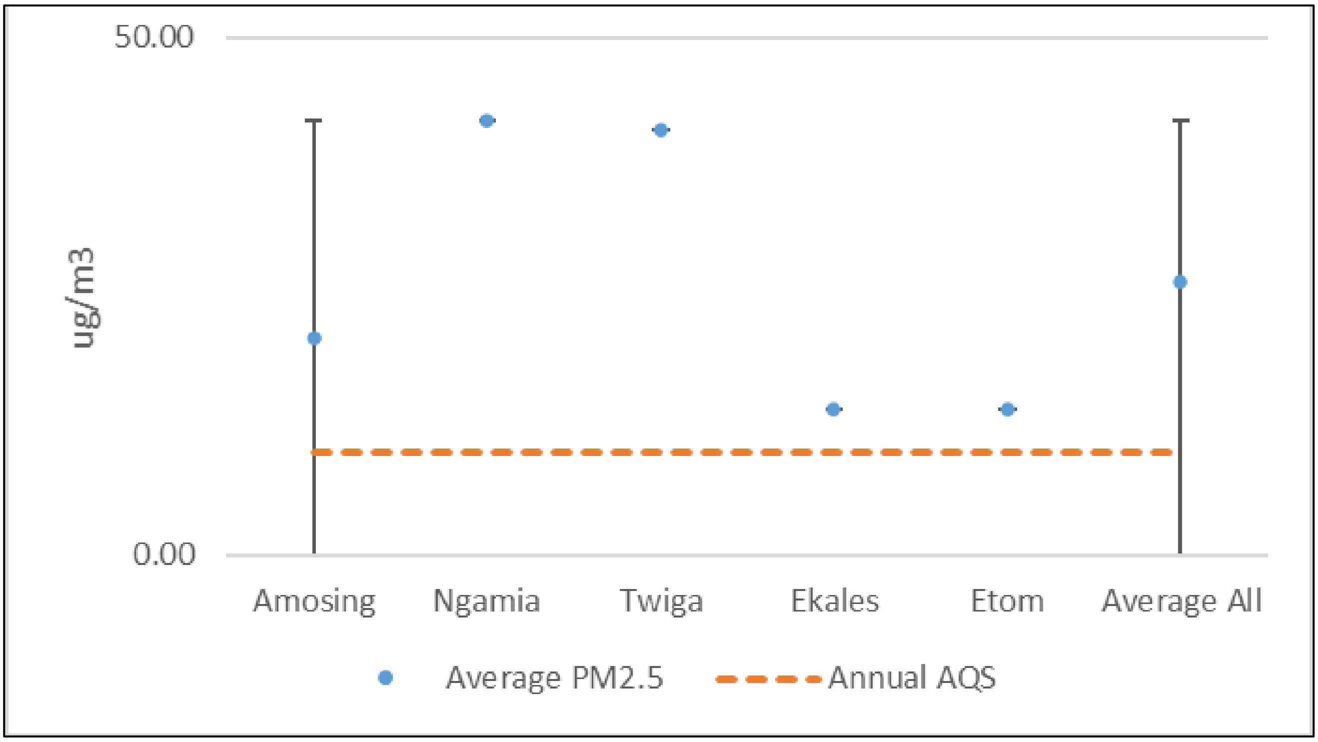

Figure 6.5-14: Annual Average MiniVol Monitored $PM_{2.5}$ Concentrations (µg/m³)

6.5.6.12 Deposited Dust

Concentrations are much lower at Amosing than the other monitored locations, with an average concentration of 7.0 mg/m²/day recorded at Amosing increasing to 211 mg/m²/day at Lokichar. It should be noted that Amosing only has a limited data set of 3 months, which will contribute to the lower concentrations. Unusually high deposited dust concentrations were monitored during August 2016 at all locations (particularly high at Kapese), and during March 2016 at Lokichar and Kapese, resulting in the high annual average observed at Lokichar. The average of the monitoring locations is 131.0 mg/m²/day. The maximum concentration observed at any station is 909 mg/m^2/day at Lokichar, which occurred during August 2016. The minimum concentration observed at any station is 0.3 mg/m^2/day at Ngamia during January 2016.

The average concentrations observed at any location excluding Lokichar are less than 77% of the relevant standard of 200 mg/m^2/day. The average concentration at Lokichar exceeds the AQS by 23.3%, which can be attributed to the two months of particularly high concentrations mentioned above. A plot of the data is included as Figure 6.5-15.

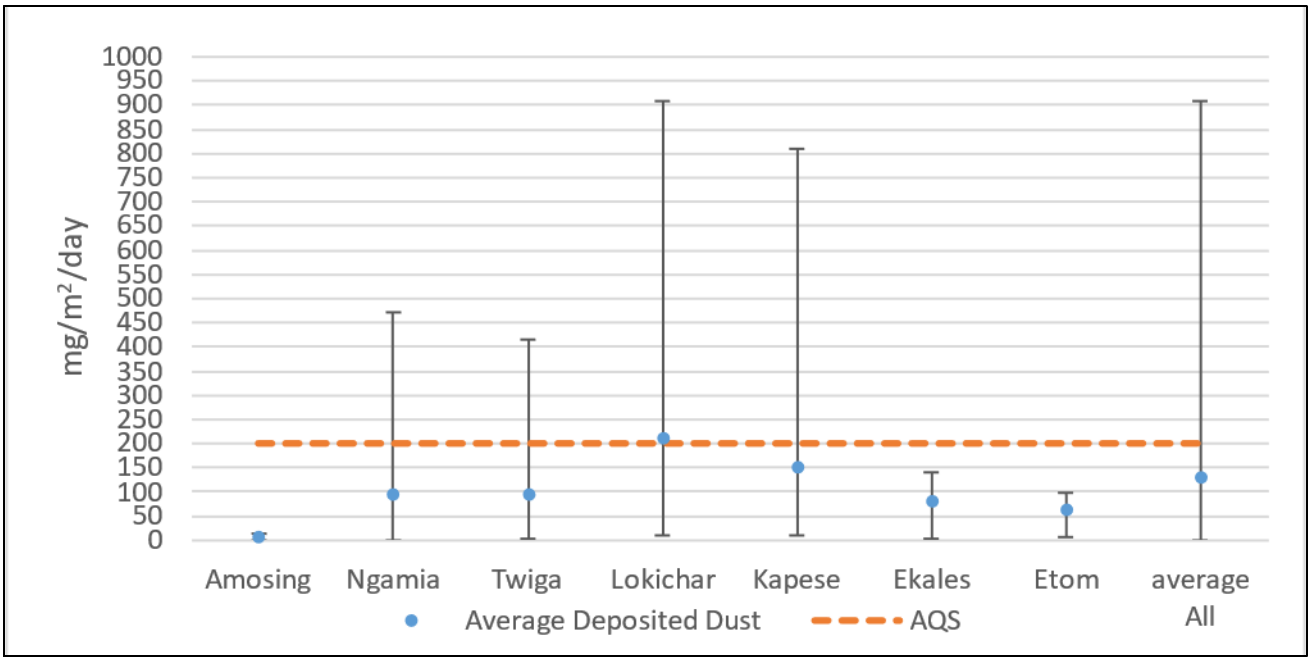

Figure 6.5-15: Daily Average Monitored Deposited Dust Concentrations (mg/m^2/day)

6.6 Noise and Vibration

Baseline noise monitoring was completed within the AoI during six field surveys between 2015 and 2020. The baseline noise monitoring locations were associated with potential receptors in the area where human activity is expected to occur.

No vibration data was gathered as part of the ESIA baseline. Due to the greenfield nature of the AoI, the baseline vibration is assumed to be negligible.

6.6.1 Noise Guidelines

As part of the EOPS Phase II ESIA (Ref. 1654017.718), Golder carried out a review of WBG EHS Guidelines and Kenya Noise Regulations, recommending the use of WBG EHS Guidelines for operations Project Standards (Golder tech memo 1654017.511 provided in Annex I). This approach was confirmed with NEMA in a minuted meeting and has been adopted for this Project also.

The receiving environment for the AoI is best categorised as "*residential; institutional; educational*" under the WBG EHS Guidelines, with noise level limits at receptors as presented in Table 6.6-1

Table 6.6-1: WBG EHS Guidelines Noise Limits at Receptors

Receptor Type	Noise Limit	Reference Period
Residential; institutional; educational	55 dBA (A-weighted decibels); LAeq,1hr or a maximum increase in background levels of 3 dB at the nearest receptor location off-site.	Daytime (07:00 to 22:00)
	45 dBA; LAeq,1hr or a maximum increase in background levels of 3 dB at the nearest receptor location off-site.	Night-time (22:00 to 07:00)

LAeq = A-weighted, equivalent continuous sound level

6.6.2 Secondary Data

There is no known data for noise or vibration in the AoI other than the primary data collected as part of the ESIA baseline monitoring associated with the Project.

6.6.3 Primary Data

6.6.3.1 Methods

Baseline noise levels were measured at the following seven locations across the AoI:

- Lokichar;
- Twiga 1;
- Amosing 5;
- Ngamia 5/6;
- Kapese Camp;
- Ekales; and
- Etom 3;

These noise monitoring locations[4] were selected to characterise the baseline noise environment at all identified sensitive receptors in the AoI and areas where pastoralists may be present.

The noise monitoring was designed in general accordance with the requirements of ISO 1996 Parts 1 and 2 (ISO, 2003; ISO, 2007), which provides guidance on the equipment to be used, conditions under which noise measurements should be undertaken, measurement parameters and appropriate siting of monitoring equipment.

Continuous, unattended noise monitoring was carried out at each noise monitoring location for a minimum 24- hour period on six separate field visits: October 2015, January 2016, October 2016, December 2018, March 2019, and December 2020. The exact location of noise monitoring set up considered security and accessibility. The noise monitoring locations are described in Table 6.6-2 below and presented in Figure 6.6-1.

Where necessary, noise monitoring was repeated at certain locations due to insufficient duration of data collection (i.e. less than 24- hours) or where there appeared to be anomalous data.

Table 6.6-2: Noise Monitoring Locations

Noise Monitoring Locations	Measurement Date						Representative Village	Latitude/Longitude [1]
	Oct-15	Jan-16	Oct-16	Dec-18	Mar-19	Dec-20		
Lokichar	√						Lokichar	Northing: 02º23'02.6" Easting: 35º38'41.8"
Twiga 1	√	√		√			Kapetatuk / Lomokamar	Northing: 02º24'24.1" Easting: 35º43'03.8"
Amosing 5	√	√	√		√		Lopuroto	Northing: 02º10'53.7" Easting: 35º47'01.9"
Ngamia 5/6			√	√			Kodekode	Northing: 02º12'42.0" Easting: 35º45'36.1"
Kapese Camp	√						Kapese Village	Northing: 02º21'51.8" Easting: 35º42'20.4"
Ekales						√	Pastoralists	Northing: 02º20’12.9” Easting: 035º42’01.7”
Etom 3						√	Pastoralists	Northing: 02º32’10.5” Easting: 035º40’52.5”

a) The latitude and longitude reported here were measured during the October 2015 field visit. Monitoring locations during subsequent visits were in the same general area but exact coordinates may have varied.

[4] Data was also gathered from locations at Lomokamar and Ekales-2 in October 2015, however, due to the quality of the data collected, these results are not considered suitable for use in the baseline.

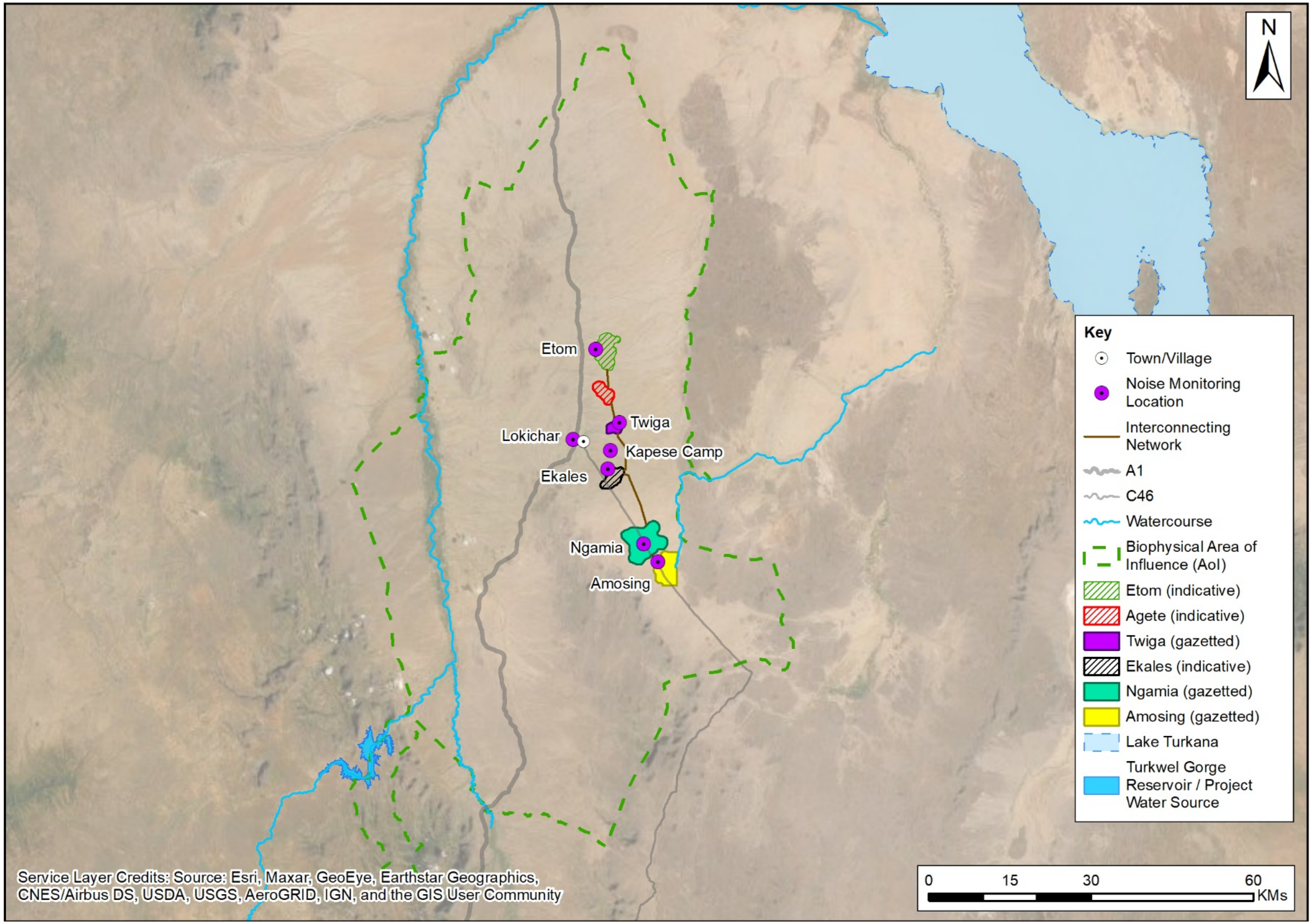

Figure 6.6-1: Noise Monitoring Locations

The sound level meters (SLMs) used for the noise monitoring program were a Larson Davis SoundExpert® LxT SLM, a Norsonic 140 SLM, and a Svantek Svan 971, all of which meet the International Electrotechnical Commission (IEC) Class 1 classification. The microphones were protected with an environmental windscreen and mounted at a height of approximately 1.5 m above ground level. The microphones were connected by cable to the SLMs which were housed in a weather-protected case. The SLMs were calibrated on-site before each measurement with a portable calibrator. The SLMs were within their required laboratory calibration period during the survey, as was the field calibrator. After each 24-hour measurement was complete, the equipment was removed from the respective location and the data were downloaded. Meteorological conditions were visually observed and noted for each monitoring period, with measurements completed during periods when conditions were generally appropriate for measuring ambient noise levels. The "*noise floor*" of the SLMs, below which electronic "*noise*" in the instrument makes accurate measurement impossible, is approximately 20 dB.

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

For the purposes of the noise assessment, the approximate 1-minute or 10-minute data were aggregated to give hourly values as well as period averages for daytime and night-time, for comparison with Project standards.

6.6.4 Results

Throughout the noise monitoring periods and at all noise monitoring locations, there was little or no precipitation and light winds visually observed. Therefore, meteorological conditions were not expected to have a significant effect on measured noise levels.

A summary of the noise monitoring results from the October 2015, January 2016, October 2016, December 2018, March 2019 and December 2020 monitoring programs are provided in Table 6.6-3 to Table 6.6-9. The noise levels presented in the tables below are for the daytime (07:00 to 22:00) and night-time periods (22:00 to 07:00). Note that only equipment used in October 2015 and December 2020 had functionality to report L_{A90} on an interval basis.

In addition, the raw baseline noise monitoring data (e.g. approximate 1-minute, 10-minute, or 1-hour interval data) are presented in graphical form in Annex I.

Table 6.6-3: Lokichar Noise Monitoring Results

	One Hour L_{Aeq} (dBA)		One Hour L_{A90} (dBA)	
	Daytime	Nighttime	Daytime	Nighttime
October 2015				
Average	65.7	62.3	57.4	45.7
Minimum	51.3	42.2	37.5	24.9
Maximum	73.6	69.0	65.8	53.2

Table 6.6-4: Twiga 1 Noise Monitoring Results

	One Hour L_{Aeq} (dBA)		One Hour L_{A90} (dBA)	
	Daytime	Nighttime	Daytime	Nighttime
October 2015				
Average	39.6	40.3	34.8	38.3
Minimum	27.5	36.7	—[a]	34.9
Maximum	44.1	43.2	39.1	40.6
January 2016				
Average	44.5	46.4	42.1	45.0
Minimum	37.2	40.9	34.8	37.8
Maximum	48.9	47.9	47.5	46.6
December 2018				
Average	36.5	27.9	—	—
Minimum	33.3	—[a]	—	—
Maximum	41.1	33.8	—	—

a) *Noise levels were at or below the approximate noise floor of the SLM.*

Table 6.6-5: Amosing 5 Noise Monitoring Results

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

	One Hour L_{Aeq} (dBA)		One Hour L_{A90} (dBA)	
	Daytime	Nighttime	Daytime	Nighttime
March 2019				
Average	44.1	29.3	—	—
Minimum	25.4	20.7	—	—
Maximum	48.0	36.5	—	—

a) *Noise levels were at or below the approximate noise floor of the SLM.*

Table 6.6-6: Ngamia 5/6 Noise Monitoring Results

	One Hour L_{Aeq} (dBA)		One Hour L_{A90} (dBA)	
	Daytime	Nighttime	Daytime	Nighttime
October 2016				
Average	59.9	43.4	—	—
Minimum	39.3	34.1	—	—
Maximum	65.8	47.3	—	—
December 2018				
Average	60.5	42.0	—	—
Minimum	31.0	27.8	—	—
Maximum	68.8	49.6	—	—

Table 6.6-7: Kapese Camp Noise Monitoring Results

	One Hour L_{Aeq} (dBA)		One Hour L_{A90} (dBA)	
	Daytime	Nighttime	Daytime	Nighttime
October 2015				
Average	55.0	30.0	32.5	24.3
Minimum	24.2	21.6	—[(a)]	—
Maximum	67.2	33.0	38.5	26.9

a) *Noise levels were at or below the approximate noise floor of the SLM.*

Table 6.6-8: Ekales Noise Monitoring Results

	One Hour L_{Aeq} (dBA)		One Hour L_{A90} (dBA)	
	Daytime	Nighttime	Daytime	Nighttime
December 2020				

	One Hour L_{Aeq} (dBA)		One Hour L_{A90} (dBA)	
	Daytime	Nighttime	Daytime	Nighttime
Average	55.2	38.7	43.2	29.5
Minimum	39.9	30.4	26.9	23.1
Maximum	64.4	45.9	53.9	33.9

Table 6.6-9: Etom 3 Noise Monitoring Results

	One Hour L_{Aeq} (dBA)		One Hour L_{A90} (dBA)	
	Daytime	Nighttime	Daytime	Nighttime
December 2020				
Average	51.2	34.2	37.1	28.1
Minimum	36.7	26.1	26.1	21.5
Maximum	57.6	37.7	44.2	32.0

6.6.5 Discussion

The measured minimum and average hourly L_{Aeq} that will be considered in the ESIA are summarised in Table 6.6-10 along with the limit values for residential receptors from the WBG EHS Guidelines. In cases where monitoring was repeated for a given monitoring location, the lowest average hourly measurement results was reported in in Table 6.6-10 and will be used for the effects assessment to provide a more conservative assessment.

Measured baseline noise levels exceeding the limit values are presented in red bold text.

Table 6.6-10: Summary of Measured Baseline Noise Levels

Noise Monitoring Location	Monitoring Period	Minimum One Hour L_{Aeq} (dBA)		Average One Hour L_{Aeq} (dBA)	
		Daytime	Nighttime	Daytime	Nighttime
WBG EHS Guidelines Limit Value		55	45	55	45
Lokichar	October 2015	51.3	42.2	**65.7**	**62.3**
Twiga 1	December 2018	33.3	—[a]	36.5	27.9
Amosing 5	March 2019	25.4	20.7	44.1	29.3
Ngamia 5/6	December 2018	31.0	27.8	**60.5**	42.0
Kapese Camp	October 2015	24.2	21.6	55.0	30.0
Ekales	December 2020	39.9	30.4	**55.2**	38.7

Noise Monitoring Location	Monitoring Period	Minimum One Hour L_{Aeq} (dBA)		Average One Hour L_{Aeq} (dBA)	
		Daytime	Nighttime	Daytime	Nighttime
Etom 3	December 2020	36.7	26.1	51.2	34.2

a) Noise levels were at or below the approximate noise floor of the SLM.
Note: Red bold text indicates where the measured noise level is greater than the limit value.

In general, the absence of natural noise sources, such as watercourse noise or wind induced vegetation noise, is noticeable in the AoI and contributes to the low measured noise levels. Similarly, the dispersed nature of settlements means that there are few concentrated areas of human noise. Measured noise levels were frequently at or near the noise floor of the equipment (~20 dBA) at several monitoring locations.

Higher daytime noise levels were recorded at all monitoring locations in comparison to night-time levels, which can generally be attributed to widespread activities during daylight hours, including vehicle traffic and human and livestock movements.

Data presented in Table 6.6-10 shows that 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 noise levels. Noise levels at Twiga 1 were influenced by occasional truck movements and waste collection activities from the nearby Twiga 2 site. Similarly, occasional truck movements were likely to influence noise levels recorded at Amosing 5. Ngamia 5/6 is located within 200 m of the Lokichar to Lokwamosing Road; traffic from this road likely contributed to the measured noise levels exceeding the WBG EHS Guidelines daytime limit. The Kapese Camp monitoring location was situated in the south-west corner of the compound, within 450 m of the site entrance, with associated vehicle movements likely resulting in higher daytime noise levels. Ekales is located south of Kapese, and occasional human traffic and livestock movements likely contributed to the observed noise levels. Similarly, noise levels at Etom 3 were likely affected by occasional human traffic and livestock movement. Etom 3 is the most northerly monitoring location.

6.7 Water Quality

This section presents the available baseline information on water quality in the AoI. Due to the ephemeral nature of the surface water in the area, this section largely focusses on the information available on groundwater quality. Information on the physical hydrological setting within the AoI is presented in Section 6.8.

6.7.1 Secondary Data

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

Not all groundwater is chemically safe for human consumption or pleasant to taste. The reasons for this may be natural or anthropogenic. Groundwater in Kenya is known to have, amongst other elements, high concentrations of arsenic, boron and fluoride originating from the natural geology that could be present in concentrations that are unacceptable for human consumption (Price, 2014b). For example, groundwater in the volcanic aquifers typically has low total dissolved solids (TDS) and high bicarbonate, and the volcanic deposits of the EARS are rich in fluoride, which leads to high groundwater fluoride concentrations (BGS, 2018).

The results of water sampling and quality analysis have been collected and collated by KJV for strategic water resources since 2014. These are groundwater wells used to source exploration supplies and supplement the water supply of local residents (see Chapter 8.0). The results of the laboratory analysis from these locations have been used to compile an understanding of the baseline groundwater quality in the AoI. The locations within the AoI and with groundwater quality data provided are Kengomo 1, Kengomo 2, East Lokichar WBHC, Ngamia East, Nakukulas 9, Nakukulas 10, Kaengakalalio C/Kaimegur B, Nabolei, ACS Tank Lokichar, Kaimegur BH, Ngamia II and Katilu Hand pump. These locations are shown on Figure 6.7-1.

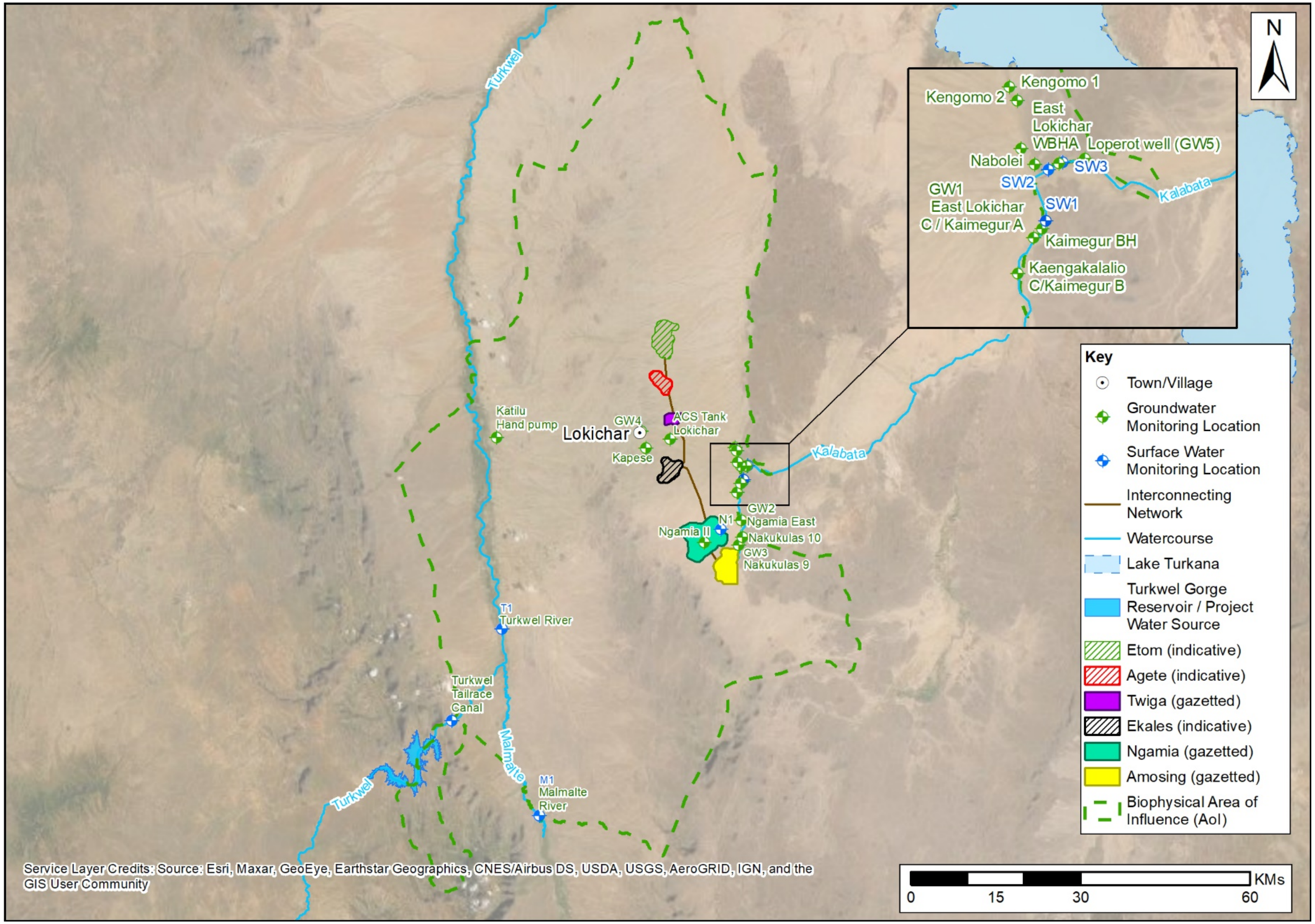

Figure 6.7-1: Groundwater and Surface Water Monitoring Locations

Golder has also taken groundwater samples from a distributed subset of these locations. The entire water quality dataset has been combined, presented in Annex I, and discussed in Section 6.7.3.

Historical surface water quality sampling data from the Turkwel Gorge Reservoir was collected between 1973 and 1983 before the reservoir dam was constructed (TKBV, 2018a). This data is reproduced in Table 6.7-1 for historical context. The water quality baseline dataset (Annex I) does not include this historic data. A review of the data presented in Annex I representing the baseline water quality is presented in Section 6.7.3.

Table 6.7-1: Historical Turkwel Gorge Reservoir Water Quality Data (mg/l unless stated)

Parameter	Project Standard	1973 – 1975	1978	1983
pH (pH units)	6.5-8.5	7.9	7.8	8.0
Electrical Conductivity (millisiemen (mS)/cm)	None	0.172	0.149	0.145
TDS	1000	Not measured	109.2	87.0
Calcium	150	17.3	16.8	18.0
Magnesium	100	4.2	5.3	3.5
Sodium	50	11.5	5.4	Not measured
Potassium	None	3.3	2.8	Not measured
Fluoride	1.5	0.4	1.1	0.4
Chloride	250	5.0	2.0	3.5
Alkalinity (as bicarbonate (HCO_3))	None	104.7	44.7	90.5
Hardness	300	62.7	Not measured	Not measured
Iron	0.3	0.6	Not measured	10.5
Silica (silicon dioxide as silicon (Si))	None	20	Not measured	Not measured

Additional historical data for pH (1998) and specific conductivity (1992 to 1995) are mentioned in the Technical Report 11 (TKBV, 2018a). These values are also compared to the primary Turkwel Gorge Reservoir water quality field parameter data in Section 6.7.3.2.

6.7.2 Primary Data

6.7.2.1 Methods

Five field visits were undertaken by the Golder team (23 to 27 November 2015, 25 May 2016 to 01 June 2016, 24 to 31 August 2016, 10 to 22 March 2019 and 8 to 12 March 2021). The two 2016 field surveys were completed to cover the wet season and post-wet season.

Flow in surface watercourses across the AoI is ephemeral and watercourses are commonly dry. Therefore, all of the surface water quality sampling (except from the Malmalte River – location M1) was taken from near-surface groundwater in dry luggas, equivalent to that used as water resources for local communities.

6.7.2.1.1 Sampling for Laboratory Analysis – Groundwater and Surface Watercourses

As part of a wider scheme of groundwater monitoring that is undertaken by KJV, Golder collected water quality samples from following groundwater wells:

- GW1 (same as KJV location East Lokichar WBHC);
- GW2 (same as KJV location Ngamia East);
- GW3 (same as KJV location Nakukulas 9);
- GW4 (same as KJV location Kapese Hand Pump); and
- GW5 (same as KJV location Loperot)
- Nakukulas 10.

The Golder surface water locations where samples were taken for laboratory analysis are as follows:

- SW1 – position on the southern lugga that drains the area of the Ngamia and Amosing and discharges into the Kalabata River;
- SW2 – position on the Kalabata River;
- SW3 – position on the Kalabata River;
- N1 – located downstream of the Ngamia area; and
- M1 - Malmalte River, downstream of the Kainuk crossing[5].

The locations of these groundwater and surface water monitoring locations are shown on Figure 6.7-1. Method statements for sampling were originally prepared and presented as part of the Work Plan for Baseline Study (Golder, 2015).

The following provides a summary of the five field trips during which the Golder team took water quality samples:

- 23 to 27 November 2015 – groundwater sampling was undertaken at GW1, GW2, GW3, GW4 and GW5. No surface water was present in the watercourses, so no samples were taken;
- 25 May 2016 to 1 June 2016 – groundwater sampling was undertaken at GW1, GW3 and GW5. No groundwater sample at GW2 was taken as the pump was being removed. A surface water sample was collected from SW3 and also from a hand dug well at SW1, but all other surface water quality monitoring locations were dry;
- 24 to 31 August 2016 – groundwater sampling was undertaken at GW1, GW3, GW4 and GW5. No surface water was present in the watercourses, so no samples were taken;
- 25 March 2019 – surface water sample from the Malmalte river just downstream of the Kainuk crossing; and
- 8 to 12 March 2021 – groundwater sampling was undertaken at GW1, GW2, GW4, GW5 and Nakukulas 10. Surface water samples were collected from hand dug wells at SW1 and SW2.

5 It was intended to take the sample from close to the confluence of the Malmalte/Turkwel Rivers, but the sample had to be taken at a location close to Kainuk due to security concerns.

6.7.2.1.2 Sampling for Laboratory Analysis – Water Bodies

Nine water samples were taken from the Turkwel Gorge Reservoir or Turkwel Dam Tailrace by KJV between May 2018 and April 2019 for laboratory analysis. These samples represent the water in the Turkwel Gorge Reservoir near the outflow. Water samples have also been taken regularly from the reservoir tailrace during the period June 2015 to April 2019. These samples are taken from the footbridge located downstream of the tailrace and are obtained using a 1 litre bottle that is submerged by hand into the flowing water. These samples represent the discharge from the power generation process after the water from the Turkwel Gorge Reservoir has passed through the turbines.

6.7.2.1.3 Laboratory Analysis and Quality Assurance

The Golder water samples gathered in 2015, 2016, 2019 and 2021 were collected in labelled bottles and stored in dedicated sample refrigerators before being sent to the (ISO accredited) SGS laboratory in Nairobi.

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

During the 2015 to 2016 campaigns, a combination of field blanks, trip blanks and duplicate samples were used for quality assurance purposes. These samples were also sent to the laboratory for analysis. A field blank is de-ionised water that is exposed to the sampling equipment in the field and handled in the same manner as the actual sample to provide information on the potential for contamination of samples during handling. The trip blank is de-ionised water that is prepared in a bottle at the laboratory and sealed. This sample remains unopened throughout the monitoring visit and is used to understand the potential for contamination of samples resulting from preparation, transport and storage activities. Duplicates are second samples taken from one of the monitoring locations and are used to understand the precision of the field technique and laboratory analysis.

The water samples that were taken from the Turkwel Gorge Reservoir and the tailrace by KJV were sent for laboratory analysis at a KJV-approved laboratory (TKBV, 2018b).

6.7.2.1.4 Field Parameter Measurements – Groundwater and Surface Watercourses

The water quality sampling undertaken by the Golder team at each of the data gathering locations included recording field parameters (e.g. pH, electrical conductivity, total dissolved solids, dissolved oxygen, temperature and oxidation reduction potential) using a handheld multi-parameter water quality meter. Method statements prepared to provide instruction on taking field parameter measurements were original prepared and presented as part of the Work Plan for Baseline Study (Golder, 2015).

Field parameter measurements were also made on the Malmalte River (M1) by Golder as part of biodiversity fieldwork campaigns in September 2018 (Golder, 2018c) and on 17 March 2019, plus at the Turkwel river downstream of the confluence with the Malmalte (T1) on 13 March 2019.

6.7.2.1.5 Field Parameter Measurements – Water Bodies

KJV undertook water quality field parameter measurements at the Turkwel Gorge Reservoir in October 2016 and October 2017 as part of water supply option survey work (TKBV, 2018a). The reservoir survey work was undertaken by boat between the power station intake at the dam and the uppermost extent of the reservoir near Pinou Gorge (TKBV, 2018b). The locations are presented in TKBV 2018a.

Measurements of turbidity in the Turkwel Gorge Reservoir were made (TKBV, 2018a) using two methods; one using a Secchi disc that was lowered into the water until it could no longer be seen and that depth was recorded; and a second using a YSI optical turbidity sensor.

Temperature, dissolved oxygen chlorophyll, blue-green algae[6], dissolved organic matter, pH and specific conductivity were also measured using the YSI sonde, which was lowered through the water to collect a vertical profile of measurements between the surface and the reservoir bed. The YSI sonde was calibrated in the field prior to use and daily quality checks were undertaken using YSI's recommended procedures (TKBV, 2018b).

6.7.2.2 Results

The laboratory certificates for the analyses undertaken on groundwater and surface water samples taken by Golder are presented in Annex I. The results of the field parameter measurements are also included in Annex I in the form of a summary document

The full results of laboratory analysis undertaken on groundwater and surface water samples taken by KJV at its strategic groundwater monitoring locations and in the Turkwel Gorge Reservoir and Turkwel Dam tailrace are presented in Annex I, as provided to Golder.

In order to present summary information on the water quality at key monitoring locations in the AoI and compare the results to water quality standards, a series of data and statistics tables have been prepared and are also presented in Annex I. The locations where groundwater and/or surface water concentrations exceed the Project water quality standards in at least one sample from a location are shown on [HOLD] Drawings 6.7-1 to 6.7-4.

6.7.3 Discussion

6.7.3.1 Laboratory Analysis

Summary statistics of the laboratory results for each of the groundwater and surface water sampling locations are presented in Annex I. A comparison to the Project water quality standards has also been undertaken and values greater than the Project standards are highlighted in red in Annex I. The Project standards were developed and presented by Golder (Annex I). National Kenyan standards have been selected, where available; followed by internationally recognised guidelines where national standards are not defined. Where more than one standard is available for the same parameter the more stringent value has been selected.

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

6.7.3.1.1 Groundwater

The laboratory water quality analysis results show that groundwater has a pH close to neutral and typically ranges from a minimum of 6.85 to a maximum of 8.65. Most pH values are within the range of the standard (>6.5 and <8.5), but there are occasional pH values greater than pH 8.5 measured in samples taken from GW2 (Ngamia East), GW5, GW3 (Nakukulas 9), Kengakalalio C (Kaimegur B), Kengomo 2 and Kaimegur BH.

Electrical conductivity values typically range from around 0.51 to 2.418 mS/cm. Higher electrical conductivity measurements greater than the laboratory Limit of Detection (LoD), between 1.5 mS/cm and 4 mS/cm, were measured in samples taken from GW3 (Nakukulas 9), Kengomo 1, Kengomo 2, Kengakalalio C (Kaimegur B), Nabolei BH, Katilu hand pump, Nakukulas hand dug well and Kareeman spring. The higher electrical conductivity measurements are mainly, but not exclusively, from deeper boreholes such as Kegomo 1 and Kengomo 2.

Metal concentrations in groundwater are often below the laboratory LoD. Metals where all concentrations in all samples from all monitoring locations were below the LoD include beryllium, cadmium, mercury and nickel. When analysed for, aluminium, arsenic, barium, beryllium, boron (either as boron or boric acid), bromate (as

[6] Not presented in this baseline

BrO_3), chromium, copper, cyanide, iron (ferrous, ferric and total), lead, lithium, manganese, nickel, selenium, vanadium, zinc and strontium were most commonly detected at concentrations greater than the LoD (in approximately a third of the samples analysed). Aluminium, arsenic, barium, chromium, copper, manganese, iron and selenium were also detected at concentrations greater than the LoD, but in a lower proportion of samples taken. Most metal concentrations are below the selected water quality standards. Occasional exceedance of the Project water quality standards occurs for aluminium, boron (as boric acid or as boron), nickel, copper, iron, manganese, selenium and zinc.

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 some samples from most locations have been measured most often in samples taken from GW3 (Nakukulas 9), Kengomo 1, Kengomo 2, Kengakalalio C (Kaimegur B), Nabolei, Kaimegur BH and Katilu hand pump. Occasional exceedances of the chloride standard are also shown in the results from samples taken from Nakukulas 9, GW5, Kengomo 2 and Nabolei. Most samples from Kengomo 1 had chloride concentrations exceeding the Project water quality standard of 250 mg/l.

Nitrate (as NO_3), nitrite, ammonia (as NH_3) and phosphate are commonly measured at concentrations above the Project water quality standards and may originate from soils or contact with sources such as human or animal waste.

Concentrations of TDS are high compared to the quality standard in samples taken from GW3 (Nakukulas 9), Kengakalalio C (Kaimegur B), Kengomo 1, Kengomo 2, Nabolei, Katilu hand pump, Nakukulas hand dug well and Kareeman spring.

Other hydrocarbon concentrations are also mainly below the LoD. The total petroleum hydrocarbon (TPH) concentration has occasionally been greater than the LoD of 0.01 mg/l. TPH has been detected once out of the two samples taken from the boreholes at GW1 (East Lokichar WBHC), GW3 (Nakukulas 9), GW4 and GW5. Benzene and toluene have been detected at concentrations greater than the LoD once out of three samples taken at GW4. Toluene has been detected once out of three samples taken from GW5. All of these detected concentrations occurred as part of the same analysis undertaken on samples from 29 or 30 August 2016 and could represent slight contamination during sampling or laboratory analysis.

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

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

6.7.3.1.2 Surface Watercourses

Due to the ephemeral nature of the watercourses and the opportunistic method of sampling, only four surface water samples were taken from the AoI by Golder:

- Two samples in 2016: One from SW3 and one from near surface groundwater in a shallow hole dug at SW1.
- Two samples in 2021: One from a shallow hand dug well at SW1 and one from a shallow hand dug well at SW2.

The results can be summarised as follows:

- No concentration above the LoDs were detected for aluminium, arsenic, beryllium, cadmium, chromium, copper, iron, lead, mercury, nickel, or selenium. Barium, boron and zinc measured concentrations are below the Project water quality standards;
- The laboratory analyses indicate that the water quality standard for Boron (as boric acid) exceeded the water quality standard in the sample taken from SW2 in 2021;
- Water quality standards for ammonia and total suspended solids were exceeded in the sample taken from SW3, and that ammonia and fluoride concentrations were higher than the standards in the sample taken from SW1 in 2021;
- Water quality standards for phosphate, nitrate and nitrite were exceeded in the sample taken from SW2 in 2021;
- Water quality standards for ammonia and fluoride were exceeded in the sample taken from SW1 in 2016;
- Napthalene was detected at a concentration of 4 mg/l at SW3 and pyrene was detected at a concentration of 0.03 mg/l at SW1. No other hydrocarbons were detected in either sample; and
- The coliform count (total and faecal) for surface water is higher than that for groundwater.

The laboratory analysis results for the surface water sample taken from the Malmalte River near Kainuk in April 2019 show that arsenic, beryllium, boron, cadmium, chromium, copper, lead, manganese, nickel, selenium and zinc were not detected at concentrations above the LoD. Other metals were detected with concentrations typically below the Project water quality standards. The exception to this is aluminium with a concentration of 0.199 mg/l which is slightly above the Project water quality standard of 0.1 mg/l. Ammonia and total suspended solids concentrations also exceeded the Project water quality standards. No hydrocarbons were detected at concentrations above the LoD.

6.7.3.1.3 Surface Water Bodies

Water in the Turkwel Gorge Reservoir has occasional exceedances of the Project water quality standards with respect to concentrations of selenium, aluminium, boron (as boric acid), ammonia (as N), nitrite and phosphate. Arsenic, bromate (as BrO_3), cadmium, chromium, cyanide, copper, lead, lithium, manganese, mercury and nickel concentrations were not detected above the laboratory LoD. Concentrations of all other parameters analysed were below the Project water quality standards, where standards are available. The pH of the reservoir water ranged between 7.38 and 8.4, which is similar to the field parameter pH values discussed in Section 6.7.3.2.

Water samples taken from the Turkwel Dam tailrace show that the tailrace water quality is generally similar to the reservoir water quality. As with the reservoir water, arsenic, chromium, cyanide, lead, lithium, mercury and nickel concentrations were also not detected above the laboratory LoD. In addition, selenium was also not detected at concentrations above the laboratory LoD. The pH of the tailrace water is slightly more acidic than the reservoir water (6.65 to 8.02).

Concentrations of sodium, sulphate and alkalinity are higher in the tailrace water samples, and bromate, cadmium, copper and manganese were all detected above the laboratory LoD in the tailrace water when they were not detected in the reservoir water. However, cadmium and copper were only detected in the tailrace water on one occasion out of 19 samples, so the results may represent anomalous outliers.

Occasional exceedances of the Project water quality standard for iron (total), boron (as boric acid), aluminium, ammonia (as N), nitrite, fluoride, sodium and phosphate were measured in the Turkwel Dam tailrace samples.

No analysis of coliforms, TPH or PAH was undertaken on the samples from the Turkwel Gorge Reservoir or the Turkwel Dam tailrace.

6.7.3.2 Field Parameters

6.7.3.2.1 Groundwater

A summary of the groundwater field parameter results collected between November 2015 and March 2021 is presented in Table 6.7-2. The complete dataset is included in Annex I.

Table 6.7-2: Summary of Groundwater Field Parameter Measurements

Parameter	Locations					
	GW1	GW2	GW3	GW4	GW5	Nakukulas 10
Temperature (°C)	34.5 to 39.1	34.3 to 34.7	34.7 to 35.2	29.7 to 32.1	33.1 to 34.5	34.10
Dissolved Oxygen (%)	16	10.7	31	34.1	23.7	-
Dissolved Oxygen (mg/l or ppm)	1.15 to 5.51	0.7	1.9 to 3.66	2	1.65 to 3.11	-
pH	6.85 to 7.95	6.97 to 7.96	7.7 to 8.92	6.59 to 8.59	6.88 to 7.41	7.02
Oxidation Redox Potential (mV)	-172.1 to +81.9	-203.9	-166.8 to +62	-120.7	-141.5 to +149.3	-
Conductivity (µS/cm)	721 to 1032	1317 to 1329	1248 to 1663	525 to 890	924 to 1174	699
Total Dissolved Solids (mg/l)	360	-	625	263	465	-

- No measurement made

The field parameter measurements indicate that groundwater has a typical temperature of around 30°C to 35°C.

The pH of groundwater (17 samples in total) ranges from 6.59 (GW4, March 2021) to 8.92 (GW3 August 2016), but it should be noted that the locations from which measurements at either end of this range were taken also gave pH measurements closer to neutral on other monitoring visits.

The electrical conductivity of groundwater ranges between 0.525 mS/cm (GW4, November 2015) and 1.663 mS/cm (GW3, November 2015). Where samples have been taken from the same location at different times of the year, there is little similarity in the results indicating this parameter is quite variable. There are no clear temporal trends in electrical conductivity over the four monitoring rounds.

The dissolved oxygen concentrations measured in groundwater range from 0.7 mg/l (GW2, November 2015) to 5.51 mg/l (GW1, May/June 2016). The values indicate that the water is not completely saturated, but that the water is also not anoxic[7]. The dissolved oxygen concentrations were higher in May/June during the wet season (3.11 mg/l to 5.51 mg/l) than in November (0.7 mg/l to 2 mg/l). No dissolved oxygen measurements were collected during the 2021 field work.

[7] Depleted of dissolved oxygen

The Oxygen Redox Potential (ORP) measurements in groundwater range from -203.9 millivolts (mV) (GW2, November 2015) to +149.3 mV (GW5, May/June 2016). The ORP measures the capacity of a solution to either release or accept electrons from chemical reactions. All of the measurements made in November 2015 were negative (i.e. indicate a reducing environment) and all of the measurements in May/June (during the wet season) were positive (i.e. indicating an oxidising environment). No ORP measurements were collected during the 2021 field work.

TDS was measured in August 2016. The results range from 263 mg/l (GW4) to 625 mg/l (GW3). These results are within the range expected for fresh water.

6.7.3.2.2 Surface Watercourses

A summary of the surface water field parameter results collected between May 2016 and March 2021 is presented in Table 6.7-3. The complete dataset is included in Annex I.

Table 6.7-3: Summary of Surface Water Field Parameter Measurements

Parameter	Locations				
	SW1	SW2	SW3	T1	M1
Temperature (° C)	30.1 to 33.2	30.94	28.7	23.0	23.3 to 27.2
Dissolved Oxygen (mg/l or ppm)	2.02	-	5.02	7.06	6.82 to 7.73
pH	7.10 to 7.37	7.29	7.85	7.07	6.81 to 8.67
Oxygen Redox Potential (mV)	+77.6	-	+62.3	+191.4	+187.4
Conductivity (μS/cm)	575 to 631	628	273.5	19.8	19.2 to 200

- No measurement made

The field parameter measurements indicate that surface water in the South Lokichar Basin (Locations SW1, SW2 and SW3) also has a typical temperature of around 30°C to 35°C.

The pH of surface water (from four samples taken in May/June 2016 and March 2021 in South Lokichar) ranges from 7.10 to 7.85. As the pH of rainwater is typically slightly acidic, the natural pH is likely to reflect contact with soils/sediments.

Electrical conductivity ranges between 0.274 mS/cm and 0.631 mS/cm in surface water samples. Typically, surface water that has come from rainfall will have a lower electrical conductivity that groundwater, which has been in contact with soils/sediments that can increase the presence of dissolved material that conducts electrical current; therefore, these results are as expected.

Dissolved oxygen in the surface water samples ranges from 2.02 to 5.02 mg/l (1 ppm = 1 mg/l).

ORP was measured in November 2015 and May/June 2016. The results in surface water (May/June 2016 only) range from +62.3 mV to +77.6 mV.

The field parameter measurements and observations made on the Malmalte River (M1) in September 2018 (Golder, 2018c) and in March 2019, and the measurements taken from the Turkwel River (T1) in March 2019 were similar to other surface water measurements in South Lokichar and were as follows:

- pH ranged from 6.81 to 8.67;
- Electrical conductivity ranged from 0.0192 mS/cm to 0.20 mS/cm;
- Dissolved Oxygen ranged from 6.82 ppm to 7.73 mg/l (1 ppm = 1 mg/l);
- Temperature range from 23.3°C to 27.2°C;
- The ORP value was positive (i.e. indicating an oxidising environment); and
- Turbidity was observed to be high.

6.7.3.2.3 Surface Water Reservoir

Annex I presents the results of the physical and chemical field parameter measurements (i.e. turbidity, temperature, dissolved oxygen, dissolved organic matter, pH and specific conductivity) collected during the KJV Turkwel Gorge Reservoir water quality survey.

It is stated in the Technical Report 11 (TKBV, 2018a) that turbidity typically increased with depth, but varied less with depth nearest the dam. It is also stated that the highest turbidity readings were measured at locations where narrowing in the shape of the reservoir causes higher flow velocities.

The 2016 survey results indicate that water temperature in the Turkwel Gorge Reservoir was warmer at the Pinou Gorge end and coolest near the dam wall (TKBV, 2018a). The depth profiles show most temperatures were around 25°C to 27.5 °C at the surface and then reduce to a similar temperature of approximately 24.5 °C at around 30 m below the surface of the reservoir.

The 2016 survey results indicate that dissolved oxygen concentration in the Turkwel Gorge Reservoir near surface are more saturated with oxygen and concentrations reduce with depth and towards zero at the base of the reservoir.

The pH measurements taken in 2016 (TKBV, 2018a) and in 2017 (TKBV, 2018a) show a reduction in pH with depth. The pH is alkaline at the surface (around 8.5 to 9.5), which is slight above the Project standard of 6.5 to 8.5, and closer to neutral at depth (around 7.5). It is stated in Technical Report 11 (TKBV, 2018a) that these values are similar to the values collected during a study in 1998 where the median pH ranged from 7.1 to 8.7. These concentrations are also similar to the historical pH values from 1973 to 1983, which ranged from 7.8 to 8.0 (Table 6.7-1).

Conductivity represents the conductance in the water, which is a function of the dissolved salt content. Conductivity varies with temperature, so is commonly normalised to a specific conductivity at 25°C. The specific conductivity in the Turkwel Gorge Reservoir in 2016 (TKBV, 2018a) did not vary notably with depth and typically was around 180 µS/cm to 190 µS/cm (0.18 to 0.19 mS/cm). The 2017 survey measurements (TKBV, 2018a) show similar results that typically range from around 170 µS/cm to 180 µS/cm (0.17 to 0.18 mS/cm). The historical measurements (Table 6.7-1) are of a similar order (0.145 mS/cm to 0.172).

6.8 Water Quantity

6.8.1 Secondary Baseline Data Gathering

6.8.1.1 Hydrological Setting

6.8.1.1.1 Rainfall

The AoI is located in an area where precipitation predominantly occurs in two rainy/wet seasons that are typically during April to June (the long rains season) and October to December (the short rains season). Much of the rain falls during the long rains. Rainfall for the remainder of the year is typically low and the area is often at risk of serious drought conditions. A summary of the rainfall information in the region is presented below and discussion in more detail in Section 6.4.

Precipitation data from Lodwar meteorological station has been used to inform the baseline. Lodwar meteorological station is situated at an elevation of 523 masl approximately 85 km north of Lokichar. The Lodwar meteorological station monthly total rainfall data averaged over 34 years indicates a peak around April/May. The maximum daily precipitation at Lodwar was 182.9 mm on 21 June 1991. There is high variability in monthly rainfall on a year to year basis (Section 6.4).

In addition, two meteorological stations were installed by a TKBV contractor between December 2015 and January 2016 at Kapese Camp and the existing Ngamia 8 wellpad.

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

6.8.1.1.2 Catchments and Drainage

An overview of the hydrological setting of Kenya (FAO, 2018) indicates that most of Kenya's water originates from its five "*water towers*": Mau Forest Complex, Aberdare range, Mount Kenya, Mount Elgon and the Cherengani Hills. They are the largest montane forests in the country and form the upper catchments of most of the main rivers in Kenya. There are six main catchments in the country, used as units for water resources management:

- Lake Victoria North Basin Area (LVNBA) that covers 3.0% of the country;
- Lake Victoria South Basin Area (LVSBA) that covers 5.0% of the country;
- Rift Valley Basin Area (RVBA), which includes the inland lakes and covers 22.5% of the country;
- Athi Basin Area (ABA) that stretches up to the coast and covers 11.5% of the country;
- Tana Basin Area (TBA) that covers 21.7% of the country; and
- Ewaso Ng'iro North Catchment Area (ENNBA) that covers 36.3% of the country.

A map of the catchment areas is shown in Figure 6.8-1 (WRA, 2018).

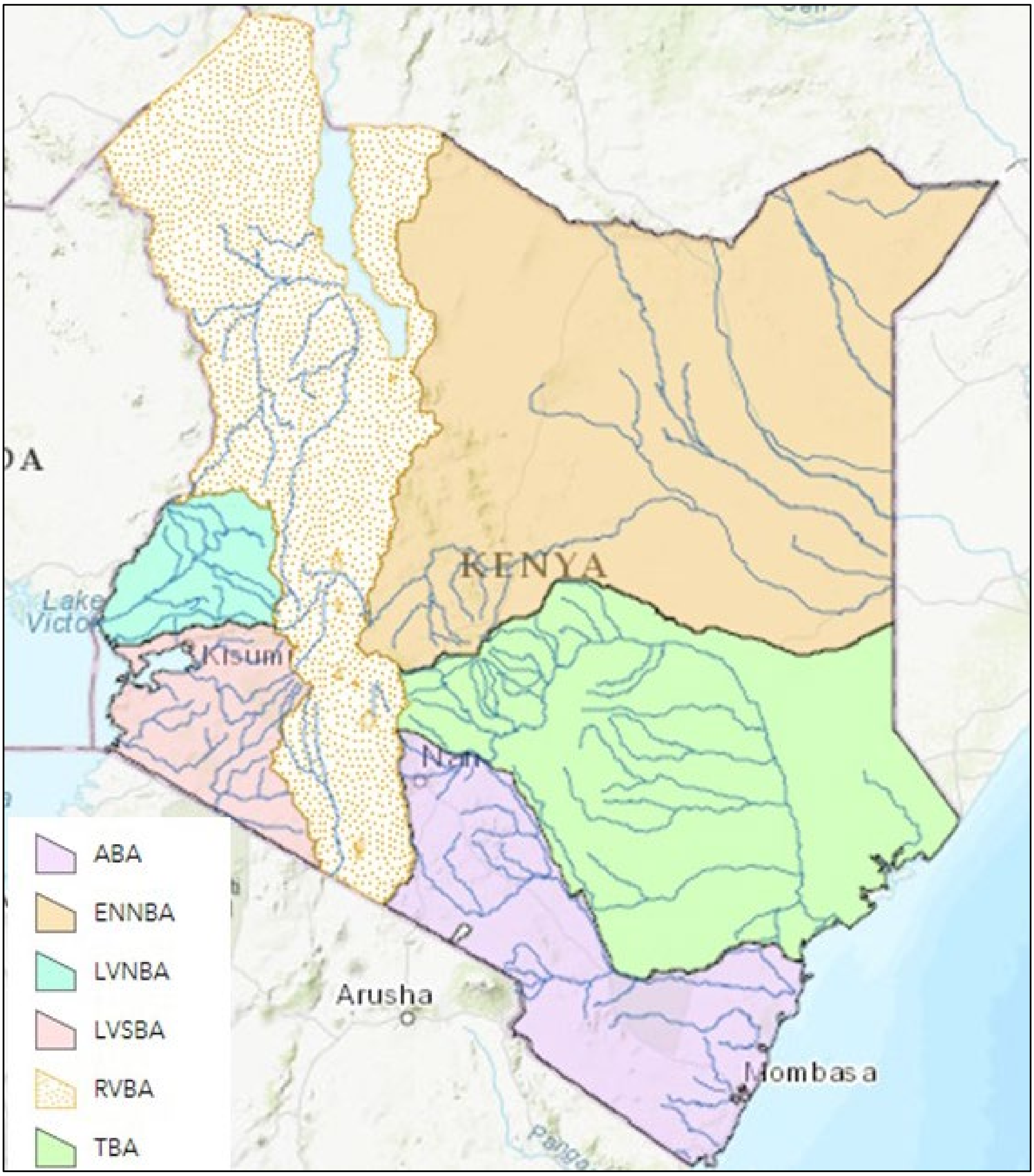

Figure 6.8-1: Main Catchments of Kenya (Source: WRA, 2018)

The AoI is located in the RVBA, partly in the Kalabata catchment and partly in the Turkwel catchment (Figure 6.8-2). The Kalabata water course is a sub-catchment of the Kerio basin. The Kerio and the Turkwel both ultimately discharge to Lake Turkana. Drainage in the AoI is dominated by a dendritic network of ephemeral streams that converge into larger channels (luggas) and drain towards the north-east or the west. The luggas that drain to north-east drain towards the Kalabata River (also ephemeral), which then flows to the north along the western edge of an outcrop of Miocene volcanics (the Auwerwer Volcanics). Near Loperot, the Kalabata turns eastwards and exits the South Lokichar Basin flowing towards the Kerio Valley and then flows northwards as the Kerio River.

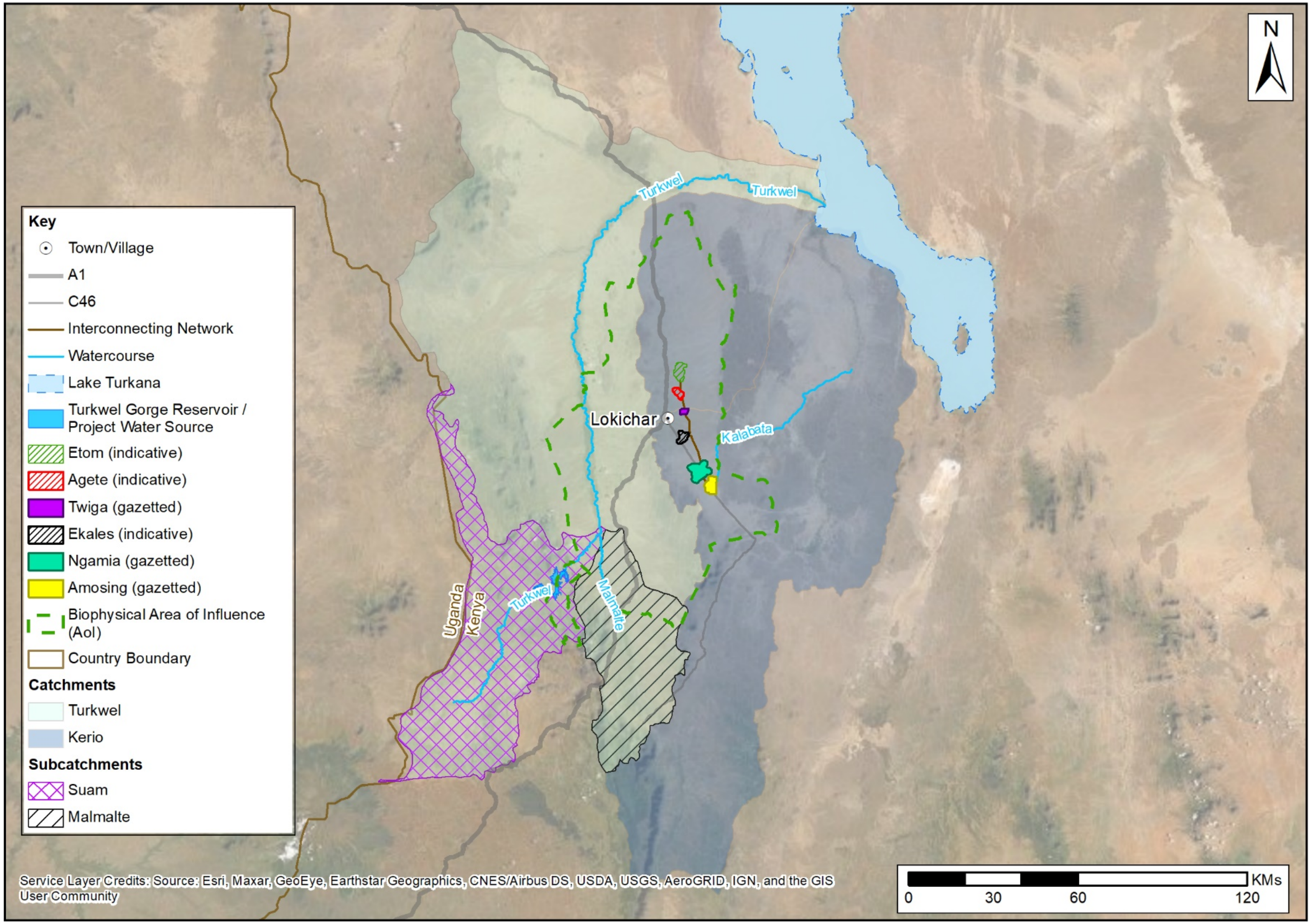

Figure 6.8-2: Kalabata and Turkwel Catchments

The Malmalte River (also known as Wei-Wei in its upstream reaches) is one of the main rivers in the Turkwel catchment. It derives its waters from Cherangany Hills and winds downwards to meet the Turkwel River approximately 25 km downstream of the Turkwel Gorge Reservoir. The Turkwel River then flows north then east and discharges into Lake Turkana. The luggas in the AoI that drain to the west drain towards the Turkwel River. Flow to the Turkwel River downstream of the Turkwel Gorge Reservoir, but upstream of the confluence with the Malmalte, is controlled by discharges from the reservoir, which are discussed further in Section 6.8.3. The main flow into the Turkwel Gorge Reservoir valley comes from the Suam River, which originates from Mount Elgon.

The luggas in the AoI that drain to the east drain towards the Kalabata River, which is an ephemeral tributary of the Kerio River. Downstream of the Kalabata, the Kerio River flows north and discharges into Lake Turkana. The drainage luggas in the Kalabata catchment are typically sandy and shallow, and the main channels are typically clear of vegetation with some vegetation along the banks (Worley Parsons Consulting, 2015a). There is flood attenuation capacity as the channels are shallow and there are wide flat plains with depressions where water can collect (Worley Parsons Consulting, 2015a). Some hydrological and flood risk modelling has been undertaken (Worley Parsons Consulting, 2015b).

The Turkwel River and the Kerio River provide the rest of the flow input to Lake Turkana. The inflow from the Kalabata River via the Kerio River to Lake Turkana is relatively minor compared to other sources. Lake Turkana has an area of approximately 7,000 km^2. The Omo River, which flows in from Ethiopia, has a catchment of approximately 74,000 km^2. It provides approximately 55% of the drainage basin area that feeds Lake Turkana and around 90% of the flow into it (Atkins, 2014). The inputs to Lake Turkana vary seasonally, but these variations have been tempered by dams; particularly on the River Omo (Avery, 2013). There are no surface water outflows from Lake Turkana as evaporative losses balance inflow (Atkins, 2014), meaning the entire region forms an endorreic catchment i.e. one which does not ultimately discharge to the sea.

With respect to transboundary matters, the FAO stated in 2015 that Kenya, together with nine other Nile riparian countries, is a member of the Nile Basin Initiative (NBI) (FAO, 2015). There is no cooperation framework between NBI member countries that border Lake Turkana. The absence of cooperative management leads to tensions, for example Ethiopia constructing dams that impact the water inflow to Lake Turkana.

6.8.1.1.3 Aquifers, Aquifer Properties and Recharge

As shown in Figure 6.8-3 (Hydrogeology of Kenya: BGS, 2018), the main hydrogeological environments in the surface geology in Kenya are volcanic or basement in the inland areas and tend to be more unconsolidated materials or intergranular and fractured sedimentary rocks towards the coast. The flow and storage characteristics are typically fracture dominated in the inland area’s basement and volcanic areas and intergranular towards the coast. Aquifer productive (yields) are typically low to moderate, but some un or semi-consolidated aquifers towards the coast can yield higher volumes of water.

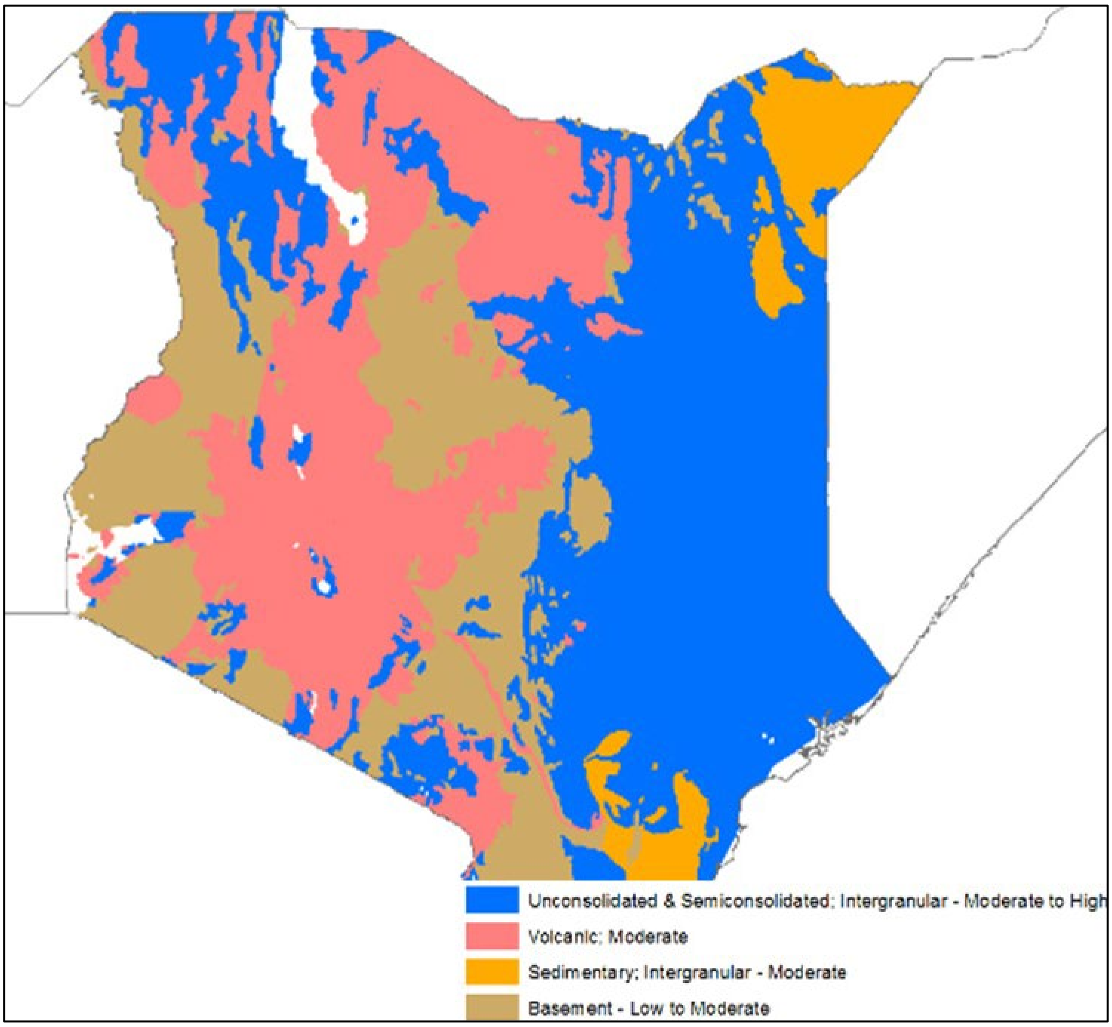

Figure 6.8-3: Main Hydrogeological Environments in Kenya

In the RVBA there are the Kerio Volcanics, which are classified as a poor aquifer[8] (WRA, 2018). Other Tertiary Volcanics in the Turkana region are also typically classified as poor aquifers. The basement rocks are also classified as a poor aquifer. There are basement rocks at depth in the AoI, and these are not known to be used for water supply. Although poor aquifers may have low yields and moderate-to-poor quality, they might have local supply potential.

In the RVBA there are also the Lodwar Alluvial Aquifer, which is classified as a special aquifer[9] and the Lotikipi Valley Aquifer, which is classified as a minor aquifer[10] (WRA, 2018). These are located in Turkana County to the west of Lake Turkana, and north of the potential AoI. The deeper saline Lotikipi Basin Aquifer may represent fossil water and receive limited, or no, recharge from the surface. This may also be the case for the Lodwar Basin Aquifer, except where the aquifer system is near the surface and more alluvial because these aquifers could receive input from precipitation and river recharge (Olago, 2018). These potential aquifers are not currently known to be exploited for water supply and there are no similar known resources at depth beneath the AoI. Recharge occurs to both by direct rainfall infiltration and, to the Lodwar aquifer by leakage from the Turkwel River. Turkana Tertiary sediments are also classified as minor aquifers.

[8] The WRA defines a ‘poor aquifer’ as being a low- to negligible-yield aquifer system with moderate to poor water quality.

[9] The WRA defines ‘special aquifers’ because of their importance as aquifers.

[10] The WRA defines a ‘minor aquifer’ as a moderate-yield aquifer system with variable water quality.

In the AoI, there are alluvial (unconsolidated sedimentary) and volcanic (igneous) aquifers that can provide water supplies of varying yields. The alluvial sands and sediments can have high groundwater potential, where dominated by coarse grained sediments (sand and gravel), but elsewhere, groundwater potential is typically limited.

Water wells have been drilled during the exploration works and the hydraulic property information determined from pumping tests and presented in Price (2016) and Unknown (2014) are summarised in Table 6.8-1. The most productive wells come from those that encounter the sandy sedimentary interflow deposits; those wells that only intersected the lavas have been found to be unproductive (Price, 2016).

Table 6.8-1: Summary of Aquifer Hydraulic Properties (Source: Unknown, 2014; Price, 2016)

<table>
<tr><th>Deposit/Aquifer</th><th>Description</th><th>Test Location</th><th>Transmissivity</th><th>Yield</th></tr>
<tr><td>Sediments (Plio-Holocene)</td><td>Not provided</td><td>Ngamia 4</td><td>No data presented</td><td><1 m^3/hr</td></tr>
<tr><td>Kerio River Gravels</td><td>Sands and gravels</td><td>Unknown</td><td>Unknown</td><td>Up to 50 m^3/hr</td></tr>
<tr><td rowspan="3">Auwerwer Volcanics (Miocene)</td><td rowspan="3">Basalt lava flows with interflow units of clay, silt, sand and occasional gravels
and cobbles (water mainly from sedimentary interflow units 5 m to 20 m thick)</td><td>East Lokichar</td><td><1 m^2/d</td><td rowspan="3">Approx. 8 m^3/hr to 12 m^3/hr,
(max.= 23 m^3/hr)</td></tr>
<tr><td>Lokwii</td><td>>750 m^2/d</td></tr>
<tr><td>Geometric Mean (excluding Lokwii)</td><td>~10 m^2/d</td></tr>
</table>

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

Recharge to the alluvial aquifers is typically local and occurs by direct rainfall. There is also some recharge from infiltration by leakage from the rivers. A study published in 2013 (Radar Technologies International, 2013) looked at the potential groundwater resources in northern and central Turkana County. The findings presented recharge values of 10% to 20% of rainfall. The average effective precipitation (i.e. the precipitation that is not lost by evaporation or transpiration) is estimated in Price (2016) to be less than 20 mm/yr (which is ~8% of annual average rainfall). However, TKBV (2015a) questioned this and proposed literature values for arid and semi-arid regions range from 0.1% to 5% of long-term average rainfall to be more appropriate.

6.8.1.2 Groundwater Elevations and Flow Directions

There is little reliable long-term groundwater monitoring data available in the South Lokichar Basin. This is because most existing boreholes that are used as monitoring wells are also production wells, so obtaining reliable data is often not possible because production would have to be stopped for data collection to allow groundwater levels to re-equilibrate (WRA, 2018). The Water Resources Situation Report for 2017/2018 (WRA, 2018) states that exploratory boreholes have been installed in a range of places including the Turkana aquifer at Loperot, Lokichar, Lopur, Meyan and Kapsor. However, no data are available.

Groundwater was typically encountered during water study drilling (Unknown, 2014) at depths between 20 m and 40 metres below ground level (mbgl). From the limited data available, an attempt was made in Price (2016) to contour the water levels in the shallow aquifer units using the maximum levels recorded for each well. The results of that exercise showed that groundwater flow is predominantly north-eastwards towards the Kerio Valley and Lake Turkana, but there was insufficient data to indicate whether there is groundwater discharge to the

Kerio River. Measurements of the hydraulic gradient between various locations indicated a range of 0.0026 to 0.0076 (Price, 2016).

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

6.8.1.3 Flooding

The NDMA produce monthly drought early warning bulletins, information on flood events and a summary of water sources in Turkana County and West Pokot. Flood event details included in the monthly drought reports for June 2020 to May 2021 are summarised in Table 6.8-2.

Table 6.8-2: Summary of Turkana Water Resource Information

Month (Year)	Flood Event Information from NDMA Monthly Drought Reports (Turkana)	Flood Event Information from NDMA Monthly Drought Reports (West Pokot)
June (2020) to September (2020)	No flood events reported.	No flood events reported
October (2020)	Occasional swelling of the seasonal rivers like Kawalase resulted in flooding of the adjacent areas.	No flood events reported.
November (2020) to April (2021)	No flood events reported.	No flood events reported.
May (2021)	Turkana West, for example Lokange and Lodwar Township in Central, experienced massive flooding.	No flood events reported.

6.8.1.4 Regional Water Use

Kenya relies on both surface water resources and on groundwater. Dependence on groundwater is highest in rural areas and in the coastal zone, but urban areas also rely on groundwater (BGS, 2018). Surface water sources include perennial or seasonal rivers and streams (luggas), lakes, springs, oases and dammed reservoirs. Groundwater sources below the surface might be accessed through boreholes or hand-dug wells (including those dug into river beds during the dry season).

The Kenya Groundwater Governance Case Study (World Bank, 2011) presents data on water resource availability in each of the main catchments in Kenya. The statistics are reproduced in Table 6.8-3. The AoI is located in the Rift Valley Catchment.

Table 6.8-3: Catchment Water Resources Availability

Catchment	Area (km^2)	Surface Water (10^6 m^3/yr)	Groundwater (10^6 m^3/yr)
Rift Valley	130,452	2,784	126
Tana	126,026	3,744	147
Ewaso Ng'iro	210,226	339	142

According to the 2014 Kenya Demographic and Health Survey Atlas (KNBS, 2016), access to an improved drinking water source is varied, as shown in Figure 6.8-4. Improved water sources include piped water; a public tap/standpipe or borehole; a protected well or protected spring water; rainwater; and bottled water. Within the AoI, access to safe drinking water is reported to be between 28% and 48%.

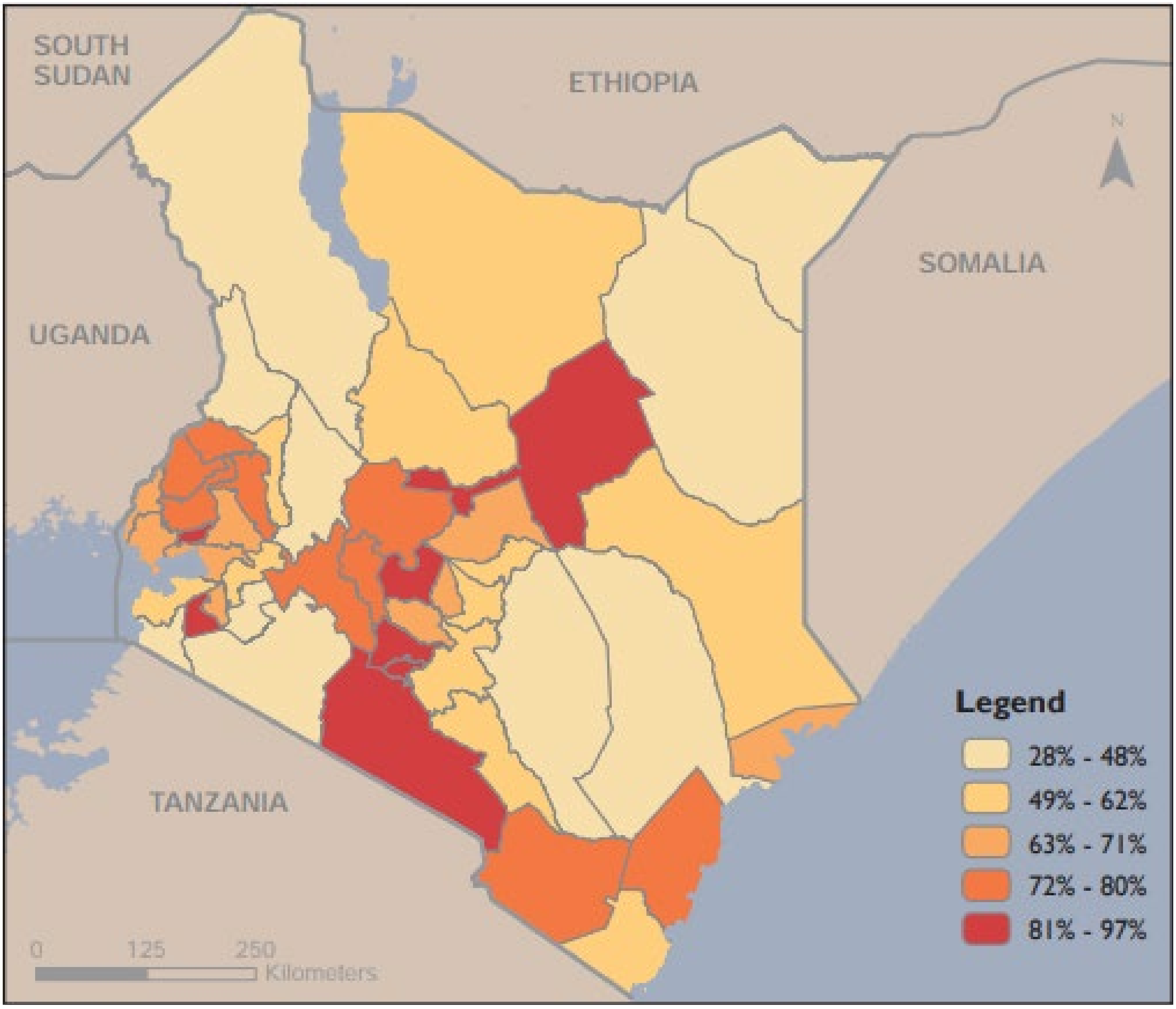

Figure 6.8-4: Access to Improved drinking water in Kenya (2014/15)

The NDMA produces monthly drought early warning bulletins that include a summary of water sources in Turkana County and West Pokot. The summaries for June 2020 to May 2021 (Table 6.8-4) indicate that a range of water sources are used for domestic supply although groundwater sources are clearly the most used resource.

Table 6.8-4: Summary of Turkana and West Pokot Water Resource Information

Month (Year)	Water Resource Information from NDMA Monthly Drought Reports (Turkana)	Water Resource Information from NDMA Monthly Drought Reports (West Pokot)
June (2020)	Water needs were met mainly through use of boreholes, traditional river wells and shallow wells.	Main water sources used were traditional river wells, pans/dams, rivers and boreholes. Recharge was stable to all surface water sources, attributed to goo seasonal rains.

Month (Year)	Water Resource Information from NDMA Monthly Drought Reports (Turkana)	Water Resource Information from NDMA Monthly Drought Reports (West Pokot)
	Not much variation was observed in the usage of water sources.	dropped due to lack of rainfall. Sources in use are normal for this time of year.
July (2020)	Boreholes, shallow wells with a pumping mechanism and traditional river wells were the main sources of water during this month. The proportion of households accessing water from the boreholes remained unchanged from the previous month.	Main water sources used were traditional river wells, pans/dams, boreholes and rivers. Good ongoing rains resulted in stable recharge of all surface water sources. Sources normal for this time of year.
August (2020)	Household water needs were met through use of boreholes, shallow wells and traditional river wells. There was no remarkable shift in the proportion of households utilising each of these sources from that reported during the previous month.	Main water sources used were traditional river wells, boreholes, pans/dams, rivers and springs. Recharge remained stable in surface sources linked to good ongoing rainfall. Sources normal for this time of year.
September (2020)	Most households utilised boreholes, shallow wells and traditional river wells to meet water needs. No significant shift in the proportion of the population utilising these sources was observed from the previous month.	Main water sources used were traditional river wells, boreholes, pans/dams and springs. Good rainfall that recharged sources. Recharge is good in all surface water sources due to ongoing rainfall. Sources normal for this time of year.
October (2020)	Boreholes, shallow wells and traditional river wells remained as the main supply sources. Use of traditional river and shallow wells increased by 8 and 3% respectively relative to the previous month.	Main water sources used were traditional river wells, pans/dams, boreholes, rivers and natural ponds. Recharge remained good to all sources and is projected to stabilise owing to ongoing sufficient rainfall. Sources normal for this time of year.
November (2020)	Major sources during this month were Boreholes, traditional river wells and shallow wells. There was no significant shift in the proportion of households utilising different sources of water in comparison to the previous month.	Main water sources used were traditional river wells, pans/dams, boreholes, rivers and natural ponds. Recharge was stable however this is likely to worsen owing to ongoing inadequate rainfall. Sources normal for this time of year.
December (2020)	Boreholes, shallow wells and traditional river wells were the main sources in use by the community during this period. Despite boreholes remaining the most preferred source, 11% of households resorted to using traditional river wells as their main source of water.	Main water sources used were traditional river wells, pans/dams, boreholes, rivers and natural ponds. Recharge to sources was poor in all surface water sources in comparison to November. Sources normal for this time of year.
January (2021)	Boreholes, rivers and shallow wells were the main sources of water and thus, the situation did not shift significantly from the previous month.	Main water sources used were pans/ dams, boreholes, rivers, and traditional river wells. Poor surface water recharge recorded in all sources during the month. Sources normal for this time of year.

Month (Year)	Water Resource Information from NDMA Monthly Drought Reports (Turkana)	Water Resource Information from NDMA Monthly Drought Reports (West Pokot)
February (2021)	The major sources of water across the livelihood zones included boreholes, traditional river wells and shallow wells. Despite boreholes remaining the most preferred water source due to better water quality, a large proportion of household used traditional water wells as their main source due to the concentration witnessed in the boreholes. There was no use of water pans, with 90% having dried up over the course of the month.	Main water sources used were pans/dams, boreholes, rivers, traditional river wells and traditional water wells. There was poor surface water recharge in all sources however, the situation is anticipated to improve owing to expected onset of long rains. Sources normal for this time of year.
March (2021)	Boreholes, traditional river/hand dug wells and shallow wells remained the major sources of water. Concentration was witnessed around strategic solar powered boreholes owing to their high yield and superior water quality. Sites without a functional borehole relied heavily on hand dug wells, partly propelled by the closeness of seasonal rivers to areas of residence and grazing. All open water sources (pans and rock catchments) had dried up	Main water sources used were boreholes, rivers, pans/dams, traditional river wells and traditional water wells. There was poor surface water recharge in all sources due to delayed onset of long rains Sources normal for this time of year.
April (2021)	The major water sources were boreholes, traditional river/hand dug wells and shallow wells. Hand dug wells were utilised by migrating pastoral households and in areas where boreholes had broken down. No recharge of the open water sources occurred because of the delayed onset of the long rains.	Main water sources used were boreholes, pans/dams, rivers, traditional river wells and springs. There was substantial surface water recharge in all sources owing to ongoing long rains. Sources normal for this time of year.
May (2021)	Boreholes, traditional river wells and shallow wells were remained the main sources of water. Water pan and rock catchments recharged to 25-50% capacity.	Main water sources used were boreholes, traditional river wells, pans/dams, rivers and traditional water wells. There was significant surface water recharge in all sources due to good long rains season performance. Sources normal for this time of year.

Figure 6.8-5 presents a plot of the percentage use from each water source provided in Turkana for the period June 2020 to May 2021. The same information for West Pokot is presented in Figure 6.8-6. This data has been collated from information presented in the NDMA monthly drought early warning bulletins from 2020 and 2021.

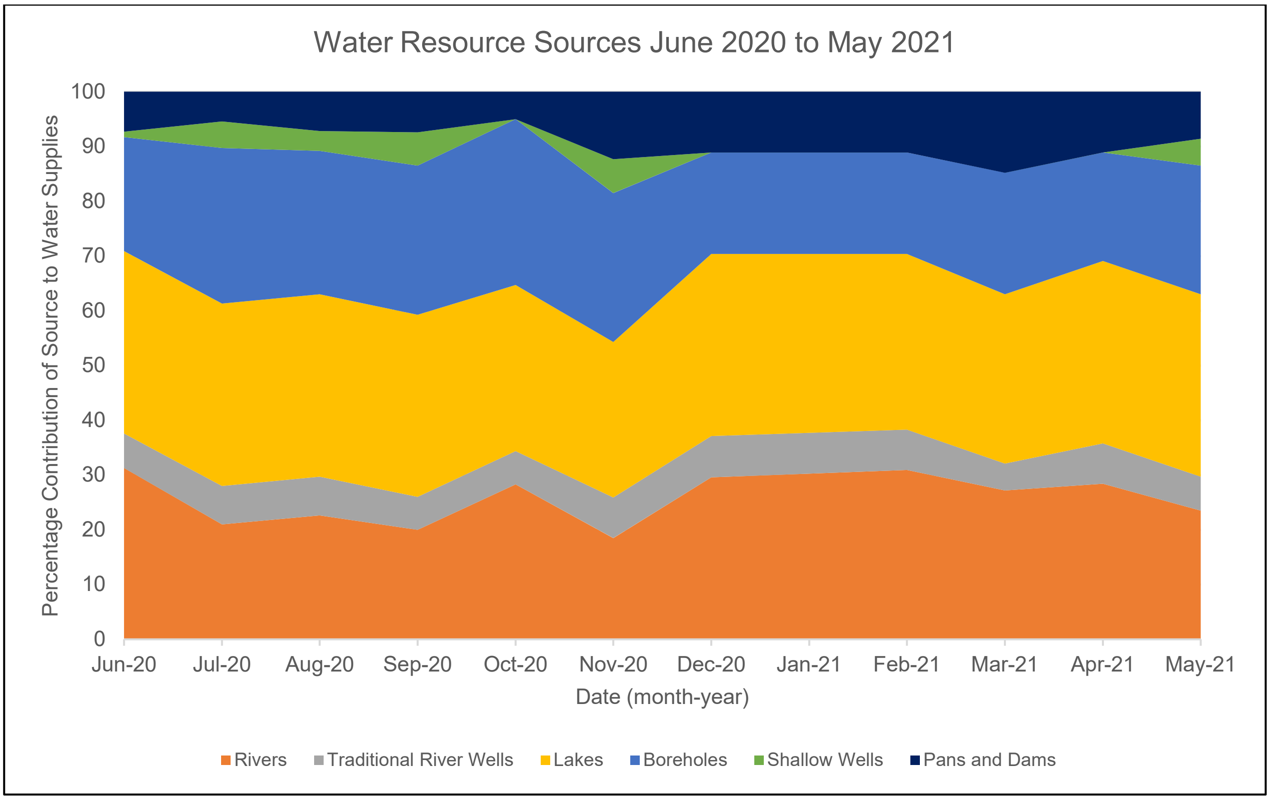

Figure 6.8-5: Turkana Water Resource Sources 2020-2021 (Source: NDMA)

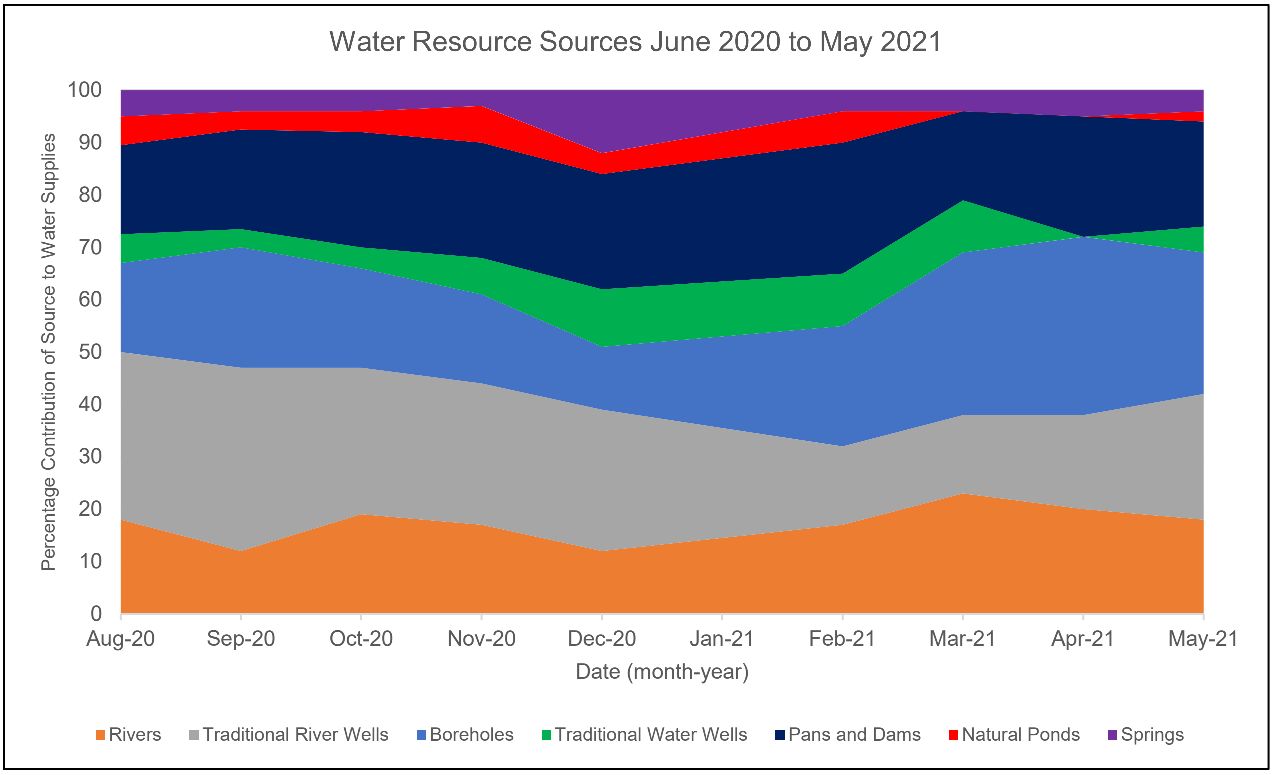

Figure 6.8-6: West Pokot Water Resource Sources 2020-2021 (Source: NDMA)

6.8.1.5 Local Water Use

Lodwar Town draws its water supply entirely from boreholes near the banks of the Turkwel River. Lodwar's annual water supply demand for 2017 was 0.116 m^3/s (TKBV, 2018c). Based on a 6% per annum growth, future water supply demand was estimated to be 0.247 m^3/s.

Historically, the water sources in the local grazing lands were provided by surface water pans and shallow lugga wells during the wet season (TKBV, 2015b). These dried up fairly rapidly after the rains stopped and people had to walk further to access alternative supplies. Between 2012 and 2014, the Operator initiated a regular supply of water for local communities from tanks positioned at 23 locations (Tullow Oil, 2015b), which are used for watering livestock, potable and non-potable supplies. The tanks are mainly filled by tankering or piped supply from some of a series of WRA-permitted abstraction boreholes (Ngamia East, East Lokichar, Nakukulas 9, Nakukulas 10, Kengomo 1, Kengomo 2, Nabolei, Ekunyuk and Ewoi – see Figure 6.8-7).

In summary, demand from the supply wells was approximately 650 m^3/d in 2014 (TKBV, 2014), approximately 500 m^3/d in 2015 (TKBV, 2015c). Of the total volumes abstracted from the abstraction wells, the volume that was used to augment the local community supplies was about 70 m^3/d between July 2014 and December 2015 and 100 m^3/d between January 2016 and November 2016.

The distances travelled from the communities to sources of water typically ranged from 0.5 km to 15 km (TKBV, 2015b). Prior to the Operator's provision of water resources to local communities, community water supplies tended to come from hand dug wells in luggas and hand pumped wells installed by NGOs.

In addition to augmenting local water supplies, the Operator used the water from the boreholes for exploration drilling (Figure 6.8-7), civil engineering requirements (e.g. road and wellpad construction) and field camps. The water was mainly piped from the wells via a pipeline network. Additional, permitted water abstraction for specific exploration operations was occasionally drawn in from other water sources. The source of the water was groundwater from shallow aquifers predominantly along river valleys and the edge of the volcanic deposits.

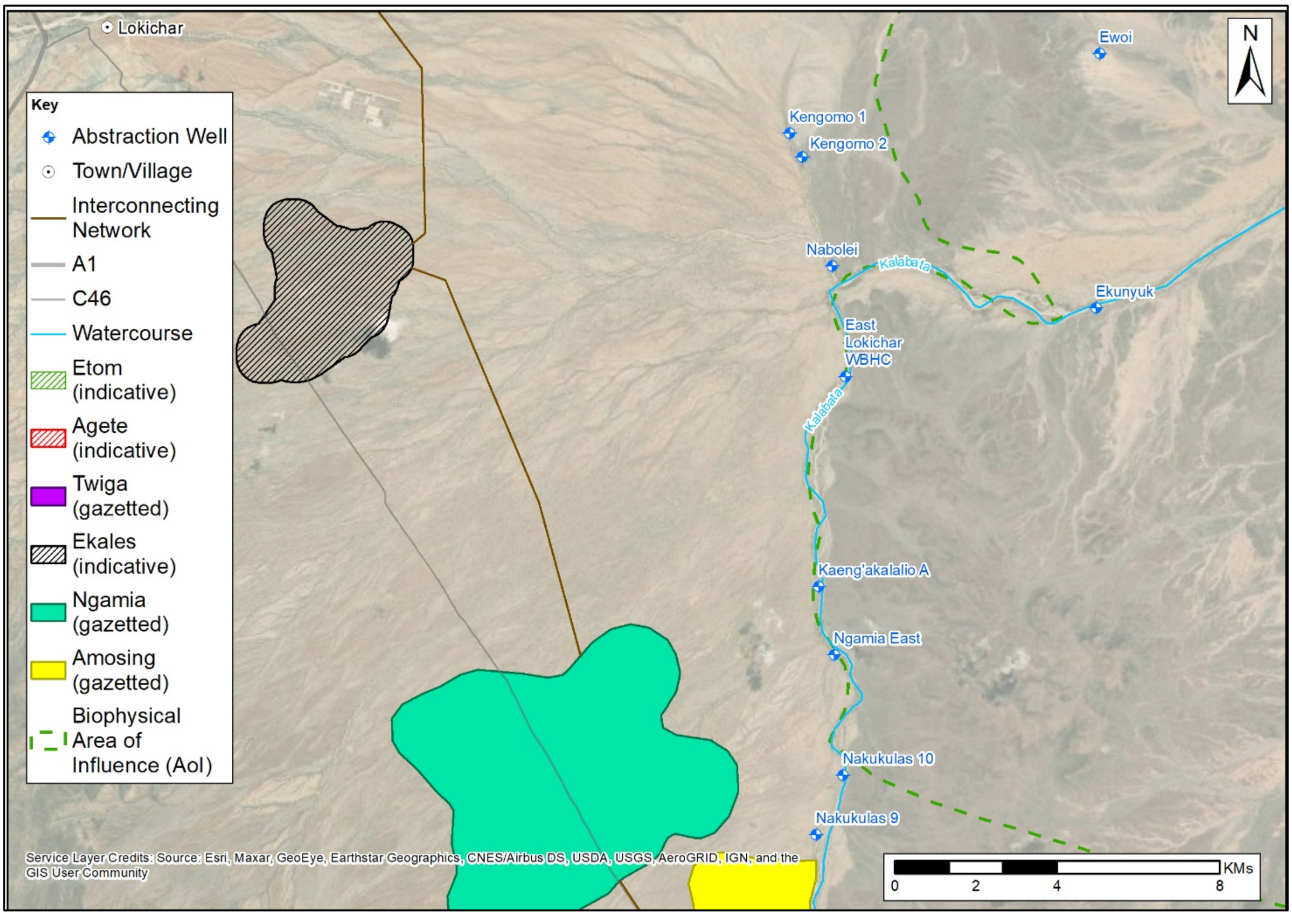

Figure 6.8-7: Operator Production Boreholes

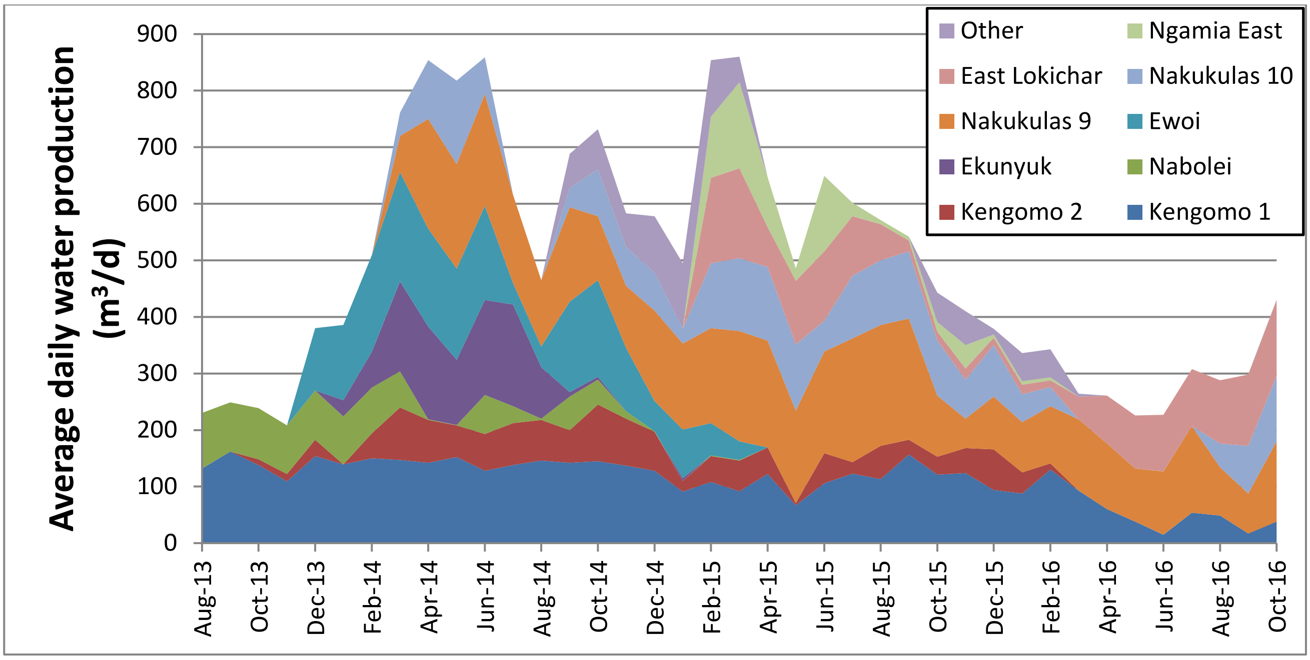

Figure 6.8-8: Operator Borehole Production Profile (TKBV, 2016a)[11]

[11] Data post October 2016 was not available for inclusion at the time the assessment was undertaken

6.8.2 Primary Baseline Data Gathering Methods

Primary data to inform the baseline water quantity section has been gathered by Golder or provided by the Operator or its contractors. This includes precipitation data, infiltration tests, groundwater level monitoring and surface water flow monitoring. Details about the method used are presented in the sub-sections below. Results are presented in Section 6.8.3.

Field trips by Golder to collect data from infiltration tests, groundwater level monitoring and surface water flow monitoring (see subsection below for method details) were completed during the following periods:

- 23 to 27 November 2015;
- 25 May 2016 to 01 June 2016;
- 24 to 31 August 2016; and
- 29 March to 3 April 2021.

6.8.2.1 Meteorological and Hydrological Setting

For the collection of meteorological data, to provide baseline hydrological information regarding precipitation, two meteorological stations were supplied by Campbell Scientific and installed by an Operator employed contractor between December 2015 and January 2016:

- Kapese met station located at Kapese Integrated Support Base accommodation unit at an altitude of approximately 700 masl; and
- Ngamia met station at Ngamia 8 wellpad at an altitude of approximately 730 masl.

Meteorological parameters were recorded on an hourly basis at each station and have been provided to Golder. Golder has calculated and plotted total precipitation from the monthly total sum. Only months with less than 35% of missing data were included in the analysis (Section 6.4).

6.8.2.2 Infiltration Tests

Field infiltration rate tests were undertaken by Golder between 29 and 31 May 2016. The infiltration tests were completed using a double open ring infiltrometer and comprised falling head tests where the time taken for the water level within the infiltrometer to drop was recorded until a constant value (or a change of <10%) was measured. Tests were performed at five sites; the locations of which are illustrated in Figure 6.8-9 and Table 6.8-5.

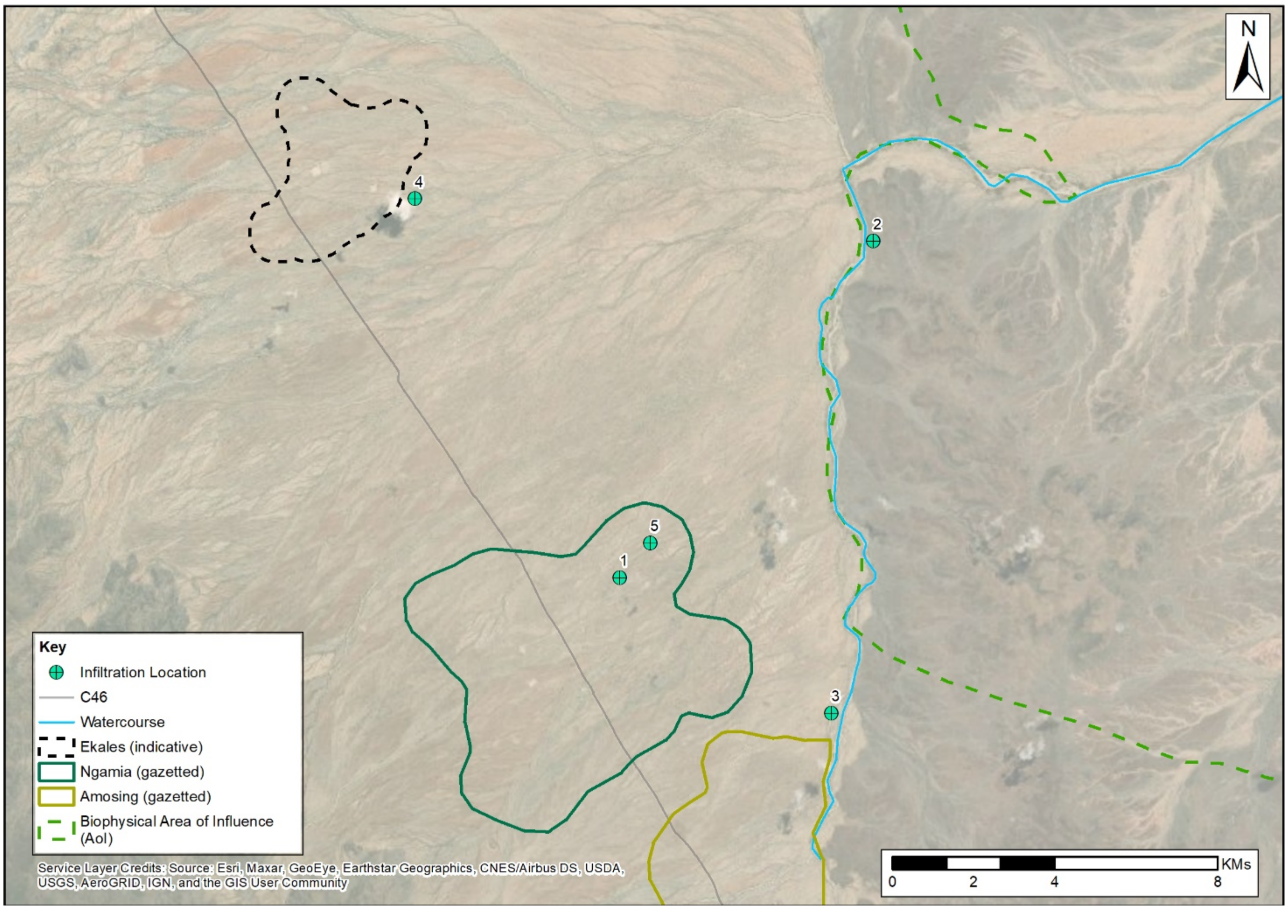

Figure 6.8-9: Location of Infiltration Test Sites

Table 6.8-5: Infiltrometer Test Coordinates

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

6.8.2.3 Groundwater Level Monitoring

Groundwater level data taken from boreholes during 2015 and 2016 are available from the Operator. Measurements of the depth to groundwater have been taken at sporadic intervals and converted to elevations. Some locations have had Troll® water level monitoring devices placed in them for some of that period to remotely record water levels at specified intervals. A summary of the available data is presented in Table 6.8-6. Comment is also included in the table as to the selection of data used to inform this baseline.

Table 6.8-6: Summary of Available Groundwater Level Monitoring Data (Source: Operator)

Location	Dip Data Available (date range)	Troll ® Data Available (date range)	Comment
Nakukalas 9 (also referred to as Golder monitoring location GW3)	Yes (January 2015 to October 2015)	Yes (26 June 2016 to 11 October 2016)	Located in AoI. Location included in baseline summary.
Nakukulas 10	Yes (January 2015 to October 2015)	No datalogger installed.	Located in AoI. Location included in baseline summary.
Ngamia East (also referred to as Golder monitoring location GW2)	Yes (January 2015 to October 2015)	Yes (29 September 2005 to 7 November 2015) (26 June 2016 to 31 October 2016)	Located in AoI. Location included in baseline summary.
East Lokichar A 1S	Yes (January 2015 to October 2015)	Yes (31 May 2015 to 5 November 2015) (26 June 2016 to 10 October 2016)	A cluster of monitoring locations in the AoI that are referred to with the prefix "*East Lokichar*". East Lokichar has a surveyed location, is a production well and Golder groundwater quality monitoring location GW1 (Chapter 6.0). Groundwater elevations in the other wells are similar. Location East Lokichar only will be included in baseline summary.
East Lokichar A 2A	Yes (May 2015 to September 2015)	Yes (1 June 2015 to 17 June 2015) (26 June 2016 to 9 August 2016)	
East Lokichar (also referred to as East Lokichar C 2A)	Yes (March 2015 to November 2015) (October 2016)	Yes (26 June 2016 to 10 October 2016)	
East Lokichar Piezo A	Yes (January 2015 to November 2015)	Yes (16 March 2015 to 2 November 2015)	
East Lokichar Piezo B	Yes (January 2015 to November 2015)	Yes (22 March 2015 to 2 November 2015)	
Nabolei	Yes (January 2015 to July 2015)	Yes (23 May 2015 to 21 July 2015)	Located approximately 0.6 km north of the AoI. Location included in baseline summary.
Kengomo 1	Yes (January 2015 to October 2015)	Yes (1 June 2015 to 18 September 2015) (26 June 2016 to 9 August 2016)	Located approximately 4 km north of the AoI – dip and logger data available. Location included in baseline summary.
Kengomo 2	Yes (January 2015 to October 2015)	No datalogger installed.	Located approximately 3.5 km north of the AoI – less data than Kengomo 1 and dip data only. Location not included in baseline summary.
Ekunyuk	Yes (January 2015 to June 2015)	Yes (1 June 2015 to 6 July 2015)	Located approximately 5.5 km east of the AoI. Location included in baseline summary.
Ewoi	Yes (January 2015 to June 2015)	Yes (2 June 2015 to 15 June 2015)	Located approximately 9 km northeast of the AoI. Location included in baseline summary

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

6.8.2.4 Surface Water Flow Monitoring (Kalabata Catchment)

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

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

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

Level and flow data were acquired, with varying success, within or downstream of the AoI at the locations presented in Table 6.8-7.

Table 6.8-7: Surface Water Monitoring Locations Relevant to the Potential AOI

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

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

The surveyed channel sections were used to assess the hydraulic capacity of the channel at the monitoring locations using the United States Army Corps of Engineers ‘Hydraulic Engineering Center River Analysis System’ (HECRAS). The section details were built into a model of the system. The model assumed a Manning’s “n” coefficient value of 0.03 for the main lugga channels and 0.045 for the overbank areas. Modelled flow, the level data and surveyed cross section information was then used to develop a rating curve to understand the relationship between water level in the channel and flow to be able to convert the corrected level logger data to channel flows. The HECRAS sections are presented in Annex I. The ratings curve developed for SW3 is presented in Figure 6.8-10.

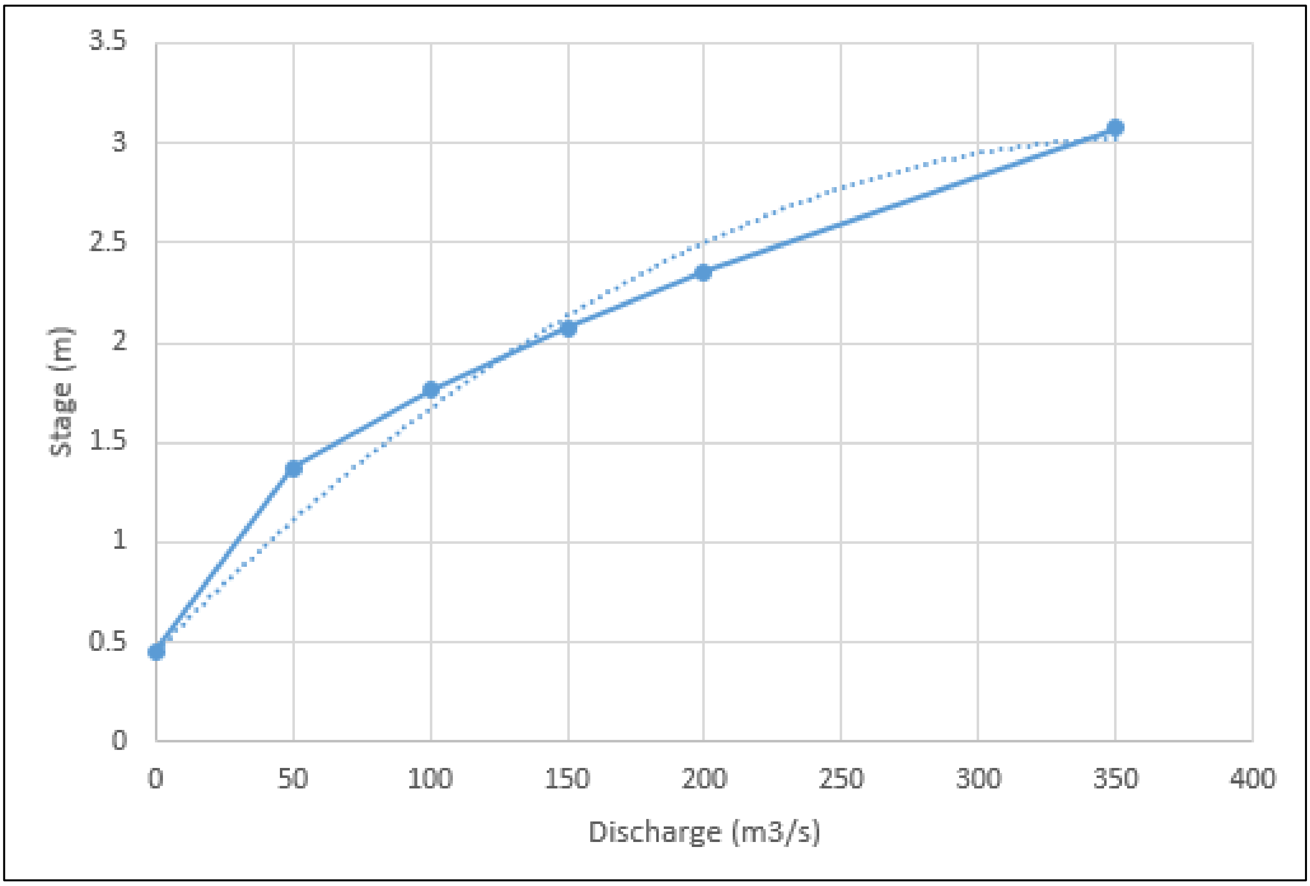

Figure 6.8-10: SW3 Rating Curve

6.8.2.5 Surface Water Flow Monitoring (Turkwel Catchment)

In 2018 the Operator initiated spot flow measurements on the Malmalte and Turkwel Rivers using Acoustic Doppler Current Profiler (ADCP) flow measurement equipment and current meter flow gauging to gather a series of snapshots of flow at several locations in the Turkwel catchment.

6.8.2.6 Turkwel Reservoir Monitoring

A series of reports have been prepared for or by the Operator with regard to a water supply for the Project. The information presented in these reports includes data on the Turkwel Gorge Reservoir. The following reports have been used to inform this baseline with respect to reservoir levels and discharges:

- Strategic Water Supply for Development, Paper 9: Selection of Preferred Option. Richard Boak, January 2016;
- Strategic Water Supply for Development, Paper 10: Optimum Intake Location at Turkwel Dam[12]. Richard Boak and Dr. Sean Avery, December 2016;
- Strategic Water Supply for Development, Report 11: Turkwel Reservoir Water Quality. Sean Avery and Richard Boak, November 2018;
- Strategic Water Supply for Development – Turkwel Dam Option, Turkwel Reservoir Water Quality. Sean Avery, October 2018; and

[12] Referred to in this ESIA as the Turkwel Reservoir Dam

- Strategic Water Supply for Development – Turkwel Dam Option, The South Lokichar Development and Other Water Demands: An Objective Perspective and Way Forward. Sean Avery, October 2018.

The methods used to collect the data are presented in detail in those documents, they include bathymetric (water-depth) surveys of the Turkwel Reservoir in 2016 and 2017.

6.8.2.7 Water Users

In 2018 and in 2021 hydro-census surveys were undertaken by the Operator to identify water points in the AoI. These censuses have led to the creation of a dataset that identifies a mixture of water points that are in use, have been test wells, or have been abandoned.

Field data was also collected as part of the Health Baseline studies undertaken for the LLCOP project (Golder, 2019b). Information was collected from water users in communities about the typical source of water used for different purposes, and in which season that supply was available. It was not typically possible for community members to locate the sources used on a map, so information on point locations was not collected.

6.8.3 Results

6.8.3.1 Meteorological and Hydrological Setting

During the monitoring period at the Kapese meteorological station, monthly total precipitation varied between 0.9 mm in February and 90.4 mm in May. The maximum daily precipitation was 59.2 mm, which was recorded on 4 June 2018. The maximum intensity precipitation (1-hour total) was 34.4 mm/hr, which was recorded on 12 May 2016 at 03:00.

The monthly total precipitation at Ngamia met station varied between 4.0 mm in September and 110.6 mm in May. The maximum daily precipitation was 44.2 mm, which was recorded on 07 November 2017. The maximum intensity precipitation (1-hour total) was 39.8 mm/hr, which was recorded on 21 June 2016 at 15:00.

The monthly total precipitation (Section 6.4) at both stations strongly varies over the year, and within years and between locations. Total precipitation at Kapese and Ngamia follow similar patterns with a distinct peak around April and May. Maximum daily and intensity precipitation events also mostly occur around this time.

In Golder (2018a), it is observed that numerous incised luggas are present in the area within the Lonopakeyu Hills from south of Lokichar to the A1 road between Lokichar and Kalemngorok. Shallow luggas, located throughout the AoI are ephemeral watercourses, which only flow during heavy rain events.

Observations of flow in the Malmalte River made during the rainy season show the river experiences a lot of flooding and a high sediment load from the catchment (Golder, 2018a). The deposition rate of sand in luggas with low slope gradients is high, with sand levels in some nearly the same height as the banks. In sloping or steep areas, however, luggas are deeply cut by erosion (e.g. within the Lonopakeyu Hills). An important characteristic of luggas is that they store water in deep profile soils and in the sandy deposits in the channel. Whilst lighter rains may not result in surface flow in luggas, they will recharge groundwater flow along the channel.

The Turkwel River channel between the Turkwel Gorge Reservoir and Lake Turkana is wide and sandy (TKBV, 2018c). Flows downstream of the Turkwel Reservoir Dam are managed by consistent reservoir discharges, which are augmented by seasonal flow for the Malmalte.

6.8.3.2 Infiltration Tests

The infiltration rates obtained by analysing the results of the infiltration tests are presented in Table 6.8-8. It should be noted that field tests 3 and 5 were ceased before a constant infiltration rate was reached, so the infiltration rates presented are approximate.

Table 6.8-8: Measured and Calculated Soil Infiltration Rate Test Results

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

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

6.8.3.3 Groundwater Level Monitoring

The depth to groundwater for the selected locations have been plotted and are presented in Annex I. Using the reference elevations of these monitoring locations, the dip measurements have also been converted to elevations and are presented on a graph in Annex I.

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

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

A graph of the groundwater elevations determined from the level logger data are presented in Annex I. These data are highly variable and clearly show a range of groundwater elevations at some of the locations that represent groundwater lows (typically during the day when pumping is taking place) and groundwater highs (typically during the night when pumps are switched off). These data suggest that the resting groundwater elevations at the pumped wells are around 660 masl at Nakukulas 9,615 masl at Kengomo 1, and 620 masl at East Lokichar. The highest and lowest groundwater elevations are the same as the manual dip measurements (indicating the general direction of groundwater flow is towards the north-east) and there are no clear seasonal variations in the dataset. A contour plot of an area in the South Lokichar Basin, for the period 15 to 17 June 2015 (the narrowest date period with the most groundwater elevation data), is presented in Figure 6.8-11. This Figure only presents contours in the area where reliable groundwater elevation data is available over a short time period and does not cover the whole AoI. Figure 6.8-11 indicates an estimated regional gradient in this area of 0.0053, which falls within the range of gradients estimated in Price (2016) (0.0026 to 0.0076).

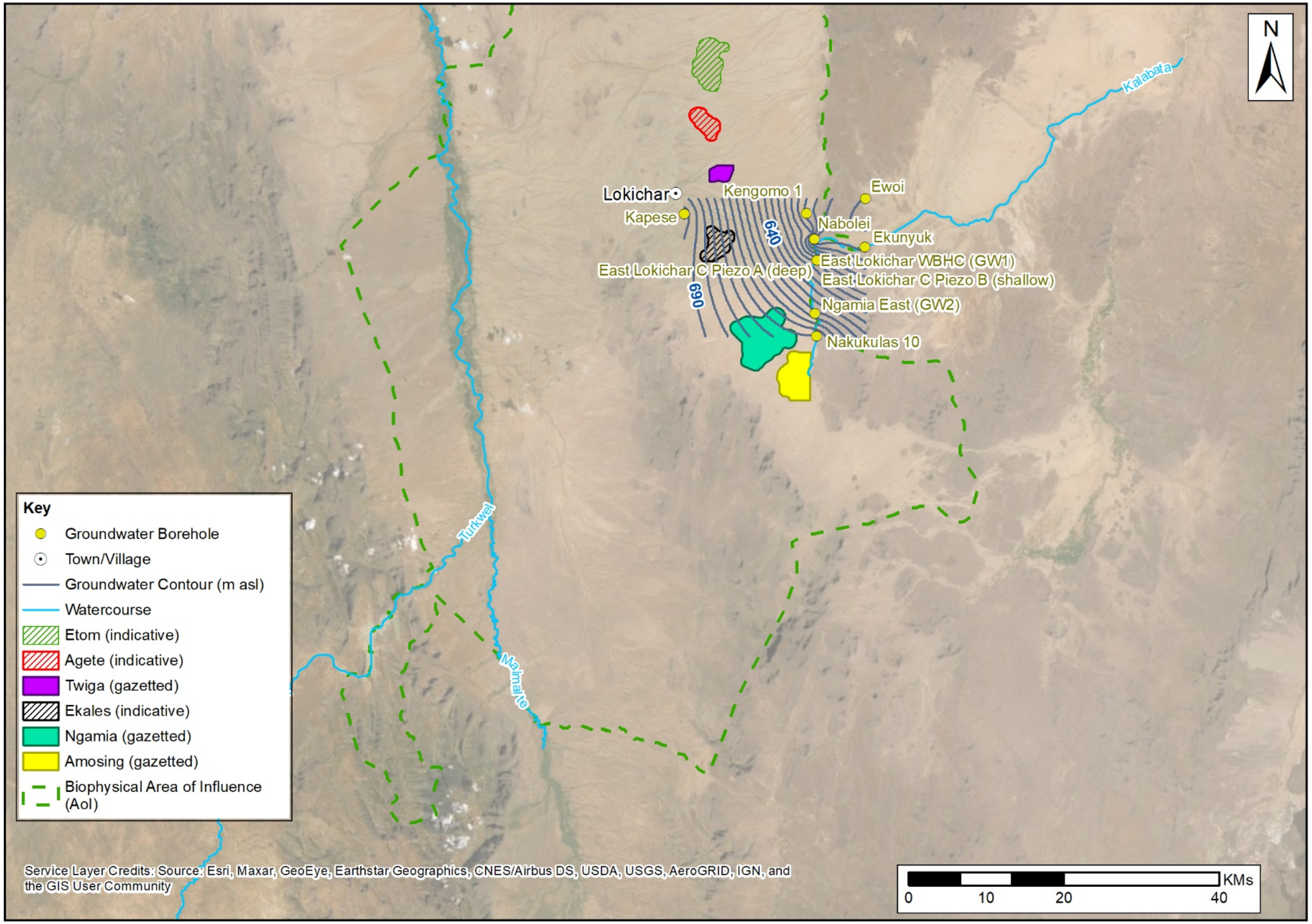

Figure 6.8-11: Groundwater Contour for the South Lokichar Area

Groundwater levels in alluvial deposits adjacent to surface watercourses may be at or near the ground surface. Near the Malmalte River crossing, some clearer areas of vegetation were noted (Golder, 2018a) that are consistent with shallow groundwater or fluvial flooding (i.e. areas of bare earth and or lush "*grass*" growth). Adjacent to the settlement of Kalemngorok, just south of the crossing of the braided River Kharinyang (Alluvial deposits), there was a significant area of ponded water, which could represent high groundwater levels adjacent to the watercourse.

6.8.3.4 Flood Level Estimation

Flood debris can (in the absence of other information) be associated to the last highest flood flow at a river section. Using the ratings curve from the HECRAS model discussed in Section 6.8.2.4 and field observations of the maximum elevation of flood debris, the flood flow velocity required to generate flow debris at a certain elevation can be estimated.

Using the observed flood debris elevation at SW1 of 634.2 masl and the ratings curve developed for that monitoring location (Figure 6.8-12), the estimated flood flow along the Kalabata is approximately 150 m³/s. The HECRAS modelling also indicates that the velocity would be 1.6 m/s during this size event, which is in agreement with the expected flood flow given the low gradient of the channel invert.

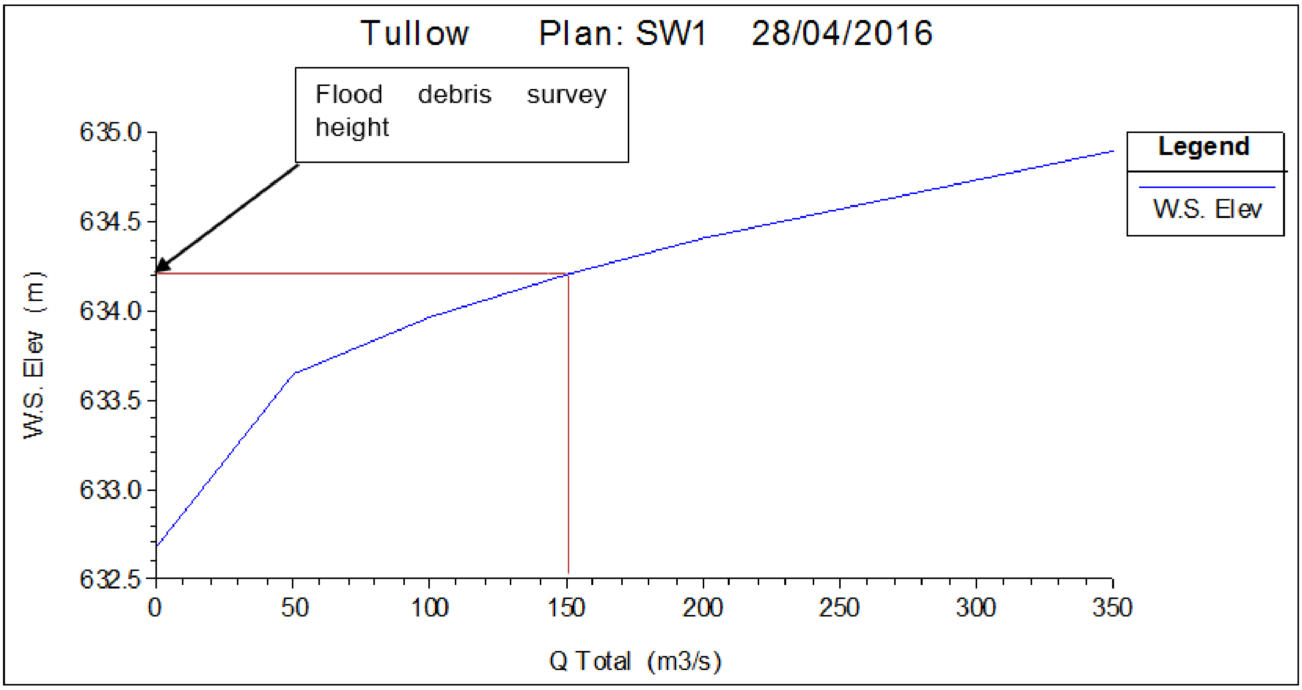

Figure 6.8-12: Predicted Flood Flow Using SW1 Rating Curve

6.8.3.5 Surface Water Flow Monitoring (Kalabata Catchment)

This section presents a summary of the key surface water flow monitoring results.

The field work undertaken between 25 May 2016 and 1 June 2016 found that that level loggers at the locations SW1 and SW2 could not be located and were most likely to have been washed away. The level logger at SW3 was located and data for the period 26 November 2015 to 28 May 2016 was downloaded. Monitoring location SW3 was revisited and data for the period 26 November 2015 to 29 August 2016 was also downloaded. This provided the only surface water data available for the baseline. Figure 6.8-13 presents the pressure data that was captured, and highlights flow events associated with the wet season.

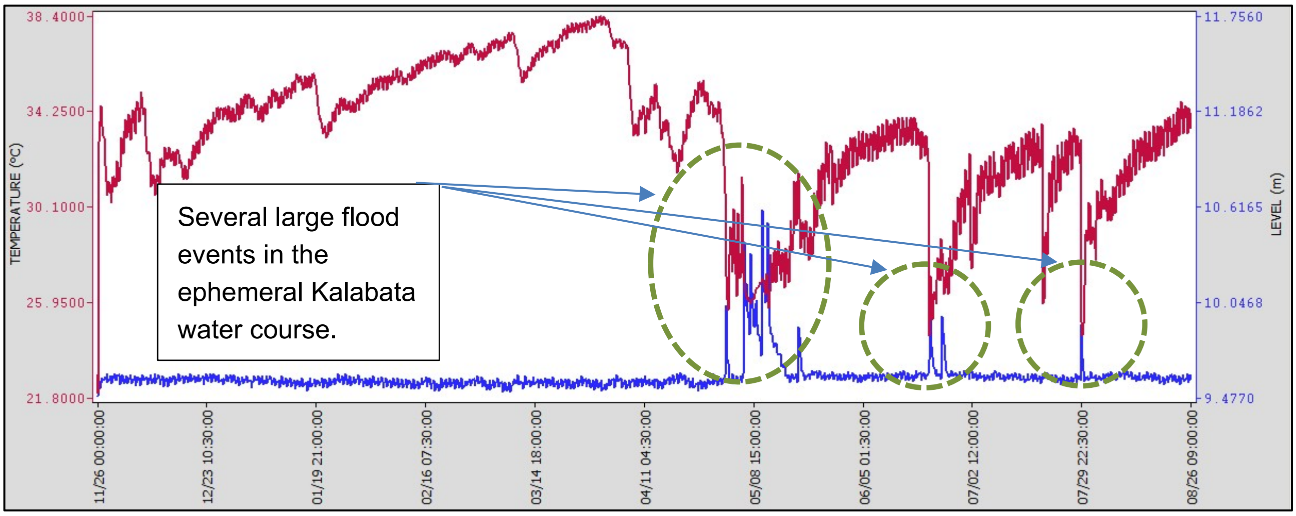

Figure 6.8-13: SW3 – Watercourse Level Data (26 November 2015 to August 2016)

The pressure data downloaded from the level logger at location SW3 has been compensated for atmospheric pressure changes and converted to flow using the ratings curve (Figure 6.8-14). The flow data has then been compared to rainfall data from a monitoring station at Ngamia in Figure 6.8-14. The graph focusses on the data collected over the period when the majority of the rainfall occurred (i.e. April and May 2016). The graph shows that there is a fairly consistent response between rainfall and the data recorded at SW3.

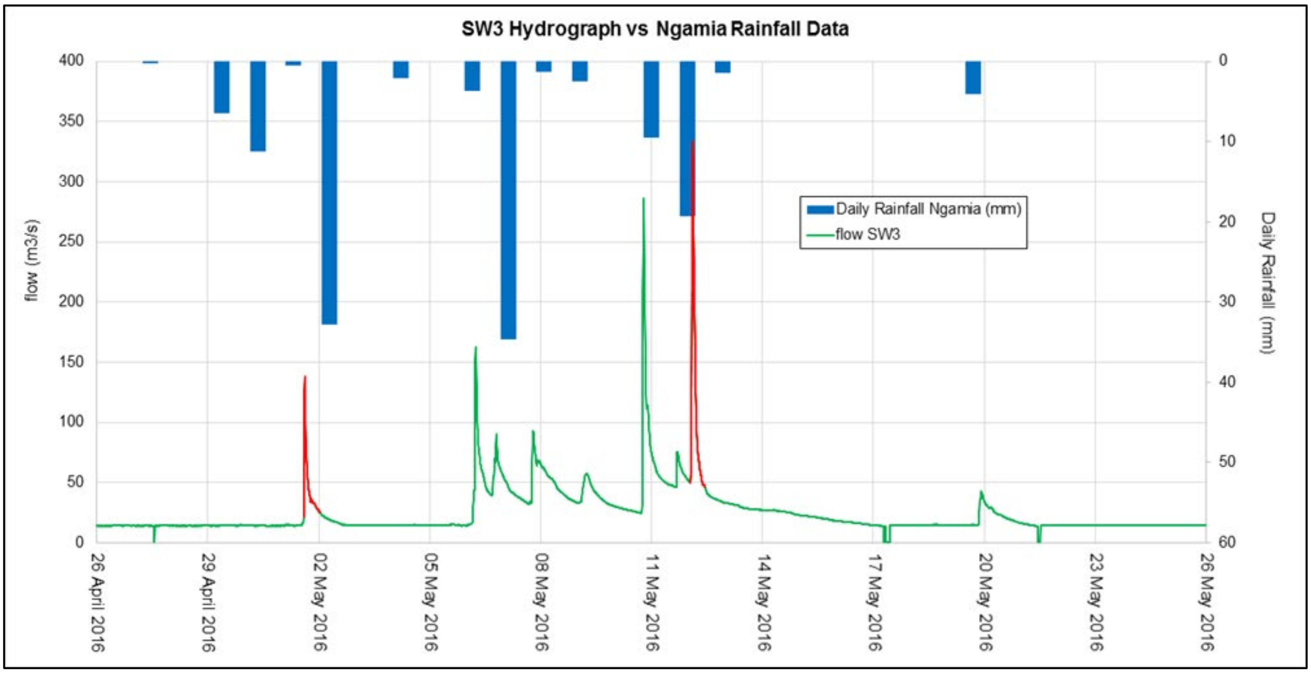

Figure 6.8-14: SW3 – Calculated Flow Comparison to Rainfall Recorded at Ngamia

The hydrological response of the Kalabata catchment (area estimated as 468 km^2) has been characterised using the two most distinct events that were recorded at SW3 (1 May 2016 and 12 May 2016 shown in red on Figure 6.8-14) and have a clear association with large daily rainfall events recorded on the Ngamia rainfall gauge, which is located within the same catchment. Run-off coefficients for the catchment have been calculated using the hydrographs on 1 May 2016 and 12 May 2016. The coefficients for both events are a similar range between 22% and 23%.

6.8.3.6 Surface Water Flow Monitoring (Turkwel Catchment)

The mean daily flow reporting to the Turkwel Gorge Reservoir is 18m^3/s (Avery, 2020). Flow gauging data at the Twin Islands gauging location, the closest gauging location upstream of the Reservoir, between 1940 and 1985 provides the flow distribution reporting to the Reservoir (Figure 6.8-15).

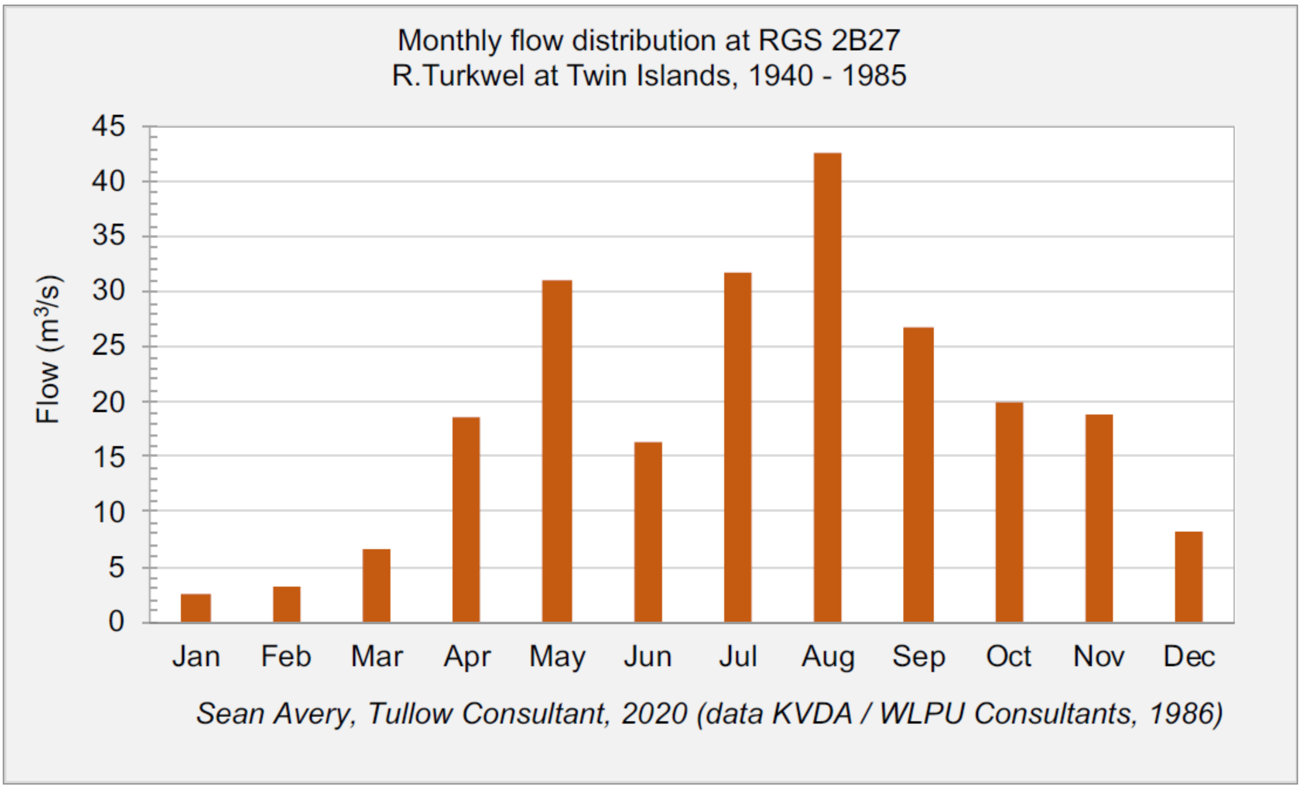

Figure 6.8-15: Average monthly flow distribution (Source Avery, 2020)

Losses occur from the Turkwel River channel between the Turkwel Gorge Reservoir and Lake Turkana through abstraction for irrigation, surface evaporation and recharge to alluvial aquifers (TKBV, 2018c).

6.8.3.7 Turkwel Reservoir

The research, field observations and calculations made to inform the Operator papers and technical reports on the Turkwel Gorge Reservoir include the following baseline information:

- The Turkwel Gorge Reservoir catchment is approximately 5,900 km^2, located predominantly within West Pokot County (Figure 6.8-16);

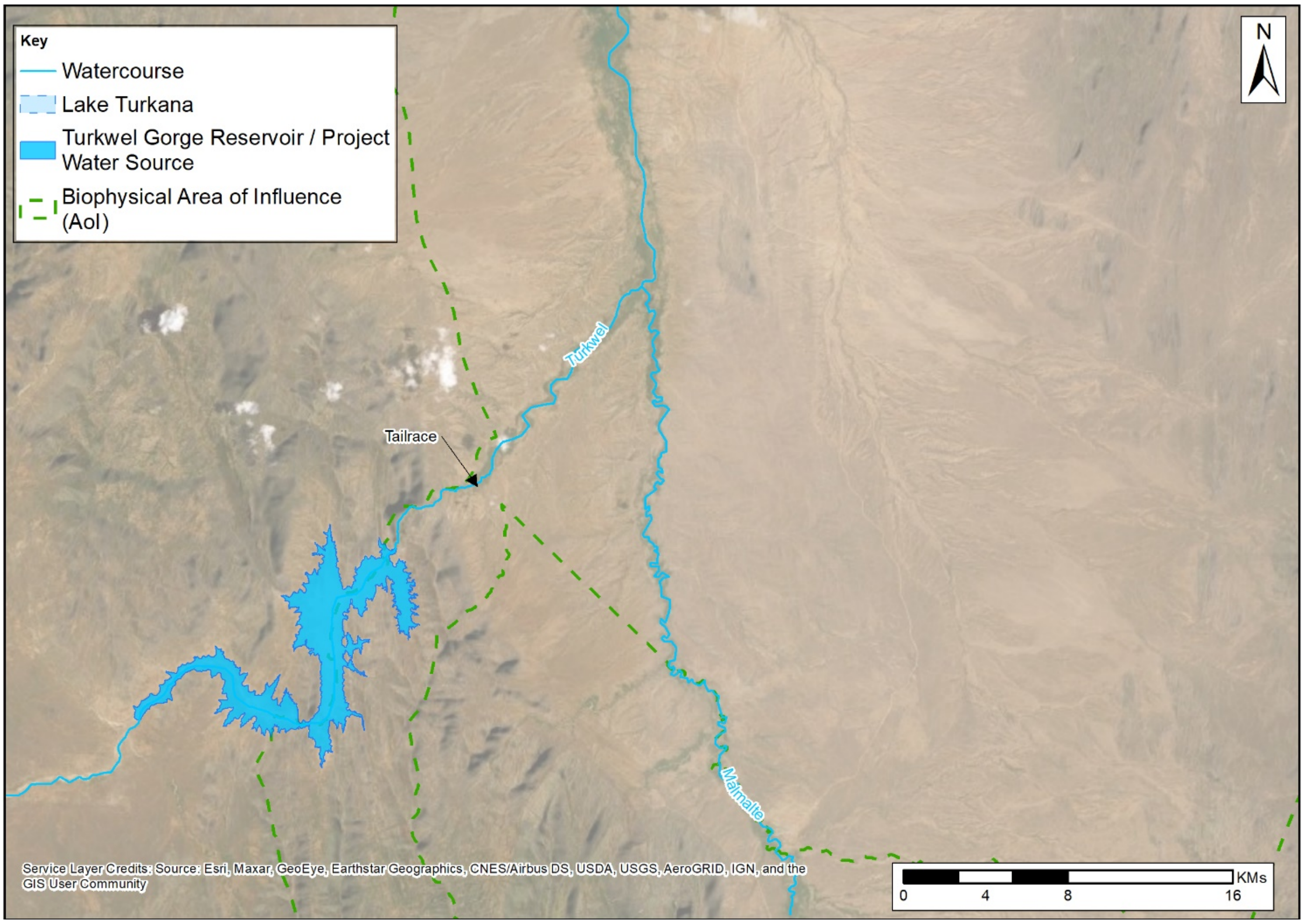

Figure 6.8-16: Turkwel Gorge Reservoir Setting

- KVDA holds a permit for Turkwel Reservoir Dam (release for the Turkwel Gorge Reservoir) for 17.0 m^3/s and Kengen holds a permit to use Turkwel Reservoir Dam for power generation for 19.2 m^3/s (Avery, 2020), after passing through the turbines, 100% of the water would discharge to the Turkwel River;
- The Turkwel Reservoir Dam generates power according to the demand from the national electricity grid and is governed by water level status in the reservoir. Since 1996, the two turbines have operated on average 12.5 hours /day or 52% of the time. On occasions turbines have operated as little as 1.2 hours/day or as much as 24 hours/day;
- The potential maximum discharge for each turbine is 17m^3/s, therefore a maximum potential discharge of 34 m^3/s. Estimated Turbine discharge from the Turkwel Reservoir Dam is 16 m^3/s on average, 48% of the potential;
- The reservoir has been operating at levels that are typically between the minimum and optimum operating level since 1990 (Figure 6.8-17) but has never reached full supply level (1150 m ASL) nor over-spilled. The optimum generation level is exceeded only 14% of the time and the reservoir has fallen below the minimum generating level 5.4% of the time (Figure 6.8-18);
- Reservoir water levels vary depending on the time of year (season and demand for power). The average reservoir water level between 1991 and 2016 was 1,119 masl;

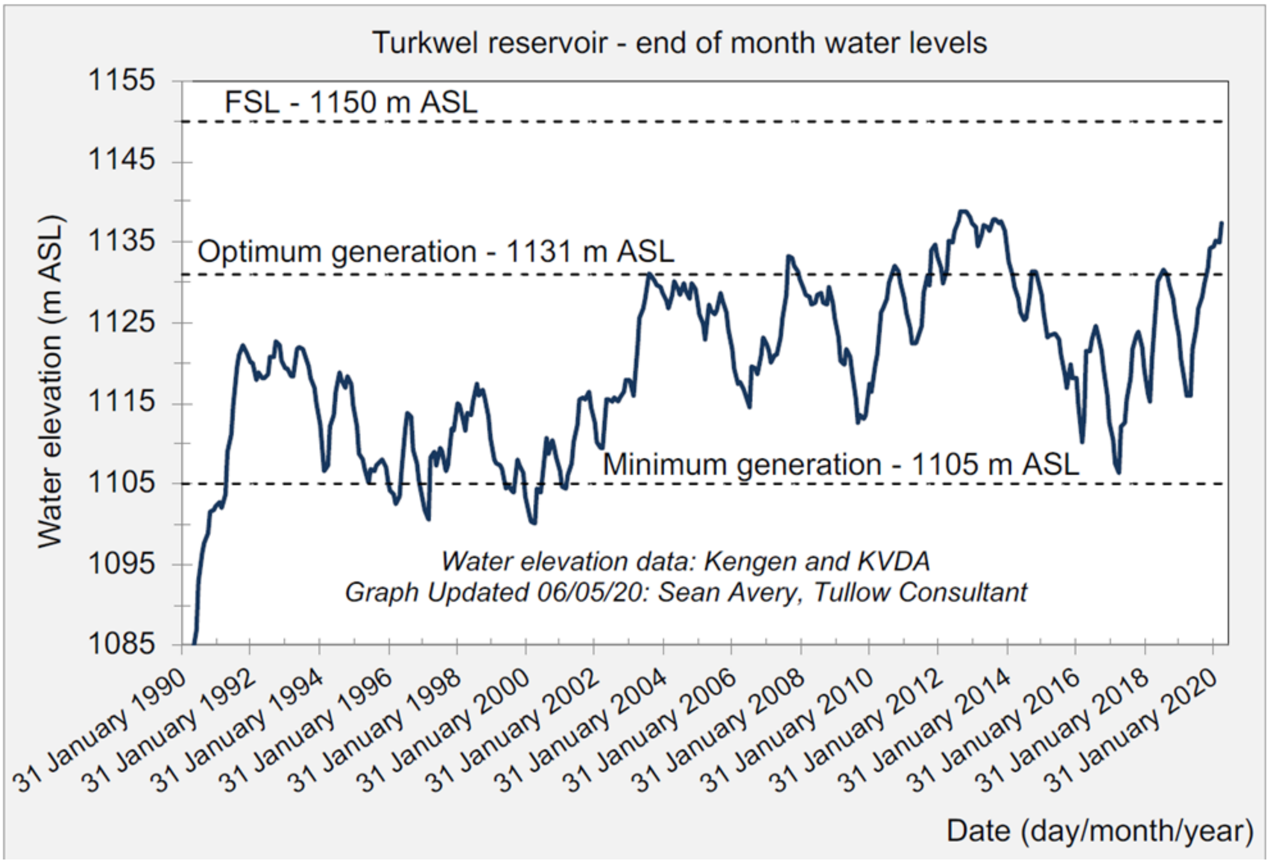

Figure 6.8-17: Turkwel Gorge Reservoir Water Level Record (Source: Avery, 2020)

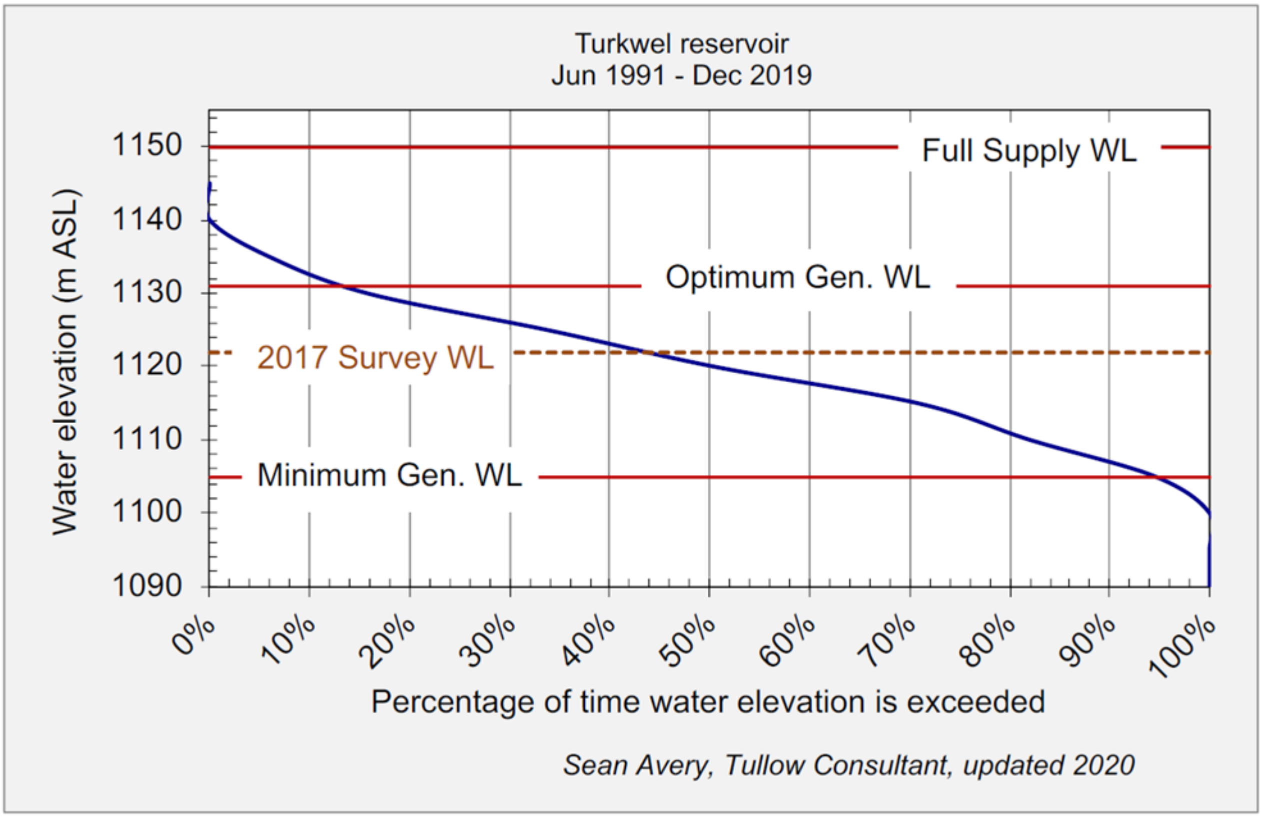

Figure 6.8-18: Turkwel Gorge Reservoir's elevation exceedance curve (Source: Avery, 2020)

- Compensation flow releases to downstream of the dam (when the turbines are not running) are non-existent and most downstream releases result from water passing through the turbines and along the tailrace, which discharges approximately 4 km downstream of the dam Figure 6.8-16. This means the Turkwel River between the dam and the tailrace outflow is usually dry due to the lack of flow compensation;
- If operating at maximum capacity (up to full supply level of 1150 m ASL), the reservoir retained water volume is approximately 1.6 billion m^3; and
- Potential evaporation at the reservoir is estimated to be 2,300 mm/year. This equates to a net evaporation loss from Turkwel Gorge Reservoir at optimum operating level (1131 m ASL) of 1.7 m^3/s, equivalent to 10% of inflow (Table 6.8-9).

Table 6.8-9: Net evaporation loss as% Turkwel Gorge Reservoir average inflow (Source: Avery 2020)

Turkwel reservoir operating levels	Evap. loss (m^3/s)	Evap. loss as % Turkwel inflow
Minimum operating level 1105 m ASL	0.569	3.2%
Optimum operating level 1131 m ASL	1.744	9.7%
Full supply level 1150 m ASL	3.365	18.7%

- The retention time within the reservoir is about four months at minimum operating level, and about 18 months at optimum operating level.
- The best estimate of reservoir water balance (Table 6.8-10) based on estimated average inputs and outputs between 1996 and 2019 shows that on average an estimated 0.8m^3/s was available water in the reservoir during this period, although no variation in inflows, evaporative losses and discharges is considered.

Table 6.8-10: Reservoir water balance from 1996 to 2019 (Source: Avery 2020)

Water component	Volume (hm^3)	Average rate (m^3/s)	As percentage of reservoir inflow
Reservoir inflow	13,681	18.00	-
Net evaporation loss	942	1.25	6.9%
Turbine discharge	12,108	16.01	88.5%
Volume into storage	634	0.8	4.6%

6.8.3.8 Water Users

Hydro-census data provided by the Operator in 2018 and by KJV[6] in 2021 provides information about water sources, including community water points (CWP) and source investigation locations in the local area. Figure 6.8-19 shows the locations of these. The locations and type of abstraction identified in the hydro-census are summarised in Table 6.8-11.

[6] 2021 fieldwork activities were initiated and undertaken by Africa Oil Kenya BV, as a member of KJV

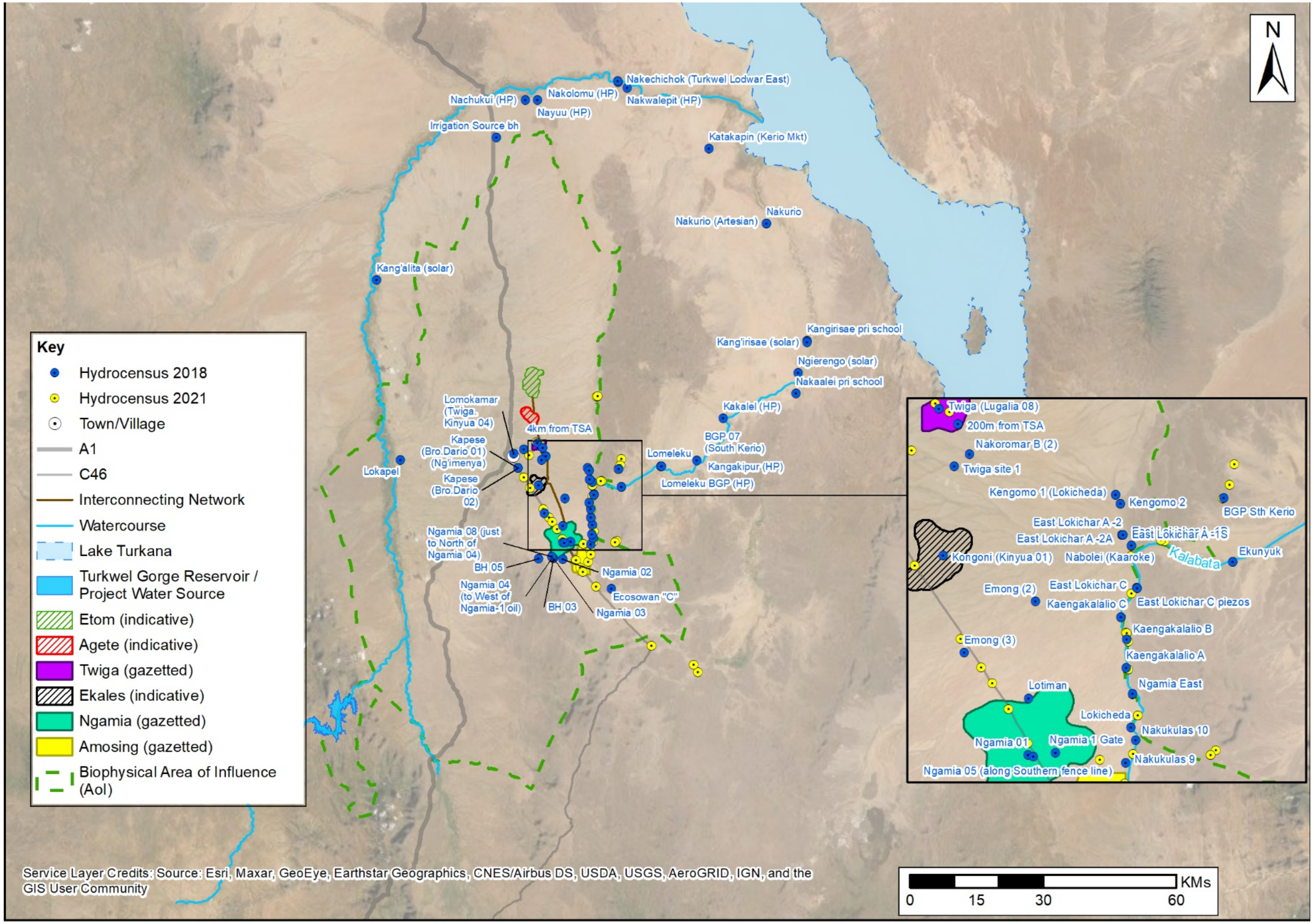

Figure 6.8-19: Water User Location Identified by the Hydrocensuses in 2018 and 2021

Information on the sources of water in each County and when they are typically used was collated in Turkana as part of the Health Baseline for the LLCOP ESIA baseline (Golder, 2019b) and a summary is presented in Table 6.8-12. During the data collection it was noted that the water users were typically not able to locate the source of their water on a map; therefore, the type of water course and its general location only are presented.

Table 6.8-11: Summary of the Operator & KJV Hydro-Census Data

Year identified	Location Name	Quality Comment	Pump Type	Supply Location	Description
2018	Nakukulas 9	Potable	submersible	pipeline to Ngamia 1 & to Amosing-A	Water supplied direct to several CWPs in Nakukulas/Lokicheda area
2018	Nakukulas 10	Potable	submersible	pipeline to Ngamia 1	Water supplied direct to several CWPs in Nakukulas/Lokicheda area; will be source for solar-powered scheme
2018	Ngamia East	No information provided	No information provided	No information provided	Bowser filling point for deliveries to CWPs
2018	East Lokichar C	No information provided	No information provided	No information provided	Back-up bowser filling point for deliveries to CWPs
2018	Kengomo 1 (Lokicheda)	Not potable	No information provided	propose to deliver to Twiga South-1	Water supplied direct to CWPs in Twiga area, and bowser filling point at Twiga lagoon
2018	Kengomo 2	Tests Good	Submersible	Twiga (1) & Etuko	Water supplied direct to CWPs in Twiga area, and bowser filling point at Twiga lagoon
2018	Nabolei (Kaaroke)	Not potable	Submersible	pipeline to Etuko-B	Former production borehole temporarily capped, available for use but saline
2018	Ekunyuk	Tests Good	Submersible	Fly Camp	Former production borehole now fitted with a handpump
2018	Lokicheda	No information provided	Hand pump	No information provided	Exploration borehole now fitted with a handpump
2018	Nakechichok (Turkwel Lodwar East)	No information provided	No information provided	No information provided	Exploration borehole temporarily capped, about to be handed over to Turkana County Government (TCG)
2018	Nakurio	No information provided	Hand pump	No information provided	Former seismic camp borehole now fitted with a handpump.
2018	Lomeleku	No information provided	Hand pump	No information provided	Former seismic camp borehole (Kangïakipur) now fitted with a handpump.

Year identified	Location Name	Quality Comment	Pump Type	Supply Location	Description
2018	Engomo	No information provided	No information provided	No information provided	Former production borehole fitted with solar, elevated tank & distribution system.
2018	Kiptoro	No information provided	No information provided	No information provided	Disused borehole rehabilitated and fitted with solar, elevated tank and distribution system.
2018	Kapese (Bro.Dario 01) (Ng'imenya)	No information provided	Hand pump for Community	No information provided	No information provided
2018	BGP 07 (South Kerio)	Potable	Submersible	BGP camp	No information provided
2018	Nakaalei pri school	Potable	No information provided	No information provided	No information provided
2018	Ngamia 04 (to West of Ngamia 1 oil)	Tastes good	Hand Pump	No information provided	No information provided
2018	Kangirisae pri school	Potable	No information provided	No information provided	No information provided
2018	Kang'alita (solar)	No information provided	Solar	No information provided	No information provided
2018	Nachukui (HP)	No information provided	Hand pump	No information provided	No information provided
2018	Nayuu (HP)	No information provided	Hand pump	No information provided	No information provided
2018	Nakolomu (HP)	No information provided	Hand pump	No information provided	No information provided

Year identified	Location Name	Quality Comment	Pump Type	Supply Location	Description
2018	Nakwalepit (HP)	No information provided	Hand pump	No information provided	No information provided
2018	Katakapin (Kerio Mkt)	No information provided	No information provided	No information provided	No information provided
2018	Nakurio (Artesian)	No information provided	Artesian	No information provided	No information provided
2018	Kang'irisae (solar)	No information provided	Solar	No information provided	No information provided
2018	Ngierengo (solar)	No information provided	Solar	No information provided	No information provided
2018	Kakalel (HP)	No information provided	Hand pump	No information provided	No information provided
2018	Kangakipur (HP)	No information provided	Hand pump	No information provided	No information provided
2018	Lomeleku BGP (HP)	No information provided	Hand pump	No information provided	No information provided
2018	Irrigation Source BH	No information provided	No information provided	No information provided	Drilled by National Water Conservation and Pipeline Company, supplies water intermittently via a 2.5 km pipeline to communities located to the east of Lokichar to Lodwar road, highly saline.
2018	Nakupurat Spring	No information provided	n/a	Nakupurat	No information provided
2021	Kaareman Spring	No information provided	n/a	Nakukulas	A permanent water source
2021	Komusia Spring	No information provided	n/a	Loperot	A permanent water source

Year identified	Location Name	Quality Comment	Pump Type	Supply Location	Description
2021	Namudat 1	No information provided	No information provided	Namudat	Hand dug well. Source is in use
2021	Namudat 2	No information provided	No information provided	Namudat	Source is in use
2021	Namudat 3	No information provided	No information provided	Namudat	Source is in use
2021	Amosing 1	No information provided	Hand pump	Amosing	No information provided
2021	Amosing Lugga	No information provided	Hand pump	Amosing	No information provided
2021	Lokicheda Lugga	No information provided	No information provided	Lokicheda	in use temporarily during dry seasons
2021	Nakukulas Lugga	No information provided	No information provided	Nakukulas	in use temporarily
2021	Kaimegur	No information provided	Hand pump	Kaimegur	Broken down
2021	Namantalem	No information provided	Hand pump	Namantalem	Not in use
2021	Loperot	No information provided	Hand pump	No information provided	Not in use
2021	Lomokamar	No information provided	n/a	Lomokamar	Water point – in use
2021	Twiga	No information provided	n/a	Twiga	Water point – in use.

Year identified	Location Name	Quality Comment	Pump Type	Supply Location	Description
2021	Lokori	No information provided	No information provided	Lokori	Borehole – in use
2021	Lokwamosing	No information provided	n/a	Lokwamosing	Water point – in use
2021	Katamank	No information provided	n/a	Katamank	Water point – no flow
2021	Ngilimokemer	No information provided	n/a	Ngilimokemer	Water point – no flow
2021	Lokosimekori	No information provided	n/a	Lokosimekori	Water point – in use
2021	Lopuroto	No information provided	n/a	Lopuroto	Water point – in good condition
2021	Kodekode	No information provided	n/a	Kodekode	Water point – in good condition
2021	Lotiman	No information provided	n/a	Lotiman	Water point – in use
2021	Kanaiki	No information provided	n/a	Kanaiki	Water point – in use
2021	Kalouchelem	No information provided	n/a	Kalouchelem	Water point – in use
2021	Lokitoeliwo	No information provided	n/a	Lokitoeliwo	Water point – in good condition
2021	Nayanaeereng	No information provided	n/a	Nayanaeereng	Water point vandalised – no tank

Year identified	Location Name	Quality Comment	Pump Type	Supply Location	Description
2021	Dapar	No information provided	n/a	Dapar	Water point – in good condition
2021	Aic Lokom	No information provided	n/a	Aic Lokom	Borehole – in good condition
2021	Ewoi BH	No information provided	handpump	Ewoi	Borehole
2021	Loperot 1	No information provided	No information provided	Loperot	Borehole
2021	Loperot 2	No information provided	No information provided	Loperot	Borehole
2021	Kangkalalio	No information provided	n/a	Kangkalalio	Sealed borehole no access
2021	Kaimegur A	No information provided	n/a	Kaimegur	Borehole

HP = hand pump

CWP = community water pump

Table 6.8-12: Community and Livestock Water Supply in the Project-Area Communities

County	Community	Water Sources	Season
Turkana	Lokichar	■ Water points at Kalapata, Lokichada, Kamanu-Kwee, Kaimegur, and Elelea-Nabolei.	Dry
		■ Traditional wells for livestock Kaakali, Kamarese (until it rains); and ■ Natural water pans, *Ngataparin,* (Lokulubech, Apa-lolemu and Askim) can hold water for about six months.	Rainy
		■ Water points Karipun, Kanging'olemogin, Riami-riame, Lokuno.	n/a
	Lokori	■ Kerio River; ■ Water points at Lohurerei and Lokwamosing; and ■ Oases at Kaachola, Napeitom, Naskeny, Kanapot, Kangiesei, Kalomesek Sil, and Agolet.	Rainy and dry for oases
	Kalapata	■ Kareko, Elelea, Nabolei are the major wells.	Mid-rainy
		■ Borehole (Nakiling'a at Loperot) shared by school, community and pastoralists.	Dry
		■ Water points at Loturerei, Lokwamosing, Nabolei water well, Kaimegur, and Kaidima; and ■ Kerio River.	n/a
		■ Wells at Lokichada are a central source of water for pastoralists in the different regions of Loperot, Nakukulas, Lokiroe-liwo, Kaching'angar, and Ikalale Akeraan.	n/a
	Katilia	■ Wells, springs, boreholes; ■ Water catchment (*ngiburin)* and oasis (*ngichwae)*; and ■ Water (*Eriong'a)* is used on the farms.	n/a

n/a = data not available

6.8.4 Climate Change Considerations

Details about current climate trends and future climate change predictions are presented in the Meteorology Baseline (Section 6.4). This section presents a summary of existing climate trend and future climate change predictions relevant to temperature, rainfall, river flows and groundwater recharge, which are all of importance when considering water quantity.

Climate change predictions with respect to rainfall, evaporation and flooding can be highly variable. In general, climate change in Kenya is expected to increase rainfall in the long-term, but with increased extremes including intense rainfall events, drought and continuing high evapotranspiration characteristics.

Uncertainty in precipitation projections for Kenya arises from the wide disagreement of different climate models in the projected change in amplitude of future El Niño events. The latter strongly influence the seasonal rainfall in East Africa (McSweeney et al. 2010a). Projections presented in the UNPD Climate Change Country Profile for Kenya consistently indicate an increase in total annual rainfall both over Kenya and the AoI. In addition, the proportion of rain falling in heavy rainfall events is predicted to increase (McSweeney et al. 2010a). However other studies predict a potential decrease in future rainfall in Kenya. Funk et al. (2010) for example predict that large parts of Kenya will experience more than a 100 mm decline in long rains by 2025, linking the reduction in precipitation to changes in circulation patterns over the warming Indian Ocean.

Rainfall change forecasts vary depending on which climate model is used. In East Africa there is high confidence in a projected increase in heavy precipitation and there is predicted to be a likely increase in mean annual precipitation over areas of central and eastern Africa (Niang et al., 2014). Values given for predicted precipitation changes east Africa in the period 2080 to 2099 (from a baseline period of 1989–1999) range between -3% and +25% precipitation (mean +7%) (World Bank, 2011). Generally, a wetter climate is predicted with more intense wet seasons, and increase in the number of extreme wet days, and less severe droughts during October to December and March to May. The rainfall records for the Turkwel catchment (Figure 6.8-20) present a trend towards a wetter climate (Avery 2020). Records to develop similar trends for evaporation are not available.

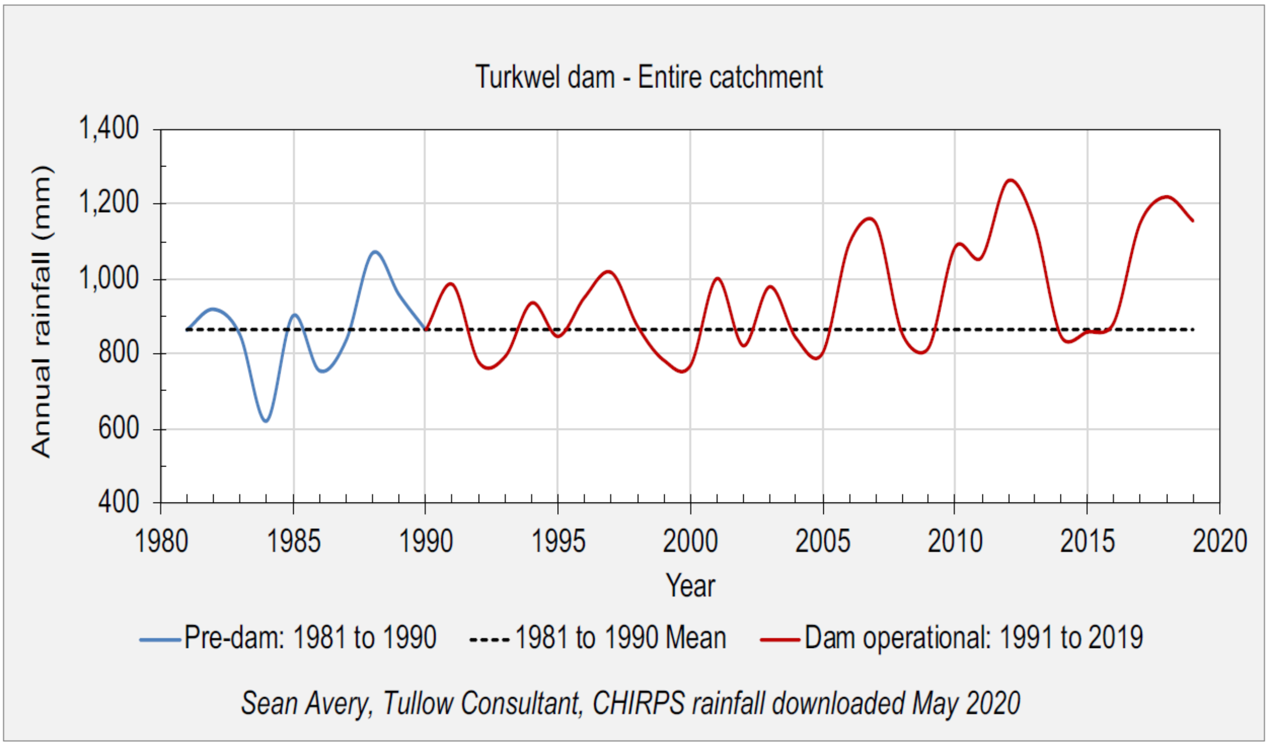

Figure 6.8-20: Annual Rainfall over entire Turkwel catchment (Source: Avery, 2020)

In summary, temperature change predictions due to climate change across different analyses are considered consistent, but changes to rainfall patterns and total rainfall are more complex to predict. The design criteria of the Project should consider an increase in temperature over the lifetime of the Project in the order of 2.5˚C, and design should consider the worst-case scenario presented during extreme events, in the order of 33% increase in maximum daily rainfall events.

There is uncertainty over predicted changes to river flows as a result of climate change. Some climate change models predict a 20% increase in Kenya's river flows by 2030 resulting from extreme runoff during intense rainfall events (Avery, 2013). Increases in runoff rates would lead to more erosion and flooding. Different groundwater systems are likely to react in different ways to climate change. Shallow aquifers recharged by rainfall and with short residence times will react more quickly to changes in recharge and are likely to be those most affected. Changes in rainfall and run-off patterns could reduce recharge to such aquifer and lead to reduced resource availability.

6.8.5 Discussion

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

- The AoI is located in an arid environment with drainage provided by an extensive dendritic network of wide shallow streams (luggas);
- Rain typically falls during the long rains season (March to June) and the short rains season (November to December);
- The main watercourses that flow through the AoI are the Kalabata River, which is located in a valley to the east of AoI, the Turkwel River, which is located downstream of the Turkwel Gorge Reservoir and Dam, and the Malmalte River, which is located to the east of the Turkwel Gorge Reservoir;
- The Kalabata River is an ephemeral watercourse that is fed by direct precipitation, run-off and ephemeral flow from luggas that provide a drainage network from the south-west;
- The Turkwel River receives input from the Malmalte River and discharges from the tailrace of the dam after power production. Discharges from the tailrace mean that flows in the upper reaches of the Turkwel River are typically perennial, but flows can dry up nearer to Lake Turkana;
- Flow in the luggas is ephemeral and driven by short duration, intense seasonal rainfall, as is shown by the data collected at SW3. Given the lack of vegetation, this likely leads to extensive erosion, high suspended solids content and rapid channel migration;
- 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 330 m^3/s with velocities exceeding 1.5 m/s;
- Much of the rainfall will run-off the more compacted, less permeable, higher ground and provides the ephemeral flow in the luggas. The run-off coefficient for the Kalabata catchment, in which the AoI is located, has been estimated as 22% to 23%;
- Infiltration rates to the ground from tests have been calculated to be between 0.063 cm/min and 0.663 cm/min. The saturated vertical hydraulic conductivity is calculated to range from 8.3×10^{-6} m/s to 2.6×10^{-5} m/s;
- When rainfall exceeds evapotranspiration aquifer recharge will to occur and, during storms, surface water flow can occur;

- Rainfall is reportedly spatially variable on a very small scale, so when surface flows do occur there is potential for a lugga to flow at one location and the same lugga to be completely dry elsewhere;
- Recharge is most likely to occur during the longer periods of rainfall or during heavy rainstorms when large volumes of water fall onto the ground over short periods of time. Aquifer recharge in arid areas such as this is likely to be less than 10% of long-term average rainfall. Estimates of local infiltration rates range between 1 mm/yr and <20 mm/yr;
- The primary data indicates that groundwater is typically encountered at depth of 5 mbgl to 20 mbgl in the wells located in the east of the basin in which the AoI is located;
- The depth to groundwater is greatest where the topographic elevation is highest (~30 mbgl at Kapese) and in the area just to the north of the AoI (35 to 40 mbgl in Nabolei and Kengomo 1);
- The groundwater flow direction indicated by both secondary and primary data sources is towards the east or north-east;
- 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 the Operator. In November 2016 the main exploration local water supply abstraction was occurring from East Lokichar, Nakukulas 9, Nakukulas 10 and Kengomo 1[14].
- The Operator 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 this provision of water resources to local communities, community water supplies tended to come from hand dug wells in luggas and hand pumped wells installed by NGOs; and
- Recharge to aquifers from rainfall infiltration is limited and aquifer storage is limited, so unmanaged abstractions could exceed available water stored and recharged.

14 The four boreholes will be used more intensely during the construction phase of the Project alongside six additional boreholes

6.9 Biodiversity

The baseline ecology and biodiversity in the AoI has been characterised using both primary and secondary data including:

- A desktop review of secondary data, including available literature and databases acquired from selected data holders including GBIF and the International Union for Conservation of Nature (IUCN); and
- Collection, processing and analysis of additional primary data generated through fieldwork.

Annex I (Group 3) supports this baseline chapter and it contains the following reference material:

- Potential species of conservation concern (SoCC);
- Plant species per vegetation community;
- Invertebrate baseline data;
- Herpetofauna baseline data;
- Avifauna baseline data; and
- Mammal data.

6.9.1 Secondary Data Collection Methods

The secondary assessment comprised a literature and database review plus analysis of existing information from the following previously completed studies:

- Landcover classification;
- Identification of expected species and ecosystems; and
- Identification of species and ecosystems of conservation concern.

6.9.1.1 Landcover Classification

In October 2016, Golder commissioned GeoTerra Image (GTI) (Pty) Ltd. to complete an 18-class landcover mapping and classification exercise for a designated area within the South Lokichar Basin based on 10 m raster cells (Golder, 2017). This landcover classification covered a key subset of the AoI using 10 m resolution Sentinel 2 satellite imagery[14], acquired on 28 March 2016.

An additional, more detailed 27-class vegetation/land-cover dataset was generated from the same source imagery. This provides more spatial and thematic detail on the vegetation communities on the plains and along the riparian zones. The Modified Soil Adjusted Vegetation Index (MSAVI) was used to extract this finer community detail. Sub-division and re-coding of riparian vegetation and plains vegetation types (supervised landcover mapping) was completed using vegetation and flora field data gathered during the vegetation field survey carried out in June 2016 and updated in 2020.

In January 2019, GTI were again appointed to extend the existing landcover classification exercise to include a corridor between South Lokichar and the Turkwel Gorge Dam.

6.9.1.2 Identification of Expected Species

A review of available literature, data and other information relating to terrestrial and aquatic ecology was completed for a geographical area that includes the Turkwel, Kalabata, Kerio, Turkwel Gorge Dam Basin and

[14] granule references 36NYH, 36NYJ, 36NZH and 36NZJ

Malmalte River catchments (the AoI). Information reviewed included that available for vegetation and habitats, flora and fauna. Data sources included, yet were not limited to:

- Global Biodiversity Information Facility (GBIF 2020);
- IBAT 2020;
- International Livestock Research Institute (ILRI, 2011);
- Van Breugel *et. al*., (2015);
- National Museum of Kenya museum and herbarium records;
- The Vegetation of Africa (White,1983);
- International Union for Conservation of Nature (IUCN, 2016 to 2020); and
- Various published scientific studies, and historical and recent reports related to the AoI.

In addition to the collection of published and unpublished data, consultation was held with regional experts to gather their input and knowledge of the area, identify additional data sources and to gain expert opinions and advice (Table 6.9-1).

Table 6.9-1: Stakeholder Consultation and Key Informant Interview Details

Date	Stakeholder/Key Informant	Organisation	Role
18 April 2016	Mr. Ademola Ajagbe	BirdLife International, Kenya	Team Leader, Conservation Action and Policy
18 April 2016	Mr. Per Karlsson	African Wildlife Foundation	Program Design Manager
23 June 2016	Mrs. Josephine Nzilani	Flora and Fauna International	Programme Coordinator, East Africa
22 February 2017	Mr. Peter Njiri Mwangi	KWS	Senior Scientist
3 March 2017	Mr. Fredrick Aloo	State Department of Livestock Production. Ministry of Agriculture, Livestock, Fisheries and Blue Economy, Range Resource Development Division	Senior Scientist
8 March 2017	Mr. Gordon Ojwang	Directorate of Resource Survey and Remote Sensing	Senior Assistant Director, Natural Resources and Remote Sensing
10 April 2018 24 January 2019	1) Prof. Steven G. Njuguna, 2) Prof. Mary Gikungu, 3) Dr. Alex Awiti, 4) Dr. Catherine Lukhoba,	1) Associate Professor at Kenyatta University 2) NMK 3) Director East Africa Institute of Aga Khan University 4) Senior Lecturer University of Nairobi	Biodiversity Advisory Panel convened specifically for the Project

Date	Stakeholder/Key Informant	Organisation	Role
	5) Mr. Peter Njiiri Mwangi, 6) Mr. James Mwang'ombe, 7) Dr. Peter Njoroge	5) Senior Research Scientist – KWS 6) Assistant Chief Conservator of Forests Kenya Forestry Services 7) Head of Ornithology - NMK	
25 February 2019	Mr. Shadrack Ngene	KWS	Assistant Director - Species Conservation and Management
21 March 2019	1) Mr. Jonathan Kirui 2) Mr. John Kagwi 3) Mr. Jackson Melly 4) Mr. Apollo Kariuki 5) Mr. Bernard Agwanda	1 to 4) KWS 5) NMK	KWS – Deputy Community Wildlife Service KWS – Assistant Community Wildlife Service KWS – Head of Land KWS – Head of Planning and Environmental Permitting NMK – Local Biodiversity Advisor
5 April 2019	Mr. Titus Peghin	NRT	Regional Coordinator
27 April 2021	Joseph Siwa (stakeholder). Discussions on Nasalot boundary.	Stakeholder.	Assistant Chief

The review of the available secondary data was used to focus the primary baseline data collection on priority areas for field survey.

6.9.1.3 *Identification of Species of Conservation Concern*

Using the secondary information, a screening exercise was completed to identify biodiversity receptors (for example, species and habitats of conservation concern, protected areas), which could occur in the AoI which could interact with the Project components.

The following attributes formed the basis of the screening.

6.9.1.3.1 Species of Conservation Concern

- Globally threatened species: These include internationally recognised IUCN Red-Listed Critically Endangered (CR), Endangered (EN) and Vulnerable (VU) species, as defined by the IUCN Red List guidelines;
- Nationally threatened species: These include species listed under the sixth schedule of the Kenyan Wildlife Conservation and Management Act (2013); species identified by KWS as priorities for conservation action (KWS, 2019);

- Migratory/Congregatory species: Species listed on Appendix I and II of the Convention on Migratory Species (CMS), also known as the Bonn Convention. This convention, to which Kenya is a signatory, aims to conserve terrestrial, aquatic and avian migratory species throughout their range, and species whose individuals gather in large groups or colonies;
- CITES species: As a signatory to the CITES convention, Kenya has obligations to protect species listed on Appendices I, II and III, from over-exploitation; and
- Restricted-range or endemic species: Restricted-range species are defined as species with global ranges or Extent of Occurrence (EoO) of 50,000 km^2 or less (Eken *et al*. 2004; Holland *et al*. 2012). For most terrestrial vertebrates (e.g., mammals, birds, reptiles and amphibians) and invertebrates (e.g., insects and arachnids), global ranges of 50,000 km^2 or less, are considered appropriate in global conservation practice (Eken *et al*. 2004). Thresholds for other invertebrates (particularly, aquatic and terrestrial molluscs) and aquatic species (e.g., fish) are typically set at 20,000 km^2 (Holland *et al*. 2012).

It is recognised that some SoCC identified in the screening list would not actually occur in the AoI for various reasons, such as lack of habitat. Therefore, an assessment of the probability of the various receptors occurring in the AoI was determined based on:

- Findings of previous studies and published scientific literature;
- Species records from the NMK up to and including 2020, and those stored in the GBIF (2017,2018, 2019 and 2020);
- Knowledge of the life histories of the species, habitat preferences and known ecological requirements, as determined through published information and information presented in the species profiles on the IUCN's Red List (IUCN, 2021); and
- Consultation with regional experts, and professional judgement and experience of the assessors.

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

- Probable: the species or ecosystem is likely to occur in the AoI due to suitable habitat and resources being present and known records from the area. The AoI is within the known EoO and/or Area of Occupancy (AoO) of the species;
- Possible: the species or ecosystem may occur in the AoI or move through the area (in the case of migratory and highly mobile species) due to presence of suitable habitat and/or resources. No records are known from the area and/or it is a rare, erratic or a poorly known species or ecosystem. Nevertheless, the AoI is within the known EoO and/or AoO; and
- Unlikely: the species will not likely occur in the area due to lack of suitable habitat and resources, and/or the AoI is outside of the EoO and/or AoO.

The probability assessment was used as the starting point for the identification of sensitive biodiversity receptors that may occur in the AoI. Only those species and habitats with a possible and probable likelihood of occurrence within the AoI were carried through and considered for the baseline surveys.

6.9.1.4 Identification of Ecosystems of Conservation Concern

Ecosystems of importance to the public, government agencies, the scientific community, and NGOs occurring within the AoI were identified. Ecosystems of conservation concern include:

- Internationally recognised sites of biodiversity importance, such as Important Bird Areas (IBA), Endemic Bird Areas (EBA), Key Biodiversity Areas (KBA), Ramsar sites and World Wildlife Fund (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;
- Community conservancies; and
- Important habitat types outside of protected areas, such as wetlands or landscape features with importance in maintaining key ecological processes and functions needed to support and maintain important biodiversity attributes, such as forests forming ecological corridors between protected areas.

6.9.2 Primary Data Collection Methods

Informed by the desk study, literature reviews and field surveys were designed to collect and process primary data gathered within the AoI. Species and habitat surveys were undertaken throughout the AoI. Figure 6.9-1 below provides an example of habitat, flora and fauna survey locations within the Agete field.

6.9.2.1 Vegetation Data Collection

The following rapid field survey programmes were carried out with reference to the guidance provided in Sayre *et al*. (1999):

- One six-day survey (10 to 16 November 2015) took place during the short rainy season at Twiga, Amosing, Ngamia, Ekales, Etom and Agete fields;
- Another six-day survey (23 to 29 June 2016) took place at the end of the wet season at Twiga, Amosing, Ngamia, Ekales, Etom and Agete fields;
- An additional six-day day survey (13 to 18 September 2018) was conducted during the dry season between South Lokichar Basin and Turkwel Gorge Dam; and
- A four-day habitat and flora re-survey was undertaken during 2015 and December 2020, to update the findings of the previous survey (2015) completed at Twiga, Amosing and Ngamia fields; and undertake new surveys at the Ekales, Etom and Agete fields in 2020.
- A review of the Nasolot National Reserve. *'Preliminary Desktop Review Report on Biodiversity-based Critical Habitat Status Potential of Nasalot National Reserve'.'* B. Agwanda 2021.

These periods were particularly suited for maximising the detection of plants in fruit and in flower, which, in many cases, facilitate more accurate and verifiable identifications. The data collected were also used to verify the mapped extent of ecosystems, vegetation communities and habitats identified in the AoI area during the review of secondary data.

The following flora and vegetation community survey methods (Larsen, 2016) and analyses were used:

- The November 2015 survey was completed according to mapped landcover units preliminarily identified using an unsupervised high-level classification[15] of LandSAT8 imagery (Ministry of Agriculture, 2015);
- For the June 2016 survey, a more refined unsupervised land cover classification of high-resolution Sentinel2 imagery (GTI, 2016 Section 1.2.3.2) was used. The map units were defined based on available

[15] Image classification techniques can be either 'supervised' or 'unsupervised'. For unsupervised image classification, the analysis software assigns output classes without the user providing pre-set classes. Supervised image classification uses the same analysis software, but the user defines specific classes for representative pixel samples before the analysis is run.

information on vegetation pattern, structure and ecological variation (e.g., soil and moisture conditions, landscape position, level of disturbance);

- In September 2018, an additional vegetation field survey was carried out with emphasis on the area between South Lokichar and Turkwel. Several vegetation transects were carried out in the different vegetation communities observed;
- Description of plant communities followed Beentje (1994) and Herlocker (1979). Plotless landscape sampling frames were used to compile an inventory of plant species (i.e., trees, shrubs, forbs and grasses), and to characterise the vegetation communities;
- Searches for the presence of Kenyan-listed and IUCN Red-listed plant species, in particular: CR, EN, and VU species; CITES listed species; other priority plant species listed by the KWS; regionally/locally endemic species, range-restricted species and species of local importance (including ethnobotanical importance); and any threatened vegetation communities;
- Identification of populations and distribution of invasive and pest plants; and
- Assessment of the ecological integrity and extent of existing vegetation communities.

6.9.2.1.1 Vegetation Community Condition Assessment

The condition of the vegetation communities was rated and assigned a subjective class based on Herlocker's (1989) Kenya rangeland condition assessment criteria (Table 6.9-2). These criteria focus on soil erosion and vegetation structure indicators, with added criteria relating to livestock grazing and timber harvest land-uses. The latter criteria were identified as the primary drivers of change in the vegetation communities in the wider AoI. Further details on the condition assessment approach are provided in Annex I.

Table 6.9-2: Condition Classes (Herlocker, 1989)

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

6.9.2.1.2 Vegetation Community Mapping

A detailed vegetation community map was derived based on the land cover assessment (Section 6.9.2.1) and verified by the data gathered during the vegetation and flora field surveys. In all cases, vegetation was evaluated as being either 'Natural' or 'Modified' habitat as defined by IFC Performance Standard 6 (IFC Guidance Note 6, 2019) refer Annex I for definitions.

6.9.2.2 Invertebrate Data Collection

A preliminary scoping survey consisting of passive observation-based surveys of transects, with no trapping was conducted between the 29 October and 4 November 2015. A dedicated invertebrate sampling survey was conducted between the 15 and 22 June 2016, during the wet season. This season was deemed to be the most appropriate to survey invertebrates in the semi-arid environment of the AoI. Expert advice identified that most species would be actively breeding and foraging during this time, thereby allowing for increased survey effectiveness. Most recently, a six-day re-survey was undertaken in December 2020 at Twiga, Amosing and Ngamia fields, and updated surveys were carried out at Ekales, Etom and Agete. Surveys during the dry season and short rains were not considered viable given the potential for the targeted invertebrate groups not to be active and breeding during those times. Despite being carried out during the long rains, the weather for the majority of the 2016 survey was very dry, with isolated showers towards the end of the survey. Those dry conditions would have influenced the diversity and richness of the taxa recorded.

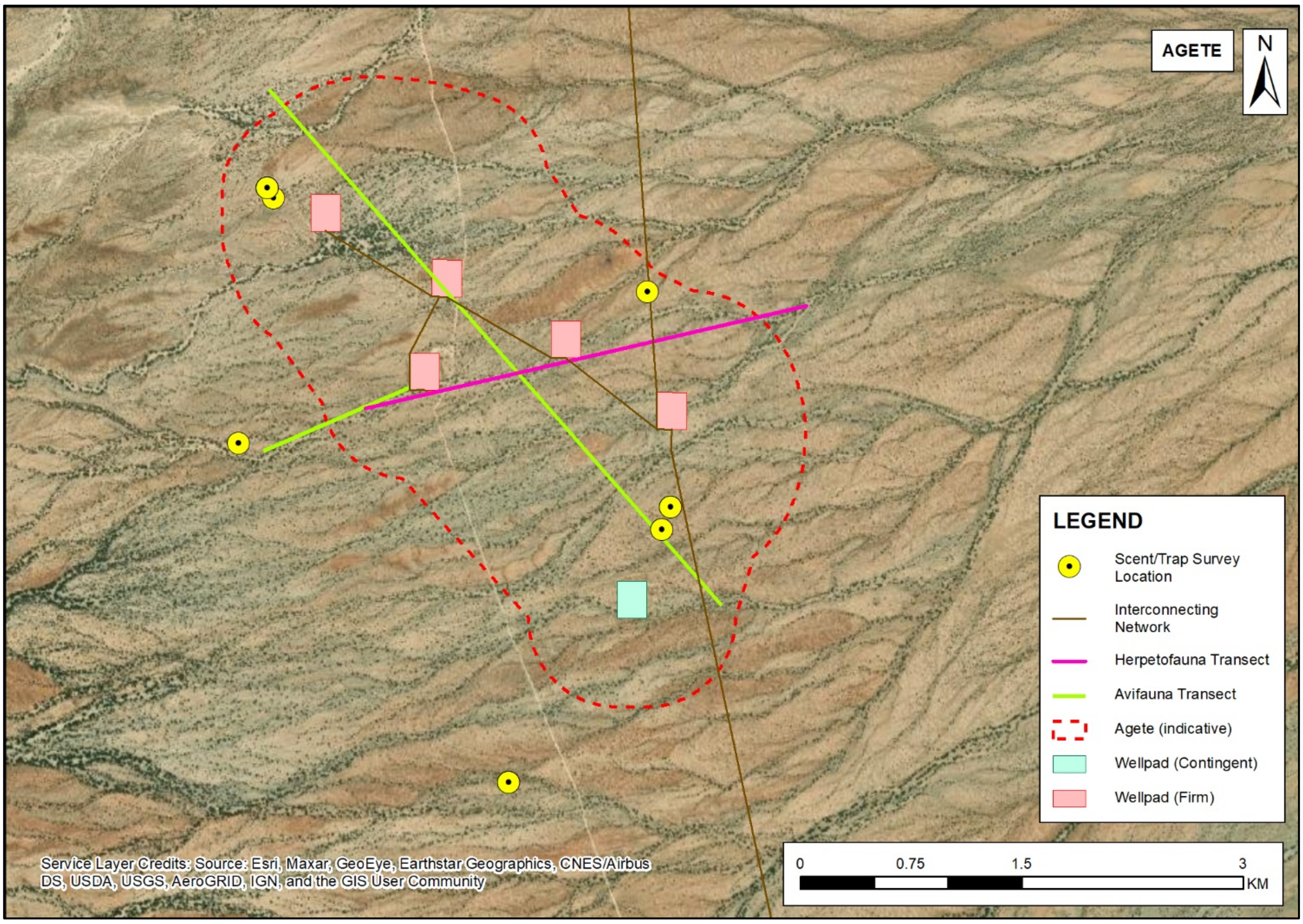

Figure 6.9-1: Survey location at Agete. Surveys were also undertaken at Twiga, Amosing, Ngamia fields, Ekales and Etom fields.

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

- Passive pitfall trap lines set in place for four-trap nights at each survey site (Figure 6.9-2) (which were at the same locations as the reptile and amphibian surveys (section 6.9.2.3);
- Two passive light-traps established at each survey location and left open for one to two hours during the night at each site (Figure 6.9-2)
- Active, timed habitat searches and sweep net surveys conducted during the day and night at each site, plus additional non-trapped sites; and
- Voucher specimens were retained for taxonomic purposes and deposited in the collection of the NMK.

The identification of the species recorded, with additional information, such as distribution, relative abundance, communities and habitat associations were used to inform the baseline of selected invertebrates of conservation concern.

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

6.9.2.3 Herpetofauna Data Collection

A single survey was conducted between the 15 and 22 June 2016, during the long rains. The survey was carried out in tandem with the invertebrate survey since both surveys made use of passive pitfall trap lines. Like the invertebrate surveys, expert advice identified that a dry season survey would not be effective. Most recently, a 6-day re-survey was undertaken in December 2020 at Amosing and Ngamia fields and new surveys took place at Twiga, Ekales, Etom and Agete. Like many other tropical desert areas, the reptile and amphibian species of the semi-arid Turkana region are cryptic during that time to avoid extremes of heat and dryness (Heyer *et al*., 1994; Spawls *et al*., 2004; Channing and Howell 2006; McDiarmid *et al*., 2012). The weather for most of the 2016 survey period was very dry, with isolated showers towards the end of the survey. Such dry conditions would have influenced the diversity and richness of the taxa recorded, particularly the amphibians.

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

- Passive trapping for ground-dwelling reptiles and amphibians using pitfall trap/funnel trap and drift fence arrays (in place for four-trap nights at each site) (Figure 6.9-2);
- Active, timed habitat searches during the day and night at each site, plus additional non-trapped sites;
- Voucher specimens were retained for taxonomic purposes and deposited in the NMK collection; and
- Species were also recorded opportunistically.

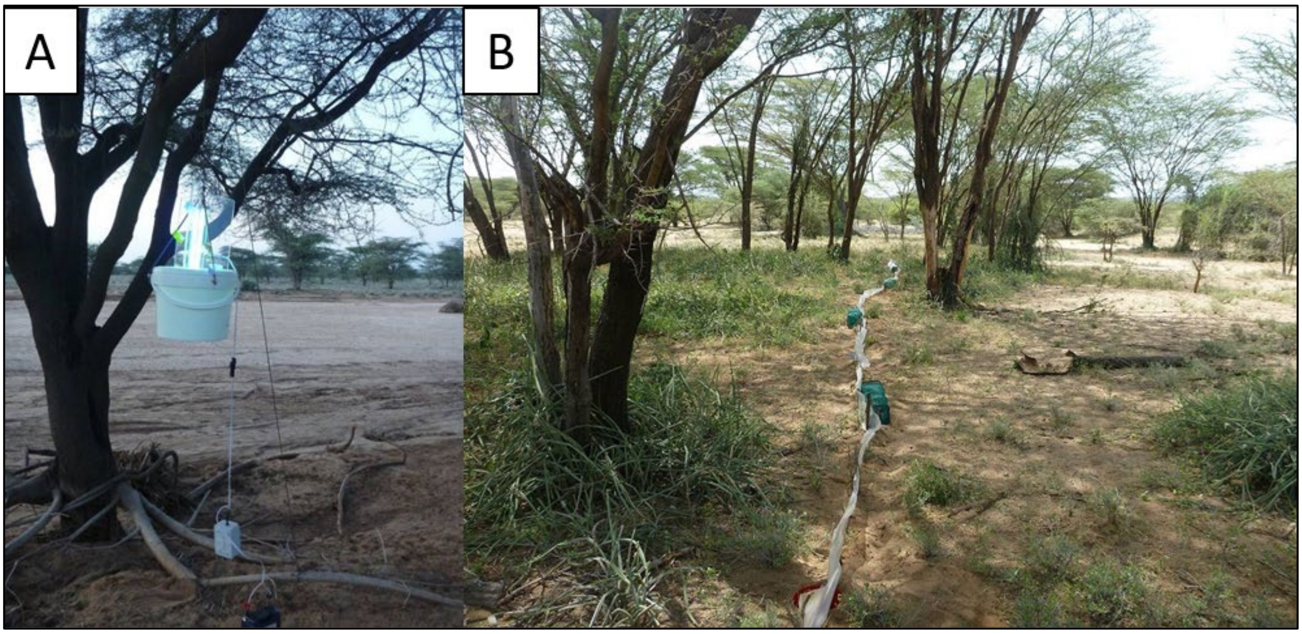

Figure 6.9-2: Examples of A: light trap; and B: pitfall and funnel trap drift fence array for sampling reptiles, amphibians and invertebrates

6.9.2.4 Avifauna Data Collection

Bird SoCC, and their respective habitat associations, were identified through seven bird field surveys, carried out during the following periods:

- A short rains season survey was carried out from 11 to 18 November 2015 (corresponding to the winter migration period);
- A long rains season survey, corresponding to the summer migration period was carried out from 11 to 18 May 2016;
- A dry cool season survey was carried out from 03 to 10 August 2016;
- A survey between South Lokichar and the Turkwel Gorge Dam was carried out from 13 to 18 September 2018. Bird surveys included both transects and vantage point surveys;
- A survey of the riparian habitats along the Malmalte River and South Lokichar Basin was carried out from 27 November to 04 December 2018;
- A survey of the habitats west of the Malmalte River was carried out from 11 to 15 June 2019; and
- Most recently, a 5-day re-survey was undertaken in December 2020 at Twiga, Amosing and Ngamia fields and updated surveys also took place at Ekales, Etom and Agete.

Sampling methods focussed on each of the identified vegetation communities and habitats to identify bird communities and populations within the AoI. Methods followed Sutherland *et al*., 2004; Hill *et al*., 2005; and Larsen, 2016 and included:

- Timed species counts across fixed transect routes within each of the oil field areas and each broad habitat type/vegetation community;
- Vantage point surveys carried out at proposed wellpad locations and locations of other proposed Project infrastructure, with reference to threatened vulture and raptor species, and large flocks of birds;

- Point counts were carried out in areas of rugged terrain, densely vegetated habitats, and habitats that were heterogeneous or highly fragmented, such as hillier areas to the west of the A1 road. Point counts were also undertaken in Lokichar town to determine whether resources in this location, such as refuse, could be drawing in species, in particular vultures; and
- Data from targeted bird surveys was supplemented with incidental observations.

6.9.2.5 Mammal Data Collection

Surveys for mammals covered medium to large and small mammals (flying and non-flying), with different sampling techniques employed to cover the three different groups during the following field surveys:

- A short rainy season survey from 03 to 18 November 2015;
- An end of dry season survey from 20 to 27 April 2016;
- A dry season survey from 03 to 10 August 2016;
- A short rainy season survey from 13 to 18 September 2018; and
- A long rainy season survey from 11 to 15 June 2019; and
- A five-day re-survey was undertaken from the 8 to 13 March 2021 at Twiga, Amosing, Ngamia, Ekales, Etom and Agete, during the dry season.

The methods employed for each group are outlined below. Survey methods largely followed those presented in Wilson *et al*. (1996) and Larsen (2016).

6.9.2.5.1 Medium and Large Mammals

A remote camera trapping survey was initially deployed during November 2015. Ten remote cameras (Reconyx PC900, www.reconyx.com) were installed at locations throughout the AoI, with a view for bi-monthly rotation and data download (O'Connell *et al*., 2011). Significant loss of remote cameras was experienced during that time. Of the ten camera traps deployed between the 8 and the 12 November 2015 six were stolen and one severely damaged. The remaining three traps were withdrawn from the field on the 7 January 2016. Additional camera trapping surveys were carried out during the June 2019 Turkwel and March 2021 field survey. In total 212 camera trap nights were achieved over the course of the baseline assessment.

Driven transect surveys (Hill *et al*., 2005) were completed between 20 and 27 April 2016, and 03 and 10 August 2016 to gain evidence of large and medium-sized mammal presence (for example, striped hyena (*Hyaena hyena*) and leopard (*Panthera pardus*)) throughout the AoI. Transects were driven during dusk (commencing approximately 30 minutes before sunset at a point furthest from Kapese Camp, and concluding upon arrival back at Kapese camp), and dawn (commencing approximately two hours before sunrise and concluding upon sun-up). The vehicle was driven at a maximum speed of 20 kph, and spotlight counts carried out with the location and species of any observed mammals recorded.

Interviews with local people were carried out throughout the AoI. Whenever the field team encountered local people during surveys, they were questioned on their knowledge of mammals observed in the area. This included gathering information on how often they had seen these animals, the most recent sighting of the animals and any interesting observations. A pictorial field guide (Kingdon, 1997) was used to assist conversations.

Track pads (Mateus *et al*., 2011) were placed in areas identified as potential large mammal movement corridors and/or areas of attraction, such as water points and obvious trails.

6.9.2.5.2 Small Mammals

The following four trapping surveys for small mammals were completed:

- A short rainy season survey from 02 to 18 November 2015;
- An end of dry season survey from 20 to 27 April 2016;
- A cool dry season survey from 03 to 10 August 2016; and
- Camera and Sherman trapping March 2021

Small mammal survey methods were focussed on the deployment of Sherman and camera trap lines across the different vegetation communities and habitat types within the AoI, to record the presence of (trappable) small mammals (Wilson et al., 1996).

Trapped mammals were photographed, identified to species level, tagged and released. A non-lethal tissue sample (ear punch) was retained from some trapped rodents for Deoxyribonucleic Acid (DNA) analysis; these individuals were also tagged to identify them in the case of recapture. Tissue sampling and tagging was carried out in accordance with standard guidelines for the use of wild mammals in research (Sikes *et al*., 2011).

6.9.2.5.3 Bats

The following bat surveys were carried out in the AoI.

- A short rains season survey from 02 to 18 November 2015;
- An end of dry season survey from 20 to 27 April 2016;
- A dry cool season survey from 03 to 10 August 2016;
- A dry season survey conducted from 11 to 19 March 2019; and
- A dry season habitat and bat detector (SM4) survey undertaken in March 2021

Methods included daytime searches for roosting bats within suitable habitat, trapping of flying bats at dusk using harp traps and/or mist-nets, passive, acoustic monitoring of bat echolocation calls at fixed points, and active acoustic monitoring during driven transects, with survey effort stratified by habitat type where possible (Wilson *et al*., 1996; Collins, 2016; Larsen 2016).

Static monitoring at several locations was carried out during the November 2015 and March 2021 survey, to scope the extent of bat activity and extent of species presence within the AoI. Active monitoring was carried out during the April 2016 survey only, using a SM2BAT+ bat detector (Wildlife Acoustics Inc., www.wildlifeacoustics.com). The bat detector was mounted on a vehicle and transects were driven across the AoI, concurrent with the large mammal driven transects. Transect routes were selected based on availability and accessibility of roads and tracks, with the aim of covering the different habitats within the area.

The additional bat data collected during the March 2019 and 2021 biodiversity survey comprised of acoustic monitoring of bat echolocation calls conducted during the evenings in Kapese camp and also in Ekales. This work included habitat appraisals and roost observation surveys.

6.9.2.6 Fish Data Collection

Fish surveys were carried out in the Malmalte and Turkwel rivers in March and June 2019. Fish or aquatic invertebrate surveys were not undertaken in the Kalabata as it was dry during the survey of June 2019. Due to high flow levels in June and security concerns in March no electrofishing or macro-invertebrate survey was carried out in the Malmalte River. As the Malmalte River is a tributary of the Turkwel River it is anticipated that the fish communities will be largely similar between the two rivers, especially in the vicinity of the confluence.

Fish sampling was conducted by deployment of baited minnow traps (Figure 6.9-3), seine netting and electrofishing (June 2019 survey only). Traps were deployed along the riverbanks and left for two hours after which they were removed. Electrofishing was conducted in shallow wadeable reaches of the Turkwel River by means of a portable electrofisher. Standard Length (SL) and weight in grams (g) were taken of representative samples of each species at each site. All species were photographed and a small sample representing individuals from all observed species were collected and preserved in 10% neutrally buffered formalin for confirmation of identifications at the NMK in Nairobi.

Figure 6.9-3: Baited Minnow Traps Prior to Deployment in the Turkwel River

6.9.3 Results - Secondary data

6.9.3.1 Biodiversity Context

The study area considered for the secondary research component comprised the following five catchments which overlap the AoI:

- Kalabata River Basin;
- Kerio River Basin;
- Malmalte River Basin;
- Turkwel Gorge Dam Basin; and
- Turkwel River Basin.

The area consists of an undulating plain, interspersed by low, steep-sided hills of volcanic origin (Amuynzu and Oba, 1991). It straddles two of the eco-climatic zones defined for East Africa (after Pratt and Gwynne, 1977) namely:

- Arid Zone (Zone V), consisting of rangeland dominated by *Commiphora* and *Acacia* shrubland; and
- Very Arid Zone (Zone VI), dominated by dwarf shrub grassland with *Acacia reficiens* occurring throughout.

The vegetation is characterised by Somalia-Masai *Acacia/commiphora* deciduous bushland and thicket (Drawing 6.9-1), much of which is sub-classified as stunted (White, 1983; Van Breugel *et al*., 2015). The stunted bushland sub-class is defined by two to three-metre-high bushes and stunted trees (mostly *A. reficiens*) and occurs in areas where rainfall is less than 250 mm annually (Van Breugel *et al*., 2015). This results in natural vegetation distributions restricted to drainage lines and natural depressions where soils are heavier and more water-retentive (Pratt and Gwynne, 1977). During the 1970s, it was recognised that overgrazing in the Arid Zones (Zone V and VI) was an important driver in this ecosystem. The lack of land titles in communal grazing areas, and the prevailing arid conditions, are cited as facilitating excessive grazing/browsing pressure and the associated degradation of the vegetation communities in the region (Pratt and Gwynne, 1977). Human settlements and livestock populations have continued to expand since then until the present day, adding further pressure.

Historically, indigenous browsing herbivores, which would have occurred in the AoI, included Grant's gazelle (*Nanger granti*), gemsbok (*Oryx gazella*), Grevy's zebra (*Equus grevyi*), Guenther's dik-dik (*Madoqua guentheri*), gerenuk (*Litocranius walleri*), reticulated giraffe (*Giraffa camelopardalis reticulata*), black rhinoceros (*Diceros bicornis*) and African elephant *(Loxodonta africana*) (Coe, 1972; White, 1983). These would have occurred in low densities and at low frequencies (Coe, 1972; Watson, 1969), primarily due to the ephemeral nature of annual grass and browse growth in the immediate aftermath of rains (Pratt and Gwynne, 1977) and the exploitation of all grazing and browsing resources by Turkana pastoralists through maintenance of mixed livestock herds (Watson, 1969). Predatory species, including wild dog (*Lyacon pictus*), lion (*Panthera leo*), leopard (*Panthera pardus*) and cheetah (*Acinonyx jubatus*), would also have been present (Coe, 1972; White, 1983). More recent studies suggest that the presence of excessive numbers of livestock throughout the Turkana region resulted in the suppression of a broad range of wild herbivore species (Riginos *et al*., 2012), presumably with concomitant effects on the assemblage of predatory carnivore species, to such an extent that wildlife is now virtually absent (de Leeuw *et al*., 2001).

The region has a rich avian fauna however endemism is low, and most species are found elsewhere in East Africa or are European and Asian migrants (WWF, 2017b). Lake Turkana is an internationally recognised IBA with 84 waterbird species, including 34 Palaearctic migrants, for which it serves as an important flyway and winter stop-over site for birds on passage (Evans and Fishpool, 2001). The AoI is located within the East Asia/East Africa Flyway, as identified by BirdLife International. The East Asia/East Africa Flyway is a group of well-established routes by which many species of birds migrate annually between mid-Palearctic breeding grounds in Asia and non-breeding sites in eastern and southern Africa.

6.9.3.2 Landcover Classification

The Landcover Assessment Area (LCAA) focused on a key subset of the AoI as shown on Drawing 6.9-2. The detailed 27-class vegetation/land-cover dataset provides spatial and thematic detail on the vegetation communities on the plains and along the riparian zones and was used as the basis for vegetation mapping within this focussed area of assessment. These more detailed categories are described in Table 6.9-3 and illustrated in Figure 6.9-4 below and Drawing 6.9-2.

Table 6.9-3: 27- Class Landcover Classification of Land Cover Assessment Area (LCAA)

Class	Class Name	Description	Approximate Area (Hectares)	Approximate Percentages[16] (%)
1	Acacia riparian forest	Acacia dominated forest (tall trees) along major riparian zones	3562	2.38
2	Mixed Acacia riparian forest	Acacia and other spp dominated forest (tall trees) along major riparian zones	164	0.11
3	Riparian woodland	Riparian woodland (not closed canopy, taller forest) along major riparian zones.	26355	17.6
4	Plain desert shrubland, tall, dense	Tall shrubland on plains, dense cover	4858	3.24
5	Plain desert shrubland, medium, dense	Medium height shrubland on plains, dense cover	11229	7.5
6	Plain desert shrubland, low, dense	Low shrubland on plains, dense cover	12242	8.17
7	Plain desert shrubland, sparse	Low or tall shrubland on plains, sparse cover	14867	9.93
8	Sand, non-vegetated	Non-vegetated bare sand areas	9087	6.07
9	Plain arid woodland / grassland, dense	Dense non-riparian woodland cover on plains	21416	14.3
10	Plain arid woodland / grassland, medium	Open / semi-dense non-riparian woodland cover on plains	14415	9.62
11	Plain arid woodland / grassland, low	Open non-riparian woodland cover on plains	9282	6.2
12	Plain arid woodland / grassland sparse	Sparse non-riparian woodland cover on plains	6445	4.3
13	Water (lake & river)	Water in lake and major river systems	283	0.19
14	Water (shallow pan), incl. dry dams	Shallow water in pan systems	2.68	0.0
15	Mountain sparse low shrub	Sparse low shrub and/or grass cover, with only a few bushes on mountains or rocky hills	2878	1.92
16	Mountain Dense low shrub	Dense low shrub and/or grass cover, with only a few bushes, on mountains or rocky hills	6087	4.06
17	Mountain open bush 1	Open and/or scattered bush and shrub cover, on mountains or rocky hills.	534	0.36

[16] Percentages derived from raw GIS (Sentinel) data. Decimal detail results in ca. 97% sum total of landcover.

Class	Class Name	Description	Approximate Area (Hectares)	Approximate[16] Percentages (%)
18	Mountain open bush 2	Open and/or scattered bushes and/or shrubs, on mountains or rocky hills	121.9	0.08
19	Mountain dense bush 1	Dense bush and/or taller shrubs (most dense bush dominated class), on mountains or rocky hills	645	0.43
20	Mountain dense bush 2	Dense bush and/or taller shrubs (but less dense than dense bush class 1, on mountains or rocky hills	3230	2.16
21	Mountain dense bush 3	Dense bush and/or taller shrubs (but less dense than dense bush class 2, on mountains or rocky hills	592	0.4
22	Mountain dense bush 4	Dense bush and/or taller shrubs (but less dense than dense bush class 3: least dense, but more dense than open bush classes), on mountains or rocky hills	29.7	0.02
23	Mountain dense trees / bush	Dense tree and tall bush combination class, on mountains or rocky hills	208	0.14
24	Mountain grassland	Grass dominated areas, with only a few trees, bushes or shrubs, on mountains or rocky hills	0.19	0.0
25	Mountain sparse grassland	Sparse to open grass cover areas, typically containing scattered bushes and shrubs, on mountains or rocky hills	955	0.64
26	Cultivated lands	All cultivated lands, including both currently active and old, long-term fallow / abandoned fields. In the extended western pipe transect, this includes a small area of what appears to be flood-irrigated pastures at a river confluence.	27	0.02
27	Settlements, including villages & kraals	All settlements and built-up areas., This includes small “kraal” concentrations as well as established settlements and built-up areas.	258	0.17

Riparian woodlands (classes 1, 2 and 3) comprise ca. 17.6% of the surface area of the LCAA. Acacia riparian forest (class 1) comprises ca. 2.3% of the LCAA. This landcover class aligns with the riverine wooded vegetation described by the Kenya Rangeland Ecological Monitoring Unit (KREMU) (Olang, 1984) and van Breugel et al. (2015). This landcover class was present along the Turkwel and Malmalte Rivers as well as along larger luggas throughout the AoI. Riparian woodland (class 3) is associated with smaller drainage lines throughout the AoI and aligns with the riverine thicket edaphic vegetation types described by van Breugel *et al*. (2015).

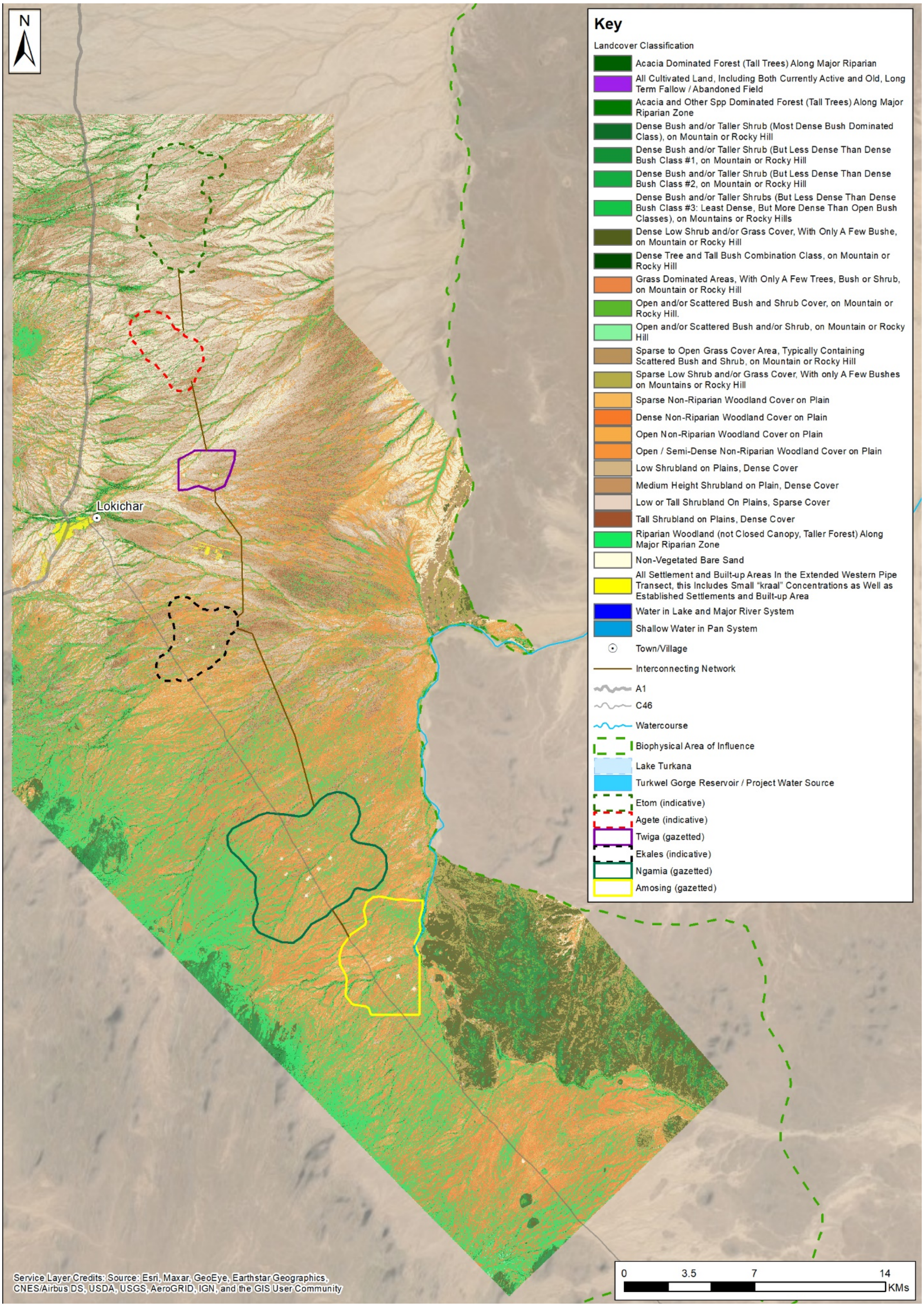

Figure 6.9-4: Landcover Classification

Plain desert shrubland (classes 4, 5, 6 and 7) comprises 28.84% of the LCAA and occurs primarily in the area around Lokichar, in the area north of Lokichar and in the area between Lokichar and Kalemngorok

The plain arid woodland (classes 9, 10, 11 and 12) comprise 34.42% of the LCAA and characterises habitats outside of luggas in the area south of Lokichar and south of Kalemngorok including the area between the Malmalte River and Turkwel Gorge Dam. This vegetation community aligns with the *Acacia-commiphora* stunted bushland described by van Breugel *et al*. (2015).

Mountainous landcover classes (classes 17 to 25) comprise 4.23% of the LCAA which aligns with the Somalia-Masai *Acacia-commiphora* deciduous bushland and thicket community described by van Breugel et al. (2015), and the Bushland described by KREMU (Olang, 1984). This landcover cover type characterises the mountainous habitats to the east of the Kalabata lugga, the mountainous habitat to the west of Ngamia and Amosing, and the ridge separating Turkwel Gorge Dam from the Malmalte River.

Settlements comprise 0.17% and cultivated lands 0.02% of the surface area of the LCAA. The largest settlement within the LCAA is Lokichar, with smaller settlements at Kalemngorok and some near to Turkwel Gorge Dam.

Non-vegetated bare sand areas comprised 6.07% of the surface area of the LCAA and was most densely concentrated around Lokichar, in the area north of Lokichar and in the area between Lokichar and Kalemngorok.

6.9.3.3 Species of Conservation Concern

Based on available information, 77 SoCC could occur within the region (as detailed in Annex I). These include:

- Five plant species;
- Three invertebrate species;
- Two fish species;
- Two amphibian species;
- Four reptile species;
- Forty-three bird species; and
- Nineteen mammal species.

6.9.3.3.1 Plants

Five plant SoCC have the potential to occur (that is, a possible or probable likelihood) within the AoI. One species namely *Blepharis turkanae* is listed as VU in the IUCN Red List of Threatened Species (IUCN, 2019). This densely branched dwarf-shrub is only known from four locations in the Lake Turkana region of Kenya (IUCN, 2019). The remainder of the expected plant SoCC are all range restricted species, but none are listed by either the IUCN, or the KWCMA (Act No. 47 of 2013); or feature on the KWS list of Endangered and Threatened Plant species (KWS, 2019).

6.9.3.3.2 Invertebrates

The KWCMA does not list any invertebrate SoCC (KWCMA, 2013). Two of the three expected invertebrate species are listed by the IUCN Red List (IUCN, 2019).

The mud snail (*Gabbiella rosea)* is a mollusc that is listed as Near Threatened (NT) by the IUCN however, its distribution is limited to the western shore of Lake Turkana outside of the AoI. Rift Valley woolly legs *(Lachnocnema riftensis)* is a butterfly that is listed as Data Deficient (DD) by the IUCN (2020). It is only known from two records in open savanna habitat in the Rift Valley, in the vicinity of Naivasha (IUCN, 2020). The bee, *Samba turkana* is a recently described bee species first collected in the Turkana Basin in May 2012 (Packer and Martins, 2015).

6.9.3.3.3 Fish

Neither of the two fish SoCC (*Haplochromis turkanae* and *H. macconneli)* expected to occur within the AoI are listed by either the IUCN, KWCMA or KWS. These species are listed due to be being little known or range restricted.

6.9.3.3.4 Amphibians

Two amphibian SoCC are expected to occur in the AoI. Of these, the Turkana toad (*Sclerophrys turkanae)* is listed as DD on the IUCN Red List and is only known from Loiengalani on the south-eastern shore of Lake Turkana and from the Ewaso Ng'iro River in the Samburu Game Reserve (IUCN, 2019). The snoring puddle frog (*Phrynobatrachus natalensis)* has a larger distributional range across Sub-Saharan Africa and is listed as Least Concern (LC) by the IUCN (2021). It is believed to represent a species complex, one of which is thought to be endemic to the Lake Turkana freshwater ecoregion (IUCN SSC Amphibian Specialist Group, 2013). Further research is needed in order to confirm the status of this species.

6.9.3.3.5 Reptiles

Five reptile SoCC are regarded as having a high likelihood of occurrence in the AoI. Of these species, three are listed as being of conservation importance in the KWCMA (KWCMA, 2013):

- Kenya sand boa (*Eryx colubrinus*) is listed as Protected in the KWCMA and is also listed as a priority species by KWS (KWS, 2019);
- Lake Turkana hinged terrapin (*Pelusios broadleyi)* is listed as Threatened in the KWCMA, as a priority species by KWS and VU by the IUCN; and
- Rock python (*Python sebae)* is listed as EN in the KWCMA and is listed as a priority species by KWS (KWS, 2019).

The remaining two reptile species are both listed as DD by the IUCN (IUCN, 2019). Barnier's gecko *(Hemidactylus barbierii*) is only known from two locations of the eastern shore of Lake Turkana. More research is needed to establish this species' full range. The southern shield-backed lizard (*Philochortus rudolfensis)* has been recorded in *Acacia-commiphora* dry bushland or semi-desert shrub at five localities in northern Kenya. The NMK have a record of this little-known species from Lake Turkana and within the AoI (NMK, 2017).

6.9.3.3.6 Birds

Forty-three bird species of conservation concern are likely to occur in the AoI. Of these 43 species, 23 are listed as being SoCC nationally in Kenya (KWCMA, 2013) (Table 6.9-4). The remaining 20 species are not listed in Kenyan legislation include migratory species listed by the Convention on Migratory Species (CMS), CITES and endemic or range restricted species.

Ten species are listed as NT in Kenya including two species that are listed as CR by the IUCN namely white-backed vulture (*Gyps africanus)* and Rüppell's vulture (*Gyps rueppelli)* (Table 6.9-4).

The white-backed vulture is the most widespread and common vulture in Africa with a range that includes most of Sub-Saharan Africa except for the Congo Basin (IUCN, 2019). White-headed vulture (*Trigonoceps occipitalis*) is listed as VU in Kenya but is listed CR by the IUCN (Table 6.9-4). Although no records exist in GBIF (2019) of this species within the region, the continued presence of wild ungulates (potential carrion food for vulture sp.) in places such as Nasolot National Reserve (NR) and South Turkana NR suggests a high likelihood of occurrence.

Rüppell's vulture occurs throughout the Sahel region of Africa from Senegal, Gambia and Mali in the west to Sudan, South Sudan and Ethiopia in the east (IUCN, 2019). It also occurs in the savanna region of East Africa including Kenya, Tanzania and Mozambique (IUCN, 2019). This species has experienced a rapid decline in population due to similar threats faced by other African vultures, loss of habitat, loss of wild ungulates leading to a reduced availability of carrion, hunting for trade, persecution and poisoning (IUCN, 2019). This species has been recorded both to the east and west of the AoI suggesting that it does have a presence in the region.

Five of the expected bird species are listed as VU in Kenyan legislation (KWCMA, 2013) (Table 6.9-4). All five are also listed as priority species by KWS (KWS, 2019) (Table 6.9-4). Lappet-faced vulture *(Torgos tracheliotos)* is listed as VU in Kenya and EN by the IUCN (Table 6.9-4). GBIF records show the presence of lappet-faced vulture to the east of Lake Turkana and in Uganda to the west and the presence of wild ungulate populations in Nasolot NR and South Turkana NR may attract it to the AoI.

Four of the expected bird species are listed as EN both in Kenyan legislation and by the IUCN (Table 6.9-4). All four are listed as conservation priority species by KWS (Table 6.9-4). None of these species have previously been recorded in the region but their distributional ranges and habitat preferences suggest they may occur in the region.

Four of the 43 expected bird species of conservation concern are listed as protected by Kenyan legislation (Table 6.9-4). Of these species one is listed as EN by the IUCN and two as VU (Table 6.9-4).

Table 6.9-4: Conservation Status of Expected Bird Species Based on the KWMCA (KWCMA, 2013), KWS (KWS, 2021) and IUCN (2021)

Common name	Species	KWCMA (2013)	KWS (2021)	IUCN (2021)
Basra reed-warbler	*Acrocephalus griseldis*	EN	Y	EN
Madagascar pond-heron	*Ardeola idae*	EN	Y	EN
Saker falcon	*Falco cherrug*	EN	Y	EN
Egyptian vulture	*Neophron percnopterus*	EN	Y	EN
Eastern imperial eagle	*Aquila heliaca*	VU	Y	VU
Greater spotted eagle	*Clanga*	VU	Y	VU
Lesser kestrel	*Falco naumanni*	VU	Y	LC
Lappet-faced vulture	*Torgos tracheliotos*	VU	Y	EN
White-headed vulture	*Trigonoceps occipitalis*	VU	Y	CR
Pallid harrier	*Circus macrourus*	NT	-	NT
European roller	*Coracias garrulus*	NT	-	NT
Sooty falcon	*Falco concolor*	NT	-	NT
Red-footed falcon	*Falco vespertinus*	NT	-	NT
Great snipe	*Gallinago media*	NT	-	NT
White-backed vulture	*Gyps africanus*	NT	-	CR
Rüppell's vulture	*Gyps rueppelli*	NT	-	CR

Common name	Species	KWCMA (2013)	KWS (2021)	IUCN (2021)
Denham's bustard	*Neotis denhami*	NT	-	NT
Maccoa duck	*Oxyura maccoa*	NT	-	NT
African skimmer	*Rynchops flavirostris*	NT	-	NT
Grey-crowned crane	*Balearica regulorum*	Protected	-	EN
Saddle-billed stork	*Ephippiorhynchus senegalensis*	Protected	-	LC
Martial eagle	*Polemaetus bellicosus*	Protected	-	VU
Secretary bird	*Sagittarius serpentarius*	Protected	-	VU

6.9.3.3.7 Mammals

Four of the expected mammal species of conservation concern are listed as VU in Kenyan legislation (Table 6.9-5). These include hippopotamus (*Hippopotamus amphibious)* which is listed as VU by the IUCN and lesser kudu (*Tragelaphus imberbis)* which is listed as NT by the IUCN (Table 6.9-5). Both species are known to occur in Nasolot NR.

Six of the expected mammal species are listed as EN in Kenya (Table 6.9-5). Of these species, African wild dog (*Lycaon pictus)* and African elephant (*Loxodonta africana)* are also listed as EN by the IUCN (Table 6.9-5). African elephant (*Loxodonta africana*), lion (*Panthera leo), cheetah (Acinonyx jubatus)* and leopard (*Panthera pardus)* are three nationally EN species that are known to be present in the Nasolot NR and South Turkana NR.

Table 6.9-5: Mammal Species of Conservation Concern Expected to Occur in the AoI

Species	Common name	KWCMA (2013)	KWS (2019)	IUCN (2021)
Acinonyx jubatus	Cheetah	EN	Y	VU
Hyaena	Striped hyaena	EN	Y	NT
Loxodonta africana	African elephant	EN	Y	EN
Lycaon pictus	African wild dog	EN	Y	EN
Panthera leo	African lion	EN	Y	VU
Panthera pardus	Leopard	EN	Y	NT
Crocuta	Spotted hyena	VU	-	LC
Hippopotamus amphibius	Hippopotamus	VU	-	VU
Taphozous hamiltoni	Hamilton's tomb bat	VU	-	DD
Tragelaphus imberbis	Lesser kudu	VU	-	NT

6.9.3.4 *Ecosystems of Conservation Concern*

6.9.3.4.1 Internationally Recognised Sites of Biodiversity Importance

6.9.3.4.2 WWF Ecoregions

The AoI lies within the northern *Acacia-Commiphora* bushlands and thickets ecoregion (Drawing 6.9-3). The Masai xeric grasslands and shrublands ecoregion, and the East African montane forest ecoregion are also present in the AoI.

The northern *Acacia-Commiphora* bushlands and thickets ecoregion is a transition zone between the drier Masai xeric grasslands and shrublands and Somali *Acacia-Commiphora* bushland and thicket ecoregions to the north, and the wetter southern *Acacia-Commiphora* bushland and thicket ecoregion to the south (WWF, 2017b). This ecoregion covers much of lowland Kenya and is currently listed as VU (WWF, 2020). Mammalian species diversity in the ecoregion is high, and reasonably well-protected across protected areas including Nasolot NR and South Turkana NR.

Masai xeric grasslands and shrublands covers most of north-central Kenya and extend into south-western Ethiopia. Much of this ecoregion has been considerably degraded by heavy grazing from excessive numbers of domesticated livestock and based on that, it is listed as VU (WWF, 2017a). Exceptions include protected areas such as Sibiloi National Park on the north-eastern edge of Lake Turkana, where good-quality habitat remains (WWF, 2017a).

6.9.3.4.3 WWF Global 200 Ecoregions

The WWF's Global 200 project analysed global patterns of biodiversity to identify a set of ecoregions that harbour exceptional levels of biodiversity (Olsen and Dinerstein, 2002). The AoI overlaps with the East African Acacia savanna ecoregion which historically boasted some of the richest large mammal faunal assemblages in Africa and is rated as Vulnerable (Olsen and Dinerstein, 2002).

6.9.3.4.4 Key Biodiversity Areas

Several KBAs are situated to the north, south, east and west however none of these overlap with the AoI (Drawing 6.9-4). The nearest KBA is Cherangani Hills which is situated approximately 30 km south of the AoI (Drawing 6.9-4). Cherangani Hills is also an IBA which contains the last known breeding population of Bearded vulture (*Gypaetus barbatus)* in Kenya (Birdlife International, 2017).

Other KBAs in the vicinity of the AoI include Lake Turkana and Mount Moroto Forest Reserve to the north-west and west of the AoI respectively and both listed as IBAs. The Lake Turkana IBA (Drawing 6.9-4) is designated on the basis of its support of approximately 84 waterbird species including 34 Palearctic migrants, some of which overwinter at the lake in very large numbers; for example, little stint (*Calidris minuta*), which typically number in excess of 100,000 individuals. The lake is also a key stop-over site for birds on passage (BirdLife International, 2017).

6.9.3.4.5 Ramsar Sites

Kenya became a signatory of the Ramsar convention on 05 October 1990 (Ramsar, 2019). It has six sites designated as Wetlands of International Importance (Ramsar Sites) (Ramsar, 2019). None of the Kenyan Ramsar sites are situated within, or near to the AoI. A map showing the location of the Kenyan Ramsar sites in relation to the AoI is provided in Drawing 6.9-5. The nearest Ramsar site is Lake Baringo, which is situated approximately 120 km south-east of the AoI (Drawing 6.9-5).

6.9.3.4.6 Nationally Designated and Protected Areas

The AoI overlaps with two National Reserves namely South Turkana NR and Nasolot NR (Figure 6.9-5).

6.9.3.4.7 South Turkana National Reserve

South Turkana NR is located within the AoI (Figure 6.9-5) and is characterised by a savanna rangeland ecosystem supporting wildlife including elephant (*Loxodonta africana*), buffalo (*Syncerus caffer*), Beisa oryx (*Oryx beisa beisa*), olive baboon (*Papio anubis*), lesser kudu (*Tragelaphus imberbis*), Thompson's gazelle (*Gazella thomsonii*) Grant's gazelle (*Nanger grantii*), warthog (*Phacochoerus africanus*), and dik-dik (*Madoqua sp.*) (Edebe *et al*., 2010).

6.9.3.4.8 Nasolot National Reserve

Nasalot National Reserve is a Wildlife Conservation and Management area situated in the West Pokot County (North-western Kenya) established in 1979 currently managed under new legislation (Wildlife Management and Conservation Act 2013) as a biodiversity conservation area. Nasolot NR is located partly within the AoI. It is a rugged and remote reserve supporting elephant, lesser kudu, bushbuck, duiker, lion, leopard, Kirk's dik-dik, spotted hyena, buffalo and hippopotamus (KWS, 2019). As part of the baseline assessment, an appraisal of the reserve's faunal assemblages was undertaken and a desk-based report was commissioned by the KJV during 2021[17]. The results of this have been used within the baseline and impact assessment chapters of this ESIA.

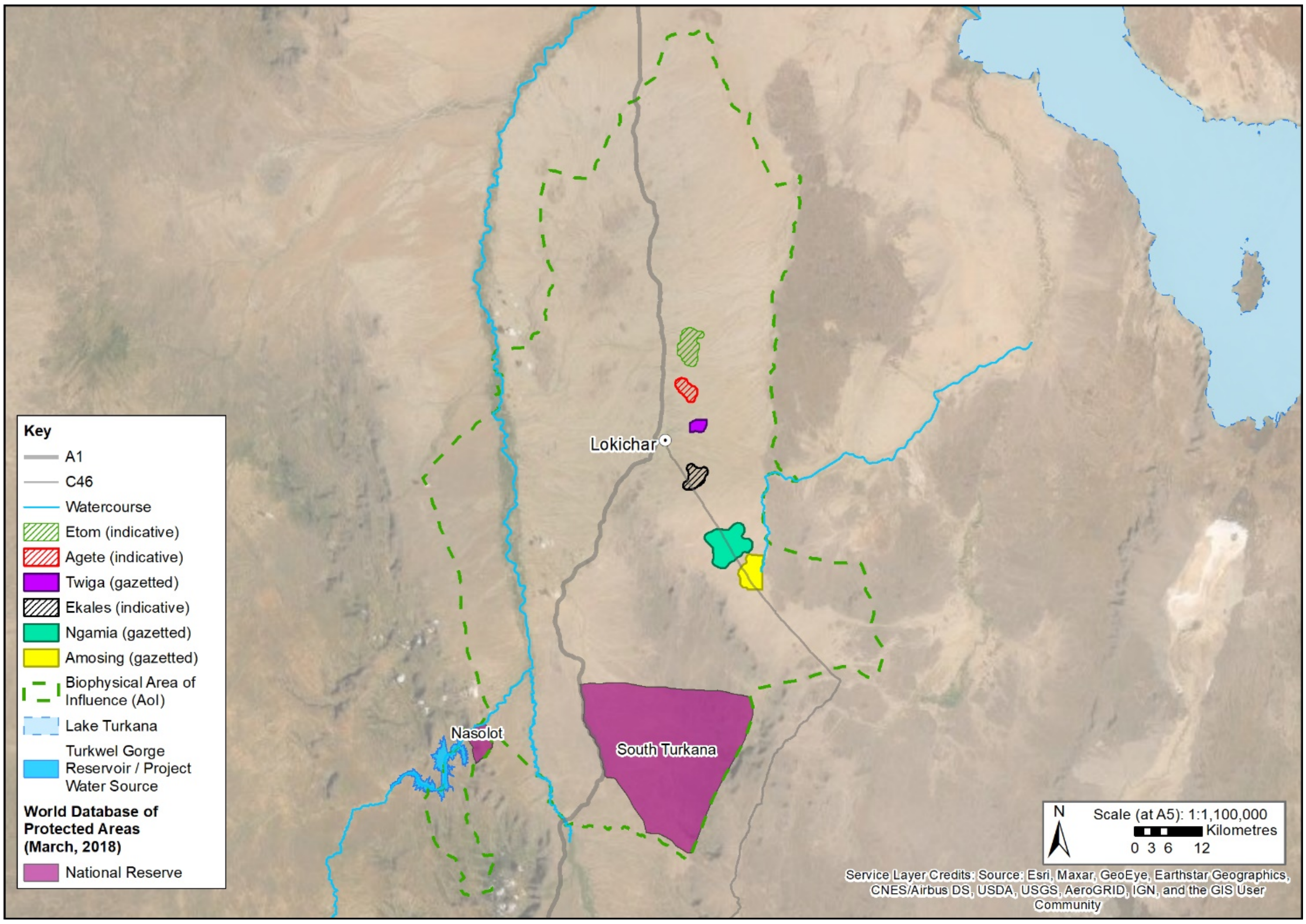

Figure 6.9-5: National Reserves Classified as IUCN Protected Area Categories Ia, Ib or II Located Within the Project AoI

[17] Preliminary Desktop review Report on Biodiversity-based Critical habitat Status Potential of Nasalot National Reserve'. B. Agwanda, 2021.

6.9.3.4.9 Surrounding Reserves

Other Kenyan reserves that are situated near to, but beyond the boundary of the AoI and as such, are considered to be beyond the Project's influence, include:

- South Island National Park which is situated on an island within the southern portion of Lake Turkana;
- Central Island National Park which is also situated on an island in the central portion of Lake Turkana; and
- Sibiloi National Park which is situated on the north-eastern shore of Lake Turkana.

6.9.3.4.10 Community Conservancies

The Pellow Community Conservancy and Masol Community Conservancy are situated in West Pokot County. Both conservancies are administered by the NRT in cooperation with local communities and government (NRT, 2017).

The Pellow Community Conservancy (Drawing 6.9-6) adjoins the Nasolot NR and Turkwel Gorge Dam. The Pellow Community Conservancy is 52,922 ha with a population of approximately 12,000 primarily pastoralist people (NRT, 2017).

The Masol Community Conservancy adjoins the south-eastern boundary of the Pellow Community Conservancy and is 151,899 ha. On its eastern boundary the Masol Community Conservancy adjoins the South Turkana NR thereby enabling migration of animals between South Turkana NR and Nasolot NR.

6.9.3.4.11 Important Habitats Outside of Protected Areas

The following three potentially threatened (Rodriguez *et al*., 2011) vegetation communities (van Breugel *et al*., 2015) were identified within the region (Drawing 6.9-7):

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

Of these, only riverine wooded vegetation and afromontane undifferentiated forest communities overlap with the AoI (Drawing 6.9-7).

6.9.3.4.12 Freshwater Ecoregions

The surface water features of the Lake Turkana ecoregion include the Malmalte, Turkwel, Kerio and Kalabata Rivers. The Lake Turkana ecoregion forms part of the Nilo-Sudan freshwater bioregion (Thieme *et al*., 2005). The Lake Turkana freshwater ecoregion is characterised by:

- A moderate level of overall aquatic biodiversity endemism;
- An extremely high level of endemism of aquatic mollusc species; and
- A moderately high level of aquatic herpetofauna endemism (Thieme *et al*., 2005).

Lake Logipi is an alkaline waterbody that is situated to the south of Lake Turkana. It falls outside of any protected areas and the area suffers from a high degree of overgrazing (Boere *et al*., 2006). Radio telemetry studies conducted on lesser flamingos (*Phoeniconaias minor*) showed that Lake Logipi is one of nine key sites for this NT species in East Africa (Boere *et al*., 2006).

6.9.3.4.13 Biological Distinctiveness

To assess all the freshwater ecoregions in Africa, Thieme *et al*. (2005) combined species richness and endemism rates for all the freshwater ecoregions to synthesise preliminary biological distinctiveness values. These preliminary values were then combined with non-species metric values to develop an overall index of biological distinctiveness. Non-species metrics that were assessed and scored included the presence of rare ecological or evolutionary phenomena and the presence of rare habitat types (Thieme *et al*., 2005). The final integrated index of biological distinctiveness of Lake Turkana ecoregion was rated as outstanding.

6.9.3.4.14 Conservation Status

The health of aquatic systems in Africa is under increasing pressure related to a variety of human induced impacts including construction of dams and reservoirs, overexploitation of resources, pollution - particularly eutrophication, and the introduction of invasive species (Thieme *et al*., 2005).

A snapshot of the level of threat to aquatic ecosystems was assessed based on the following categories:

- Land-based threats;
- Aquatic habitat threats; and
- Biota threats (Thieme *et al*., 2005).

The level of threat was then reassessed with the inclusion of a future threat assessment. This inclusion resulted in nearly two-thirds of the ecoregions qualifying for an elevation in conservation status based on projected threats from climate change, planned developments and human population growth (Thieme *et al*., 2005). The outcome of the assessment was that the conservation status of the Lake Turkana freshwater ecoregion was rated as endangered.

6.9.4 Results - Primary data

6.9.4.1 Vegetation

The field surveys confirmed six broad vegetation communities within the AoI exhibiting various sub-sets:

- *Acacia/Commiphora* bushland and thicket:
  - *Acacia/Commiphora/indigofera* stunted thickets;
  - *Acacia/Commiphora/euphorbia* thicket;
  - *Acacia/Commiphora* deciduous thicket;
  - *Acacia/Commiphora* semi-desert shrubland; and
  - Mixed *Acacia/Commiphora* bushland on rocky outcrops.
- *Acacia tortilis* riparian woodland:
  - Ephemeral stream woodland.
- *Acacia reficiens* low woodland/bushland on plains;
- Acacia/Sansevieria bushland/thicket mosaic;
- *Acacia/Boswellia* shrubland on steep rocky hillslopes; and
- Faidherbia/Celtis riparian forest.

These vegetation communities broadly align with those described by White (1983), ILRI (2007), KREMU (Olang, 1984) and van Breugel *et al*. (2015). The characteristics of these communities, and their condition and integrity, are summarised below. Full species lists for each community are provided in Annex I.

6.9.4.1.1 Acacia/Commiphora Bushland and Thicket

This vegetation community in the South Lokichar Basin aligns with the *Acacia-Commiphora* stunted bushland described by van Breugel *et al*. (2015). Five sub-types of this community were identified, according to variations in coverage and structure due to location (for example on plains or on lava hills) and degrees of aridity; however, the species composition of the sub-types were similar.

The five sub-types identified are described in the following sections.

Acacia/Commiphora/Indigofera Stunted Bushland

This sub-type is associated with the plain desert shrubland land cover classes and aligns with the dwarf shrubland described by the KREMU (Olang, 1984). It occurs on plains within the AoI.

This community occurs in drier areas of the region and is more prevalent in the northern regions. It is dominated by a flat-topped form of the deciduous *Acacia reficiens*. Associated species include *Maerua crassifolia*, and occasional patches of dwarf *Acacia tortilis* and *Balanites rotundifolia* (Figure 6.9-6A). Undergrowth is dominated by the dwarf shrub *Indigofera spinosa*, to approximately 20 to 30 cm in height, with grasses and forbs occurring infrequently.

Acacia/Commiphora/Euphorbia Stunted Bushland/Thicket

This sub-type occurs throughout in the southern portion of the AoI and is the dominant vegetation community in the LCAA. It aligns with the *Acacia-Commiphora* stunted bushland described by van Breugel *et al*. (2015), and the shrub-grassland described by KREMU (Olang, 1984). It is associated with the plain arid woodland land cover classes.

This community shows greater species diversity than the *Acacia/Commiphora/Indigofera* stunted bushland occurring in the northern, more arid region. Typical vegetation composition consists of patches of pure *Acacia reficiens*; *Acacia reficiens* mixing with dwarf *Acacia tortilis*; occasional individuals of *Acacia paolii* and *Euphorbia cuneata*, *Acacia reficiens* and *Balanites rotundifolia*; and dwarf *Acacia tortilis*, *Euphorbia cuneata* and *Jatropha dichtar* (Figure 6.9-6B). The understorey is dominated by *Indigofera spinosa* and *Sericocomopsis hildebrandtii*. The difference between thicket and more open bushland is a factor of density of plant growth, as opposed to any real difference in flora species composition and may be attributed to differences in soil characteristics (particularly soil moisture) and rainfall levels (e.g., the density and tree height of *Acacia reficiens* increases with increasing rainfall (Olang, 1988)) rather than the vegetation itself.

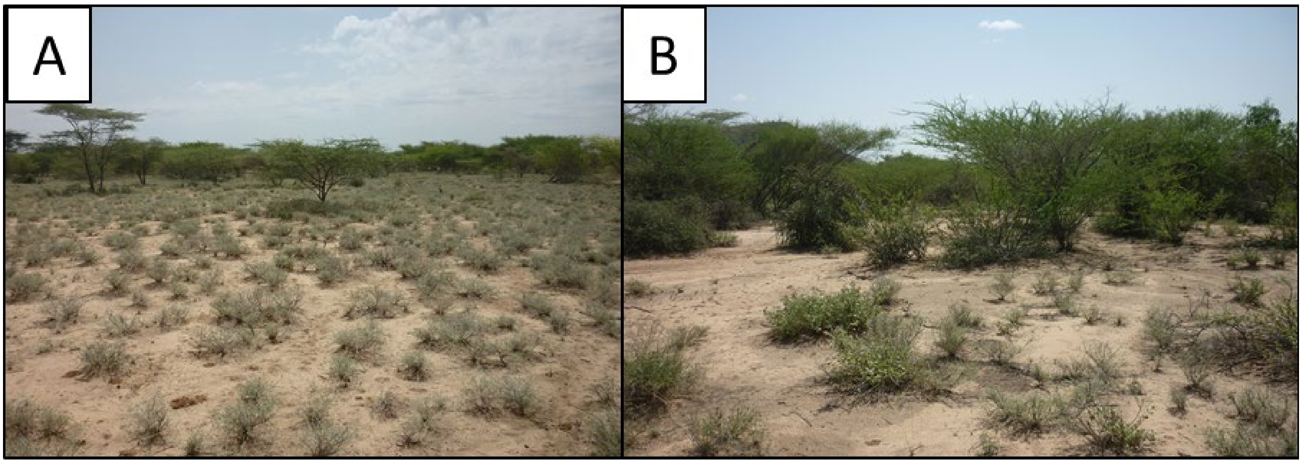

Figure 6.9-6: Acacia/Commiphora/Indigofera Stunted Bushland. B: Acacia-Commiphora-Euphorbia Stunted Bushland/Thicket

Acacia/Commiphora Deciduous Bushland and Thicket

This sub-type aligns with the Somalia-Masai *Acacia-Commiphora* deciduous bushland and thicket community described by van Breugel *et al*. (2015), and the 'bushland' described by KREMU (Olang, 1984). This community occurs in elevated, hill regions in the east of the region and does not occur within the AoI. It is associated with the mountain dense shrub/bush land cover classes. It is characterised by a few emergent species, dominated by *Acacia tortilis*, *Acacia reficiens*, *Acacia mellifera*, and *Salvadora persica*, with an understorey of *Indigofera spinosa*, with *Barleria acanthoides* and *Euphorbia turkanensis* also occurring. Most species have a growth habit of small bushy trees, branched near the base (Figure 6.9-7A). The species composition is very similar to that described for semi-desert shrubland. The main differentiating factor is the association of this bushland and thicket with preferential flow paths or drainage lines, and places where rainwater temporarily pools, as opposed to the rocky substrate where semi-desert shrubland occurs.

Acacia/Commiphora Semi-Desert Shrubland

This sub-type of *Acacia/Commiphora* bushland and thicket aligns with the Somalia-Masai *Acacia-Commiphora* deciduous bushland and thicket community described by van Breugel *et al*. (2015) and the bushland described by KREMU (Olang, 1984). This community occurs in rocky habitat in the eastern hills region and does not occur within the AoI. It is associated with the mountain sparse/open shrub/bush/grassland land cover categories. It is characterised by a sparse cover of shrub species (Figure 6.9-7B), dominated by *Acacia tortilis*, *Acacia reficiens*, and *Acacia mellifera*, with an understorey of *Indigofera spinosa*. *Barleria acanthoides* and *Euphorbia turkanensis* also occurring.

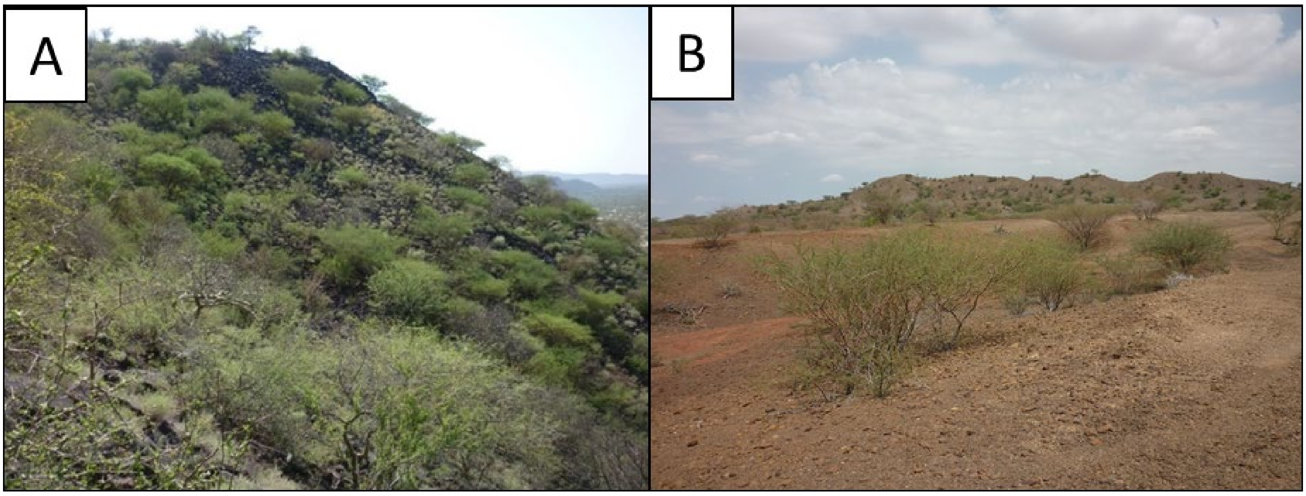

Figure 6.9-7: A: Acacia/Commiphora Deciduous Bushland, B: Acacia/Commiphora Semi-Desert Shrubland

Mixed Acacia/Commiphora Bushland on Rocky Outcrops

This vegetation community is confined to the low ridges and rocky outcrops between Lokichar and Kalemngorok and corresponds most closely to the *Acacia/Commiphora* deciduous bushland / thicket community described above. However, none of the habitat observed within the area between South Lokichar and Turkwel Gorge Dam could be classified as thicket and most of the vegetation in the AoI is deciduous, which is why the classification was revised. *Acacia reficiens* and *Acacia senegal* var. *kerensis* are co-dominant along with *Commiphora africana* and *Commiphora kataf*. Other common woody shrubs include *Euphorbia cuneata*, *Grewia fallax* and *Cadaba farinosa*. Small semi-succulent trees are a diagnostic feature of this vegetation community, particularly *Adenium obesum* and *Adenia venenatum*. Succulent dwarf shrubs and climbers include *Desmidorchis retrospiciens*, *Cynanchum viminale* and *Caralluma dicapuae*. Trees are more prominent on the higher ridges and include species more typical of the *Acacia/Boswellia* bushland community, such as *Sterculia stenocarpa*, *Boswellia neglecta* and *Diospyros scabra*.

6.9.4.1.2 Acacia tortilis Riparian Woodland

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

Acacia tortilis-dominated riparian forest is most commonly found associated with the large luggas in all areas of the AoI, and consists largely of mature *Acacia tortilis*, typically between 8 to 12 m in height, with dwarf shrubs of the same species typically forming the understorey. During field surveys, this vegetation community was recorded on sandy, alluvial soils primarily along the banks of large, seasonal luggas within the AoI (Figure 6.9-8A). These luggas typically have periodic flows following significant rainfall and increased moisture storage-capacity in their sandy soils. This increased water storage capacity compensates for the low rainfall and high potential evaporation experienced in the region, thus supporting large individual trees in these areas (van Breugel *et al*., 2015).

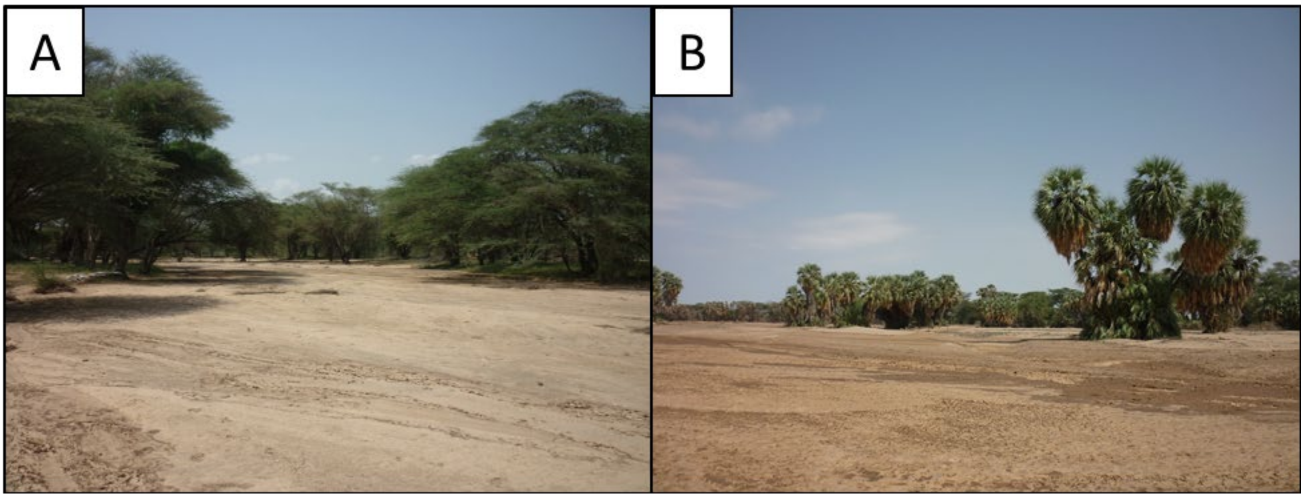

Figure 6.9-8A: Acacia tortilis-Dominated Riparian Forest, B: Hyphaene Stands in Kalabata Lugga

Some stands of hyphaene riparian forest occur in the large Kalabata lugga (Figure 6.9-8B). These palm stands are often associated with a more diverse riparian forest flora, including *Hyphaene coriacea*, *Acacia elatior*, *Acacia tortilis* and *Ziziphus mauritiana* existing as narrow forest strips along channel margins and on stable alluvial "*islands*". The understorey of these palm stands typically includes *Salvadora persica*, *Calotropis procera*, *Ziziphus mauritiana*, and young specimens of *Acacia tortilis*, and *Hyphaene compressa*. Some of the larger tributaries of the Kalabata River also support very large specimens (in excess of 15 m) of *Acacia tortilis* and *Acacia elatior*.

6.9.4.1.3 Ephemeral Stream Woodland

A subset of *Acacia tortilis* riparian woodland is the ephemeral stream woodland, a community which aligns with the riverine woodland and riverine thicket edaphic vegetation types described by van Breugel *et al*. (2015). It occurs on the banks of smaller luggas, and across the braided channels of the wider ephemeral streams (Figure 6.9-9) throughout the region and is the second most prevalent vegetation community in the AoI with the exception of Twiga where it was the third most prevalent.

Species diversity is relatively high compared to the riparian forests, due to the presence of a greater diversity of small shrubs, grasses and forbs in the understorey, and the presence of some of the species more typical of terrestrial vegetation communities.

Figure 6.9-9: Ephemeral Stream Woodland

6.9.4.1.4 Acacia reficiens Low Woodland/Bushland on Plains

This is the dominant vegetation community on the plains throughout the AoI (Figure 6.9-10A and Figure 6.9-10B). This vegetation community comprises elements of two of the vegetation communities described above namely:

- *Acacia/Commiphora/Indigofera* stunted bushland; and
- *Acacia/Commiphora/Euphorbia* stunted bushland/thickets.

The distinction between these two communities was not clear in the area between South Lokichar and Turkwel Gorge Dam and elements of both were present. *Acacia reficiens* is the dominant small tree throughout, with other Acacia species including *Acacia senegal* var. *kerensis*, *Acacia etbacia*, *Acacia paolii* and *Acacia tortilis* subsp. *spirocarpa*. *Commiphora africana* and *Commiphora kataf* are common in patches, although commiphora species are more prominent in the mixed *Acacia/Commiphora* bushland community on rocky outcrops. Other frequently encountered woody shrubs included *Maerua crassifolia*, *Cadaba farinosa* and *Balanites rotundifolia*. *Indigofera spinosa* is the dominant dwarf shrub species in many areas, particularly on sandy plains, while *Duosperma eremophilum* and *Sericocomopsis hildebrandtii* are co-dominant dwarf shrubs in some areas. Succulents include the black-flowered *Desmidorchis retrospiciens*, as well as several Euphorbia species.

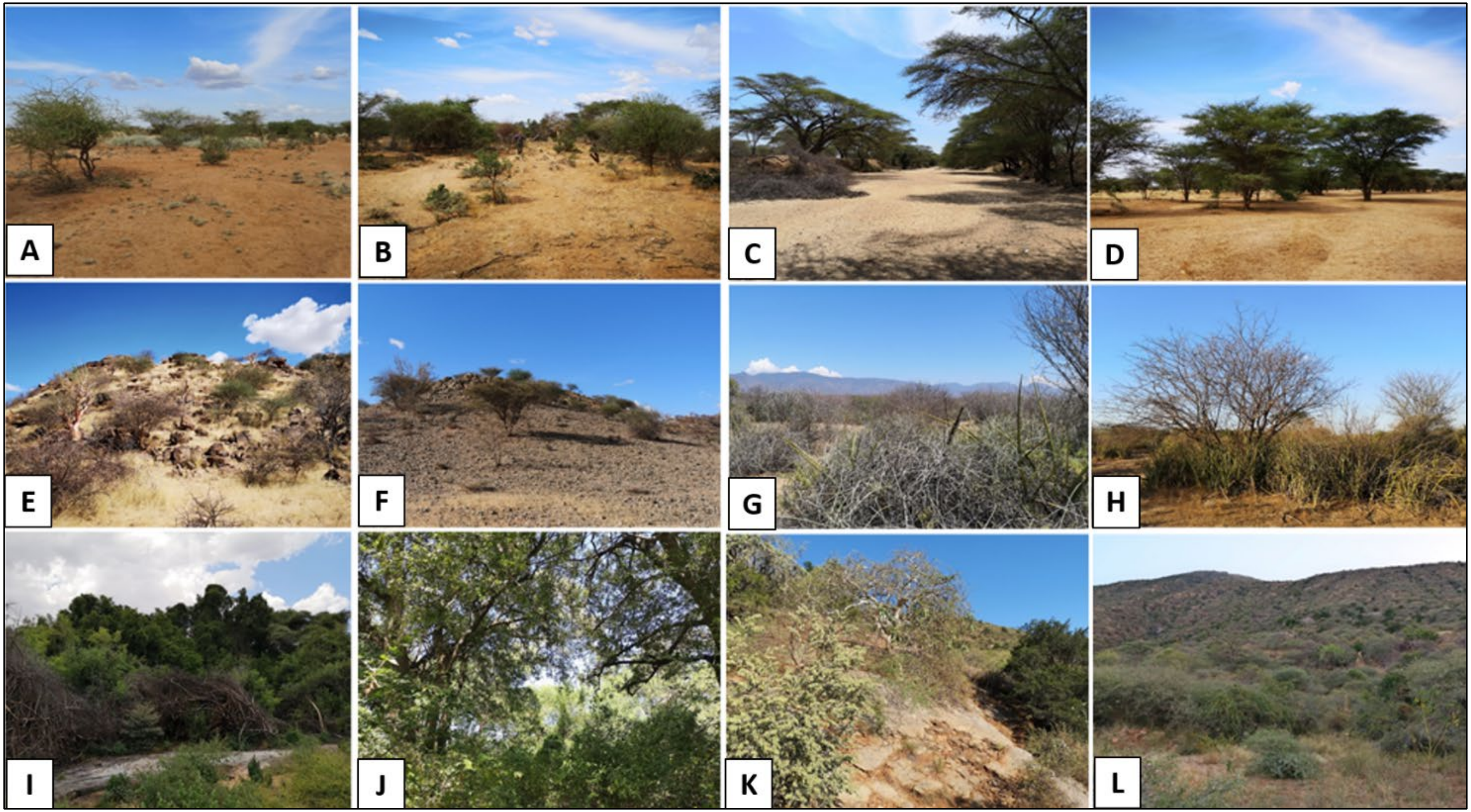

Figure 6.9-10: A & B: *Acacia reficiens* Low Woodland/Bushland, C & D: *Acacia tortilis* Riparian Woodland, E & F: Acacia – Commiphora Bushland on Ridges, G & H: Acacia – Sansevieria Bushland/Thicket, I & J: Faidherbia – Celtis Riparian Forest, K & L: Acacia – Boswellia

6.9.4.1.5 Acacia – Sansevieria Bushland/Thicket Mosaic

The *Acacia/Sansevieria* bushland/thicket mosaic replaces *Acacia reficiens* low woodland/bushland as the dominant vegetation community on the plains west of the Malmalte River (Figure 6.9-10G and Figure 6.9-10H). Low woodland/bushland is dominated by *Acacia reficiens* and is similar in species composition to *Acacia reficiens* low woodland/bushland. The numerous dense, deciduous thickets that define this community are characterised by *Sansevieria ehrenbergii*, which is present in most of the thickets. Other thicket species include *Acacia mellifera*, *Ximenia americana*, an unidentified maculate aloe species, *Grewia fallax* and *G. tenax*.

6.9.4.1.6 Acacia - Boswellia Shrubland on Steep Rocky Hillslopes

This is the primary vegetation community on steep rocky slopes of the high ridge between Turkwel Gorge Dam and the Malmate River (Figure 6.9-10K and Figure 6.9-10L). *Acacia senegal* var. *kerensis*, *Acacia mellifera* and *Acacia tortilis* are dominant on the lower slopes where rocks are less prominent. The rocky midslopes and upper slopes have a diverse woody community that is characterised by trees such as *Boswellia neglecta*, *Sterculia stenocarpa*, *Diospyros scabra* and *Commiphora edulis* subsp. *boiviniana*.

6.9.4.1.7 Faidherbia - Celtis Riparian Forest Along the Malmalte River

This was the only true forest community observed between South Lokichar and the Turkwel Gorge Dam and was restricted to the riparian habitat along the perennial Malmalte River. No riparian forests were observed along any of the dry luggas that were surveyed in the AoI. This community showed some similarity to the Riparian Forest community described above however, whereas *Acacia tortilis* was the dominant species in those riparian forests *Faidherbia albida* and *Celtis africana* were the most frequently encountered canopy trees at all three transects in this vegetation community. Other less common canopy trees were *Ficus sycomorus, Ziziphus mauritiana, Acacia tortilis*, *Tamarindus indica* and *Trichilia emetica*. The understorey is far more diverse than the *Acacia tortilis* riparian woodland that occurs along non-perennial luggas and is characterised by several species that are confined to this vegetation community. *Acalypha fruticosa* is the dominant herbaceous species throughout, forming dense stands in some places, while the woody mid-stratum is dominated by large shrubs such as *Cordia sinensis, Gymnosporia senegalensis* and *Allophylus rubifolius*.

6.9.4.1.8 Prevalence of Vegetation Communities

The prevalence of the different vegetation communities was assessed and the following communities dominated the AoI:

- *Acacia/Commiphora/Euphorbia* stunted bushland/thicket;
- Ephemeral stream woodland; and
- *Acacia/Commiphora/Indigofera* stunted bushland.

Habitat composition at Amosing, Ngamia, Agete, Etom, Twiga within the AoI was generally similar though northern areas are more arid and the mapped vegetation community extents reflect this (ERA, 2014, Golder Associates UK, 2015a, and Foundation Stage Development ESIA baseline). Significant observations were the presence of alien and/or invasive species, the evidence of disturbance attributed to charcoal burning and overgrazing the presence of domestic livestock (ecosystem services). The AoI is dominated by 'modified' habitat as defined by IFC PS6 (IFC GN6, 2019). Discrete exceptions to the modified habitat status occurred at the Malmalte riparian zone where 'natural' habitat occurs. The primary drivers of change in vegetation communities e.g., natural or modified characteristics in the region are overgrazing by livestock (primarily goats, shoats, donkeys and camels), and timber harvest for firewood and/or charcoal production. The intensity of these effects tends to be magnified with the proximity to areas of permanent settlement, such as Lokichar and Nakukulas, and with proximity to water supply points, and roads. The IFC defines modified habitat as areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition (IFC 2019, GN34).

According to the IFC, the determination of modified habitat can be based on the level of human-induced disturbance (for example, presence of invasive species, level of pollution, extent of habitat fragmentation, viability of existing naturally occurring species assemblages, resemblance of existing ecosystem functionality and structure to historical conditions, degree of other types of habitat degradation) and the biodiversity values of the site (for example, threatened species, ecosystems, and ecological processes necessary for maintaining nearby critical habitats) (IFC 2019, GN27). Further details on the classification of modified and natural habitats are provided in Annex I (group 4).

6.9.4.1.9 Plant Species of Conservation Concern

In total, 155 plant species were recorded during field surveys (Annex I). Of these, four are listed as being SoCC (Table 6.9-6). All of these species were recorded in the Katamanak hill region in the east of the AoI. *Euphorbia turkanensis* is a range-restricted plant species only known from the general vicinity of Lokichar town, with the type locality situated between South Lokichar and the Malmalte River about 1.5 km south-west of Lokichar town (Carter and Smith, 1998). Plants of this species were observed at the type locality and then searched for between South Lokichar and the Malmalte River. Several small colonies of *Euphorbia turkanensis* were found at 11 sites between Lokichar and just south of Kaputir (Drawing 6.9-8). Photos of this species are displayed in Figure 6.9-11.

Table 6.9-6: Plant Species of Conservation Concern Identified During Baseline Surveys

Scientific Name	Occurrence	Conservation Status				Other
		KWCMA (2013)	KWS (2019)	IUCN (2020)	CITES (2019)	
Blepharis turkanae	Only known from Turkana County (Vollesen, 2008) prior to baseline surveys in the AoI	-	-	VU	-	Restricted range
Euphorbia turkanensis	Type locality is 1.5 km south-west of Lokichar, and the species was previously also known from a limited distribution at a small area of north-west Kenya (Carter and Smith 1988)	-	-	-	II	Restricted range
Neuracanthus kenyensis	Only known from northern Kenya (Marsabit, Isiolo and Turkana), at Kora National Reserve and in the Gemu Gofa region of Ethiopia-Kenya border (Darbyshire *et al.* 2010)	-	-	-	-	Restricted range
Xerophyta schnizleinia	Known from Northern Frontier in Kenya, Karamoja in Uganda, Ethiopia, Somali republic and Nigeria (Smith and Ayensu 1975).	-	-	-	-	Restricted range

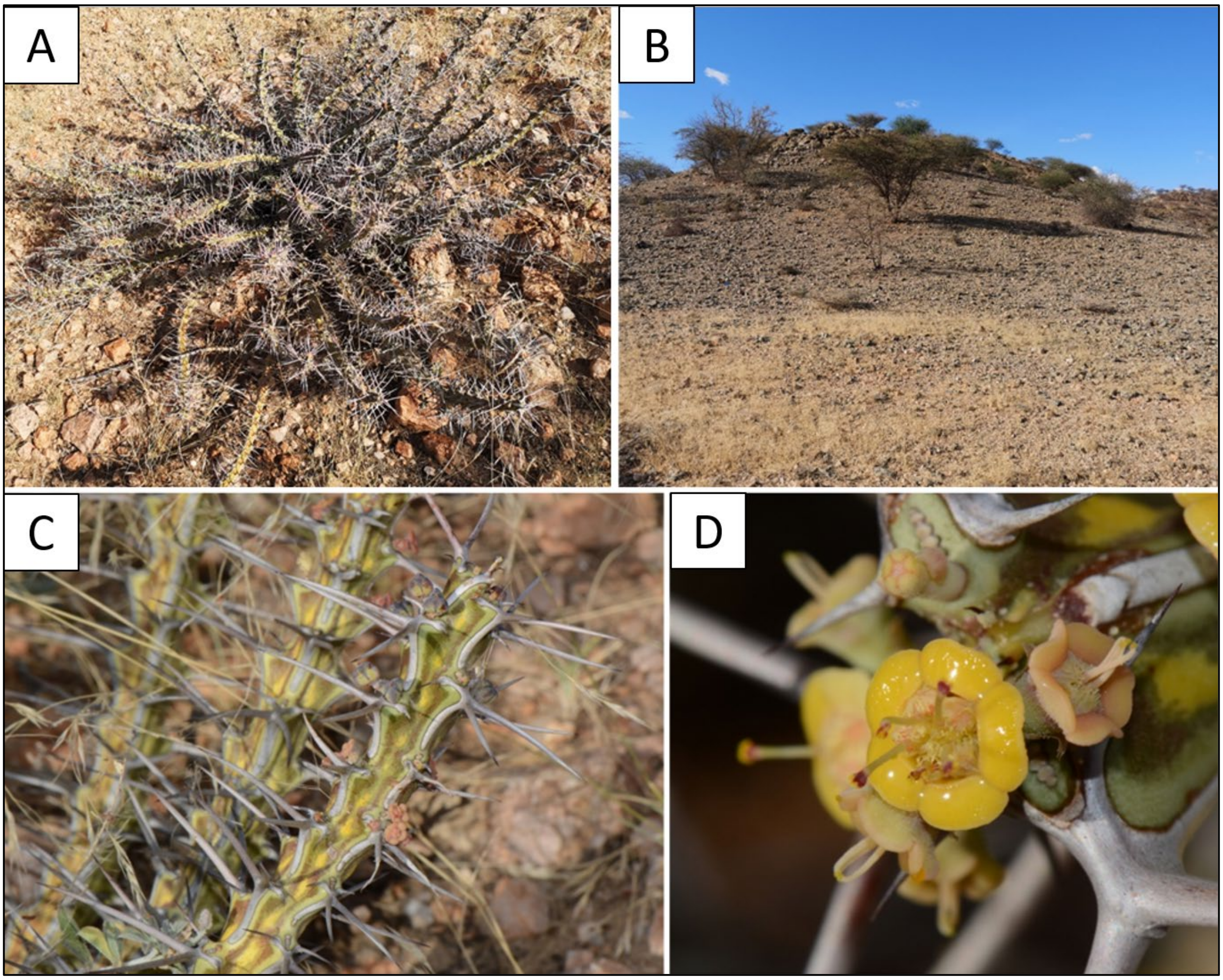

Figure 6.9-11: *Euphorbia turkanensis* A: Growth Form, B: Habitat at Type Locality, C: Branch and Spine Detail, D: Flower

A breakdown of plant SoCC per vegetation community is provided in Table 6.9-7. All four plant SoCC were recorded in the *Acacia/Commiphora* bushland and thicket vegetation community which comprises approximately 90% of the surface area of the AoI (Table 6.9-7). The only exception was *E. turkanensis* which was also recorded in the *Acacia reficiens* low woodland community (Table 6.9-7).

Alien invasive plant species were predominantly recorded in the *Acacia tortilis* riparian woodland and *Faidherbia – Celtis* riparian forest vegetation communities (Table 6.9-7).

Table 6.9-7: Total Number of Plant Species, Number of Alien Invasive Plant Species and Plant SoCC Recorded in Different Vegetation Communities

	ACB	ESW	ARW	ALW	FCR	ASB	ABS
Total number of plant species	130	69	71	36	31	31	23
Alien invasive plant species	0	0	6	3	6	2	1
Plant species of conservation concern	4	0	0	1	0	0	0

ACB - Acacia/Commiphora bushland and thicket
ESW - Ephemeral stream woodland

ARW - Acacia tortilis riparian woodland
ALW- Acacia reficiens low woodland
FCR - Faidherbia – Celtis riparian forest
ASB - Acacia – Sanseviera bushland
ABS - Acacia boswellia shrubland

6.9.4.2 Invertebrates

A summary of the baseline invertebrate species data collected is presented below. Detailed baseline results are provided in Annex I.

More than 20,000 invertebrate specimens have been collected. These included spiders (Class: Arachnida, Order: Aranae), centipedes (Class: Chilopoda), millipedes (Class: Diplopoda), woodlice (Class: Isopoda), camel spiders (Class: Arachnida, Order: Solifugae), scorpions (Class: Arachnida, Order: Scorpionae), and insects (Class: Insecta). By far the most abundant and diverse invertebrates in the region were the insects, with 12 orders comprised of 61 families and 466 genera recorded.

As discussed with NMK this assessment focussed on beetles (Coleoptera); flies (Diptera); ants, bees and wasps (Hymenoptera); butterflies and moths (Lepidoptera); and grasshoppers and crickets (Orthoptera) and the results are presented below.

6.9.4.2.1 Coleoptera (Beetles)

In excess of 250 species of beetle were recorded, representing 20 families and 66 genera. Darkling beetles (Tenebrionidae) were the most species rich and abundant, with 14 genera, 19 species and 1,928 individuals recorded. Scarab beetles (Scarabeidae) were the next most abundant, with ten genera, 12 species and 1,502 individuals recorded. Ground beetles (Carabidae) were the third most diverse group, with nine genera and ten species recorded.

6.9.4.2.2 Diptera (Flies)

Twenty-three species were recorded, representing seven families and six genera. House flies (Muscidae) were the most species rich and abundant, with three genera, and 115 individuals. All the other flies recorded were not species rich or very diverse, with families typically being represented by one or two genera and/or species. Fruit flies (Drosophilidae), although not species rich or diverse, were abundant, with 30 specimens collected.

6.9.4.2.3 Hymenoptera (Sawflies, Wasps, Bees, Ants)

Thirty species of Hymenopteran were recorded, representing 12 families and 15 genera. Ants (Formicidae) were the most species rich and abundant Hymenopteran group, with six genera and 866 individuals recorded. Chalcid wasps (Chalcidae) were the second-most abundant group, with 205 specimens collected. Other families showed lower levels of richness, diversity and abundance (with one to three genera represented).

6.9.4.2.4 Lepidoptera (Butterflies)

Twenty-four butterfly species were identified, representing four families and 13 genera. Whites (Pieridae) was the most species-rich and abundant family, with 15 species positively identified. All other species were sampled in low numbers (one to five individuals) during the baseline survey.

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

6.9.4.2.5 Orthoptera (Grasshoppers, Crickets, Katydids, Locusts)

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

Updated invertebrate surveys undertaken in 2020 recorded a total of 121 invertebrate species and 19,147 individual invertebrates. This included 33 species that were previously unrecorded in the combined AoI in recent years. However, none of these new records are SoCC.

6.9.4.2.6 Invertebrate Species of Conservation Concern

A single invertebrate SoCC was recorded during the baseline surveys - a single specimen of a ground beetle in the genus Omophron (Family: Carabidae, Sub-family: Omophrininae) (Figure 6.9-12), which was collected near Loperot in the east of the AoI. Omophron (Latreille 1802) is a genus of ground beetle, and the only extant genus in the subfamily Omophrininae. It is mostly distributed in the northern hemisphere, with the southern border of its African distribution running through South Africa and Madagascar (Valainis, 2010). This genus has never been recorded in Kenya and may represent a new species. The specimen was confirmed by NMK

[18] to be a new species. Additional surveys were undertaken in December 2019 and December 2020 to look for additional specimens, but none were recorded.

[18] The specimen was confirmed by NMK (Entomology department, Jirka Hava) to be a new species on 19th July 2016.

Figure 6.9-12: Unidentified Omophron *sp*. Collected at Loperot During the June 2016 Survey

6.9.4.3 Amphibians and Reptiles

A summary of the primary baseline data for reptile and amphibian species is presented based on the findings of the field investigations. The detailed baseline survey results are presented in Annex I.

Due to the dry weather conditions experienced during the multiple surveys, reptiles and amphibian diversity was lower than expected. Some rainfall occurred towards the end of the 2016 survey, mostly as isolated showers. Active searches were conducted in those areas where rainfall occurred. Only one species of amphibian, the Turkana toad (*Amietophrynus turkanae*), was recorded.

Thirteen reptile species have been recorded in the project area. In addition, the TKBV snake catching team has recorded seven snake species which were not recorded during the formal surveys. With the addition of these records, the total count of reptile and amphibian species is 21, 18 of which were recorded in the AoI.

Additional observations of reptiles were made during March and June 2019 baseline surveys; however, no new species were observed. Photographs of reptile species observed during the March 2019 survey are provided in Figure 6.9-13. An additional survey was carried out in December 2019 with the specific objective of confirming the presence of the Turkana toad in the project area and describing its habitat preference. No specimens of this species were recorded during the survey however three other amphibian species were recorded, all of which had been confirmed previously.

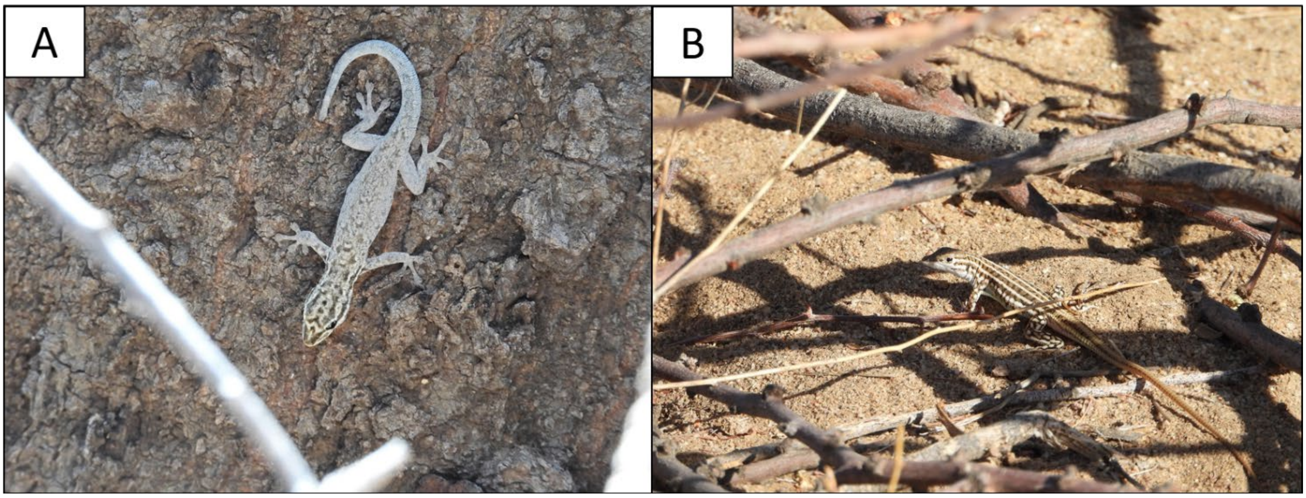

Figure 6.9-13: A: Kenyan Dwarf Gecko (*Lygodactylus keniensis*) and B: Speke's Sand Lizard (*Heliobolus spekii*) observed in the AoI during the March 2019 Field Survey

Habitats

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

6.9.4.3.1 Herpetofauna Species of Conservation Concern

Four herpetofauna species of conservation concern were recorded during the baseline surveys.

The rock monitor (*Varanus albigularis*) is a species of monitor lizard in the family Varanidae. Although it has a distributional range that covers central, eastern and southern Africa, it is listed as Protected by Kenyan legislation (KWCMA, 2013) and is listed by KWS as a priority species (KWS, 2019).

The Turkana toad is a range restricted amphibian species previously only known from two localities, Loiengalani on the south-eastern shores of Lake Turkana and the Ewaso Ng'iro River in the Samburu Game Reserve (IUCN, 2019). Its presence in the Project area represents a range extension. It is listed as DD by the IUCN and listed as Protected by Kenyan legislation (KWCMA, 2013).

Of the seven snake species collected by the TKBV Snake Catchers two are listed as protected in Kenya namely:

- Kenya sand boa (*Eryx colubrinus*) (KWCMA, 2013); and
- Puff adder (*Bitis arietans*) (KWCMA, 2013).

Both species are also listed as priority species for conservation by KWS (2019).

6.9.4.4 Avifauna

In excess of 277 bird species were recorded during the combined baseline surveys. Most of the recorded species are relatively common and typical of the region. Species community composition generally comprised resident woodland and grassland species. The full list of bird species recorded is presented in Annex I. Photographs of selected bird species are provided in Figure 6.9-14.

Figure 6.9-14: Bird Species Observed During the June 2019 Biodiversity Baseline Survey, A: African Pygmy Kingfisher, B: Jackson's Hornbill, C: Parrot Billed Sparrow, D: White-Headed Buffalo Weaver, E: White-Throated Bee-Eater, F: Grey-Hooded Kingfisher, G: Golden-Backed Weaver, H: Chestnut Weaver, I: Beautiful Sunbird, J: D'Arnaud's Barbet, K: Ruppell's Sunbird and L: Olive Bee-Eater

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

A relatively high diversity of raptor species (19 species) was recorded over the course of the baseline surveys. Several of the observed raptor species are Palearctic migrants, including black kite (*Milvus migrans*), Eurasian hobby (*Falco subbuteo*), lesser kestrel (*F. naumanni*), pallid harrier (*Circus macrourus*), steppe buzzard (*Buteo rufofuscus*) and steppe eagle (*Aquila nipalensis*).

The highest avifaunal diversity was recorded in the *Acacia/Commiphora/Euphorbia* bushland/thicket vegetation community (116 species). However, the majority of these (103 species) were also recorded in the ephemeral stream woodland community. The richness, diversity and abundance of birds recorded within the riparian forest community was lower, with only 36 species recorded. In general, the birds recorded within specific vegetation types were subsets of the wider bird community recorded across the region, with no species being particular to a specific vegetation community the only exception being the *Faidherbia* - *Celtis* riparian forest along Malmalte River.

In November 2018 and December 2020, additional bird surveys were carried out with the objective of assessing bird communities between South Lokichar and Turkwel Gorge Dam with specific emphasis on the riparian habitats along the Malmalte River. One hundred and nine species were recorded over the course of the survey. Seventeen of these species (61% of species newly recorded compared to the 2016 surveys) were only recorded at sites along the Malmalte River, highlighting the difference between the Malmalte River bird community and that of the remainder of the AoI. The 2020 surveys focussed on Ekales, Etom and Agete. A Steppe eagle (*Aquila nipalensis* (EN) was recorded during this latest study. This species was also recorded in June 2019 as part of previous studies. The presence of this endangered and migratory species indicates that critical habitat is potentially triggered. This species is likely to leave Kenya during February and March to return to breeding grounds in Central Asia[19].

6.9.4.4.1 Avifaunal Species of Conservation Concern

Forty-two species that are endemic to the Somali-Masai biome were observed during fieldwork. This comprises 15% of the total number of observed bird species. The Somali-Masai biome has 129 species that are described as "*biome-restricted endemics*", 94 of which occur in Kenya (Fishpool & Evans, 2001). Even though these species are referred to as "*endemics*", they are confined to large regions and none fulfil the requirements for being classified as "*range-restricted species*", i.e., they each have an extent of occurrence of greater than 50,000 km^2.

Fourteen bird SoCC were recorded (Table 6.9-8). This included two species listed as VU and two as NT by Kenya legislation. Rüppell's vulture and white-backed vulture are both listed as CR by the IUCN. Lappet-faced vulture and steppe eagle are both listed as EN by the IUCN. The observed bird community also contained a number of migratory species, with five species listed on Appendix I (Endangered migratory species) of the CMS, and a further seven species listed on Appendix II (Migratory species conserved through Agreements) (Table 6.9-8).

Table 6.9-8: Bird SoCC Recorded in the AoI

Common name	Scientific Name	KWCMA (2013)	IUCN (2021)	CMS (2021)	KWS (2019)	Confirmed in AoI
Lappet-faced vulture	*Torgos tracheliotos*	VU	EN	I	✓	✓
Lesser kestrel	*Falco naumanni*	VU	LC	I	✓	✓
African white-backed vulture	*Gyps africanus*	NT	CR	I	-	✓
Rüppell's vulture	*Gyps rueppelli*	NT	CR	I	-	✓
Pallid harrier	*Circus macrourus*	NT	NT	II	-	✓
Steppe eagle	*Aquila nipalensis*	-	EN	I	-	✓

[19] *Ferguson-Lees, J.; Christie, D. (2001). Raptors of the World. Houghton Mifflin Harcourt. ISBN 0-618-12762-3.*

Common name	Scientific Name	KWCMA (2013)	IUCN (2021)	CMS (2021)	KWS (2019)	Confirmed in AoI
Tawny eagle	*Aquila rapax*	-	VU	II	-	✓
Bateleur	*Terathopius ecaudatus*	-	NT	-	-	✓
Kori bustard	*Ardeotis kori*	-	NT	-	-	✓
Eurasian hobby	*Falco subbuteo*	-	LC	II	-	✓
Spur-winged plover	*Vanellus spinosus*	-	LC	II	-	✓
Common quail	*Coturnix*	-	LC	II	-	✓
Black kite	*Milvus migrans*	-	LC	II	-	✓
Steppe buzzard	*Buteo*	-	LC	II	-	✓

Photographs of selected bird species observed during the June 2019 survey are provided in Figure 6.9-14 above.

6.9.4.5 Mammals

Thirty-seven mammal species were either directly observed or considered likely to be present based on secondary evidence such as track-pads or anecdotal records gathered from local people (Table 6.9-9).

During the September 2018 biodiversity survey between South Lokichar and the Turkwel Gorge Dam, signs of African elephant (*Loxodonta africana*) activity were noted in the *Faidherbia-Celtis* riparian forest along the Malmalte River. This led to engagement with KWS to obtain an understanding of the movements of these elephants and particularly to understand whether there was a seasonal element to their movements. In 2014 and 2015, Elephants Without Borders (EWB) together with KWS and with support from The Great Elephant Census conducted aerial surveys throughout Kenya to obtain updated information on the status of elephant populations in various ecosystems throughout Kenya (Chase *et al*., 2016). Based on that assessment around 600 elephants were found in the Kerio Valley with the majority occurring in Nasolot NR and South Turkana NR (Chase *et al*., 2016).

Research conducted by KWS and Save the Elephants from 2017 onwards confirmed extensive movements of elephants between Nasolot NR and South Turkana NR with the animals also spending considerable time along the Malmalte River between the two reserves (Ihwagi *et al*., 2018), although the collared elephants did not venture northwards past the confluence of the Malmalte and Turkwel Rivers towards Kaputir. Honey producers that were interviewed at Kaputir during the March 2019 biodiversity survey also confirmed the occasional presence of elephants along the Turkwel River. The seasonal presence of elephants along the Malmalte and Turkwel Rivers was confirmed during the June 2019 survey.

Table 6.9-9: Mammal Species Considered to be Present in the AoI Either Based on Direct Observations, Identification of Tracks/Scat and Anecdotal Information Obtained from Local Inhabitants

Common Name	*Scientific Name*	KWCMA (2013)	IUCN (2019)	KWS (2019)	CITES (2019)	Observed in AoI during baseline
Elephant	*Loxodonta africana*	EN	VU	✓	I	✓
Striped hyena	*Hyaena*	EN	NT	✓	III	✓

Common Name	*Scientific Name*	KWCMA (2013)	IUCN (2019)	KWS (2019)	CITES (2019)	Observed in AoI during baseline
Leopard	*Panthera pardus*	EN	NT	✓	I	-
Lesser kudu	*Tragelaphus imberbis*	VU	NT	-	-	✓
Percival's spiny mouse	*Acomys percivali*	-	LC	-	-	✓
Wilson's spiny mouse	*Acomys wilsoni*	-	LC	-	-	-
African grass rat	*Arvicanthis niloticus*	-	LC	-	-	-
Four-toed hedgehog	*Atelerix albiventris*	-	LC	-	-	-
Somali hedgehog	*Atelerix sclateri*	-	LC	-	-	-
Golden jackal	*Canis aureus*	-	LC	-	III	-
Black-backed jackal	*Canis mesomelas*	-	LC	-	-	✓
African civet	*Civettictis civetta*	-	LC	-	III	✓
Spotted hyena	*Crocuta*	-	LC	-	-	✓
Rufous sengi	*Elephantalus rufescens*	-	LC	-	-	-
Senegal galago	*Galago senegalensis*	-	LC	-	-	✓
Small-spotted genet	*Genetta*	-	LC	-	-	-
Large-spotted genet	*Genetta maculata*	-	LC	-	-	✓
Black-tailed gerbil	*Gerbilliscus nigricaudus*	-	LC	-	-	-
Cosen's gerbil	*Gerbillus consensus*	-	DD	-	-	✓
Cape/Crested porcupine	*Hystrix africaeaustralis/ H. cristata*	-	LC	-	-	-
Striped polecat	*Ictonyx striatus*	-	LC	-	-	-
Yellow-winged bat	*Lavia frons*	-	LC	-	-	-
Serval	*Leptailurus servalis*	-	LC	-	II	✓
Cape hare	*Lepus capensis*	-	LC	-	-	✓
Guenther's dik-dik	*Madoqua guentheri*	-	LC	-	-	-
Honey badger	*Mellivora capensis*	-	LC	-	III	-
Schlieffen's twilight bat	*Nycticeinops schlieffeni*	-	LC	-	-	-

Common Name	*Scientific Name*	KWCMA (2013)	IUCN (2019)	KWS (2019)	CITES (2019)	Observed in AoI during baseline
Aardvark	*Orycteropus afer*	-	LC	-	-	✓
Bat-eared fox	*Otocyon megalotis*	-	LC	-	-	✓
Olive baboon	*Papio anubis*	-	LC	-	-	-
Emin's tateril	*Taterillus emeni*	-	LC	-	-	-
Unstriped ground squirrel	*Xerus rutilans*	-	LC	-	-	✓
Vervet monkey	*Chlorocebus pygerythrus*	-	LC	-	-	✓
Yellow-spotted rock hyrax	*Heterohyrax brucei*	-	LC	-	-	✓
Warthog	*Phacochoerus africanus/P. aethiopicus*	-	LC / LC	-	-	✓
White-tailed mongoose	*Ichneumia albicauda*	-	LC	-	-	✓
Striped ground squirrel	*Xerus erythropus*	-	LC	-	-	✓

6.9.4.5.1 Medium and Large Mammals

Twenty-five medium and large mammal species[20] were recorded over the course of the five seasonal mammal surveys (Table 6.9-9). The medium and large mammal fauna assemblage consists primarily of medium-sized carnivorous/omnivorous mammals, such as African civet, large-spotted genet, serval, jackals, bat-eared fox, spotted and striped hyena, as well as the herbivorous species dik-dik and lesser kudu. African elephant was confirmed to be present along the Malmalte – Turkwel corridor based on visible signs and anecdotal information obtained from *ad hoc* interviews with local community members.

6.9.4.5.2 Small Mammals Including Rodents

Ten small mammal species were recorded across the baseline surveys (Table 6.9-9). The abundance and species richness of captured species was low compared to a potential 22 small mammal species that have been recorded in Turkana region to date (Coe, 1972; Webala *et al.*, 2010). The overall trap success rate for the survey was also relatively low, varying between 3% and 8% across the survey events (Annex I). Similar results were achieved in a relatively recent small mammal study conducted on the eastern side of Lake Turkana (Webala *et al.*, 2010) in which low species diversity (11 in total, and 6 in similar habitat) and low capture success (5.46% average success rate) was also noted; the baseline survey results may thus reflect generally low levels of species richness associated with arid plain habitats. The most frequently recorded species were unstriped ground squirrel (*Xerus rutilans*) and Cape hare (*Lepus capensis*) which were present throughout the AoI.

[20] Medium and large mammal species include all species except rodents and bats.

Photographs of selected mammal species or the visual signs that indicate their presence are provided in Figure 6.9-15.

Figure 6.9-15: Mammal Species Recorded During the Baseline Surveys: A) Vervet Monkey, B) Yellow-Spotted Rock Hyrax, C) Warthog Dung, D) Elephant Dung, E) Günther's Dik-Dik Droppings, F) African Civet Midden, G) Mongoose Tracks, H) Lesser Kudu Tracks, I) Aardvark Track, J) Porcupine Dung

6.9.4.5.3 Bats

Two bat species were confirmed via trapping during baseline surveys (Table 6.9-9). These were yellow-winged bat (*Lavia frons*) and Schlieffen's twilight bat (*Nycticeinops schlieffeni*), which are both listed as LC by the IUCN (2021).

Active, driven transect surveys were carried out during 12 dusk and dawn periods in April 2016 and covered approximately 153 km. Two hundred and one bat echolocation call files were generated during the driven transect survey. Of these, 61 were indistinguishable. Most of the remaining calls were identified as from the families Molossidae and Vespertilionidae, suggesting up to six additional species including *Myotis tricolor*, *Pipistrellus kuhli*, *Neoromicia nanus*, *Charaephon pumila*, *Mops condylurus* and *Mops cf demonstrator* (Webala et al., 2009) may occur. The mean encounter rate per kilometre was 0.91 calls, indicating a low overall level of bat activity during that survey period. During the 2021 surveys, a tomb bat *(Taphozous sp.)* was recorded by sonogram at Ekales.

Suitable roosting habitat for tree/crevice-roosting species is present in the AoI; Schlieffen's twilight bat was recorded from a tree roost. Cave-roosting species may be present along the ridge separating Turkwel Gorge Dam from the Malmalte River and fruit bats may be present along the Malmalte River but due to security concerns nocturnal surveys could not be carried out in these areas.

6.9.4.5.4 Mammal Species of Conservation Concern

Five mammal SoCC were confirmed within the AoI during the baseline surveys (Table 6.9-10).

Three species are listed as EN in KWCMA (2013) and identified as priority species for conservation by KWS (2019). The African Elephant is listed as EN by the IUCN whilst Striped Hyena and Leopard are both listed as NT (Table 6.9-10). The lesser kudu is currently listed as NT by the IUCN (2019) (Table 6.9-10). Within the study area it was recorded along the Malmalte River. The lesser kudu is closely associated with *Acacia/Commiphora* thorn bush in semi-arid areas of north-eastern Africa (IUCN, 2019). Although resilient to some degree of hunting pressure, it is susceptible to outbreaks of rinderpest, an infectious disease of ruminants, especially cattle. Cosen’s gerbil is considered to be a Kenyan endemic (B. Agwanda pers. Comm, 2021) and is classified as DD by the IUCN.

Table 6.9-10: Mammal SoCC Recorded as Likely to Occur or Confirmed in the AoI

Common Name	*Scientific Name*	KWCMA (2013)	IUCN (2019)	KWS (2019)	Recorded in AoI during baseline
African elephant	*Loxodonta africana*	EN	VU	✓	✓
Striped hyena	*Hyaena*	EN	NT	✓	✓
Leopard	*Panthera pardus*	EN	NT	✓	
Lesser kudu	*Tragelaphus imberbis*	VU	NT	-	✓
Cosen’s gerbil	*Gerbillus consensus*	-	DD	-	✓

6.9.4.6 Fish

During March 2019, the Turkwel River was surveyed for fish downstream of the confluence with the Malmalte River in the vicinity of Kaputir village. The Turkwel River at this point is approximately 150 m wide and shallow with a sandy substrate and well vegetated margins (Figure 6.9-16).

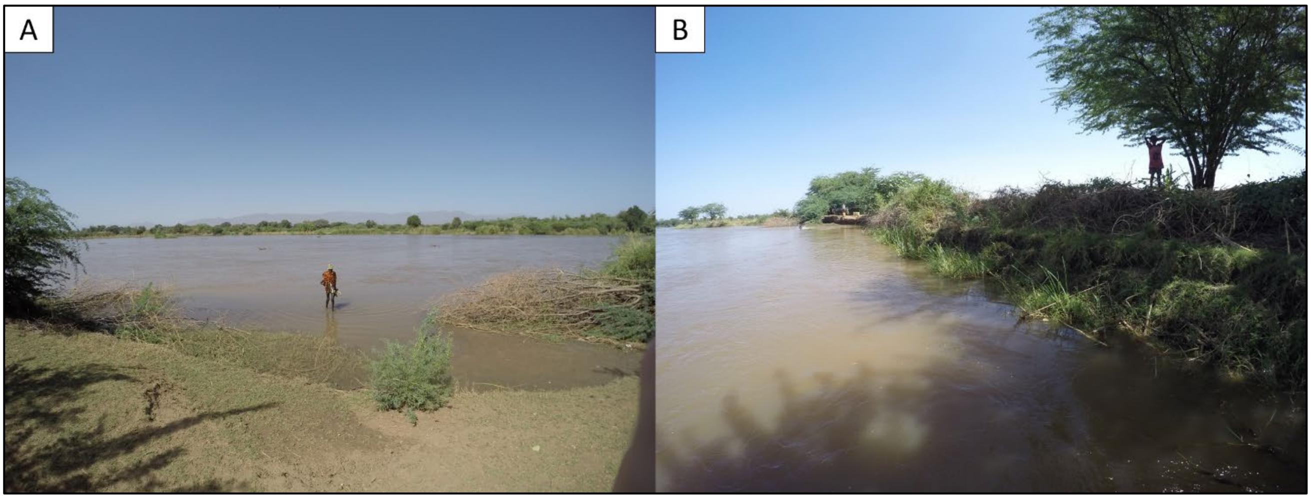

Figure 6.9-16: Turkwel River in the Vicinity of Kaputir Village Showing A: Width and B: Vegetated Margin

Eleven fish species from two families were recorded on the Turkwel River during the March and June 2019 surveys (Table 6.9-11).

The Senegal minnow (*Raiamas senegalensis*) was the most abundant species recorded, while the Cyprinidae was the most diverse family, with seven species recorded (Table 6.9-11). Four cichlid species were recorded including Nile tilapia (*Oreochromis niloticus*) (Table 6.9-11). The Nile tilapia has reportedly been stocked in the Turkwel Gorge Dam in order to promote fisheries in the impoundment. Two Haplochromis species were recorded in the Turkwel River, both species are known from Lake Turkana. The records from the Turkwel River therefore represent a range extension for both species. Photographs of selected fish species are provided in Figure 6.9-17.

Table 6.9-11: Fish Species Recorded in the Turkwel River During the March and June 2019 Biodiversity Baseline Surveys

Family	Species	IUCN (2019)	March 2019	June 2019
Cyprinidae	*Enteromius aff. stigmatopygus*	-	7	47
	Enteromius aff. jacksoni	-	3	1
	Labeo cylindricus	LC	4	29
	Labeo horie	Unlisted	-	1
	Labeo aff. coubie	-	1	-
	Labeobarbus intermedius	LC	3	23
	Raiamas senegalensis	LC	103	24
Cichlidae	*Haplochromis turkanae*	LC	-	30
	Haplochromis macconneli	LC	-	2
	Oreochromis niloticus	LC	1	46
	Coptodon zillii	LC	-	5
No of species			**7**	**10**

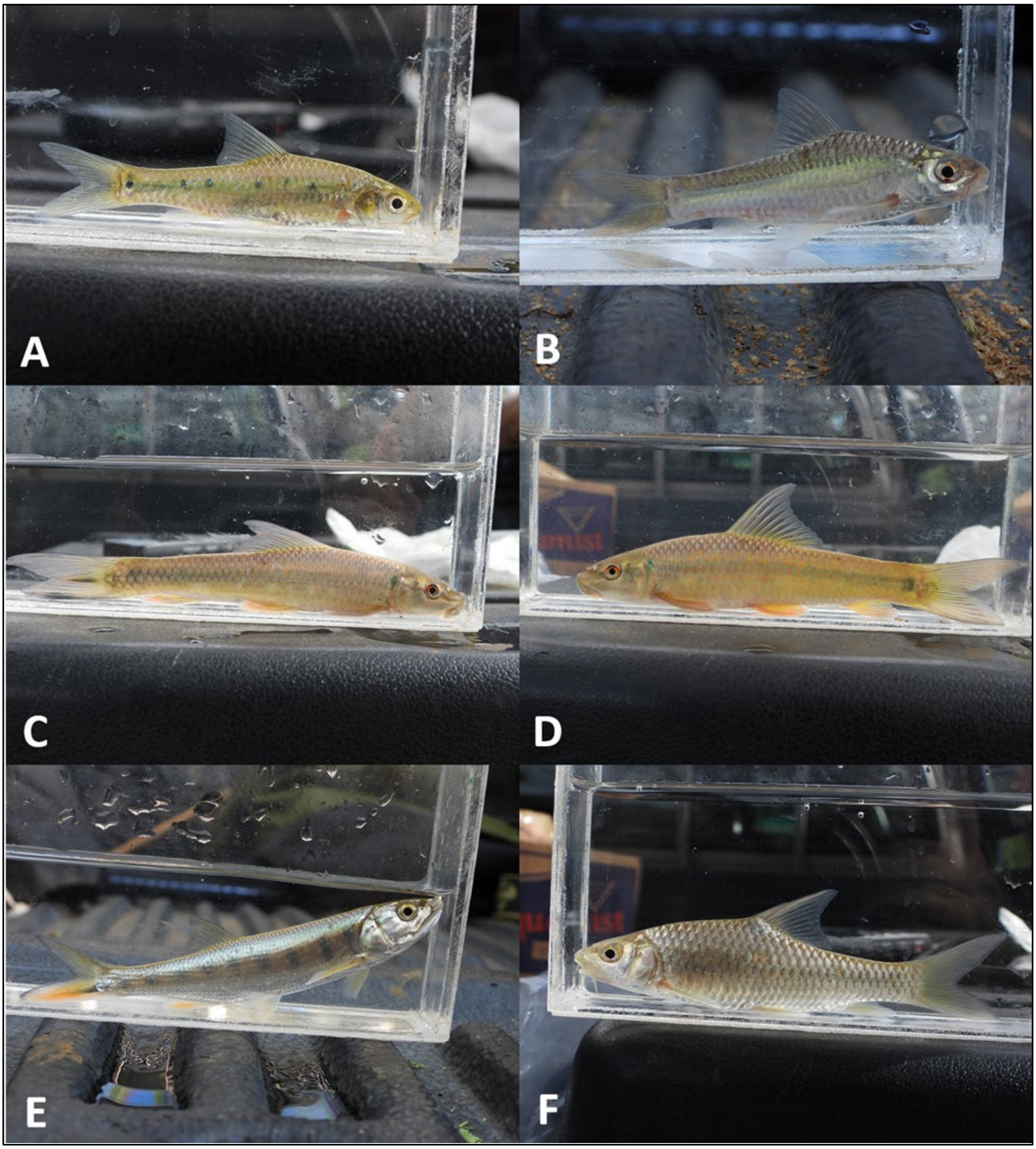

Figure 6.9-17: Fish Species Recorded in the Turkwel River During the March and June 2019 Biodiversity Baseline Surveys. A: *Enteromius aff. stigmatopygus*, B) *Enteromius sp. jacksoni*, C) *Labeo horie*, D) *Labeo cylindricus*, E) *Raiamas senegalensis*, F) *Labeobarbus intermedius*

It is likely that the observed fish community represents only a fraction of the full fish species diversity of the Malmalte and Turkwel Rivers. This is based on the short duration of the surveys and the limited access to the Malmalte River in particular. Very limited baseline information exists on the fish communities of the Malmalte and Turkwel Rivers.

6.9.4.6.1 Fish Species of Conservation Concern

Two fish SoCC were recorded during the baseline survey. These were *Haplochromis turkanae* and *H. macconneli* both of which are considered to be Lake Turkana endemics[21]. Their presence in the Turkwel River represents a range extension for both species. Despite the extension of their range, the extent of occupancy of both species remains below the 500 km Criterion 2 threshold and both species are therefore regarded as range restricted.

The likelihood that additional species of conservation concern occur in the Malmalte and Turkwel Rivers, including little-known and previously undescribed species, is regarded as high.

6.9.5 Discussion

The AoI overlaps with portions of South Turkana NR and the northern-most portion of Nasolot NR as well as the Pellow Community Conservancy. These areas provide refuge for wild ungulates and large mammal species such as elephant and lion that have largely been extirpated from the remainder of Turkana County. Critical habitat for a number of species was recorded within the AoI and Natural habitat was also recorded in the Malmalte riparian corridor (refer Annex I). The presence of wild ungulates, large mammals and domestic livestock (camels, donkeys, cattle) attracts scavenging bird species such as the white-backed vulture (CR), which was observed in the AoI, Rüppell's vulture (CR) and lappet-faced vulture (EN). The Malmalte River is situated between these reserves and although not officially protected it has received some *de facto* protection due to the security issues in the region. The Malmalte River was shown by the KWS and Save the Elephant study (KWS, 2019) to represent key habitat for the elephants in the region. These reserves, their adjoining areas and the Malmalte River corridor should therefore be regarded as highly sensitive biodiversity areas and impacts on these areas should be avoided.

Several plant SoCC were confirmed as present in the AoI during the baseline surveys. These included four endemic plant species all of which were recorded in the Katamanak hill region in the east of the AoI. *Euphorbia turkanensis,* a range-restricted plant species only known from the general vicinity of Lokichar town, was found at 11 sites between Lokichar and the area just south of Kaputir.

A single invertebrate SoCC was collected near Loperot in the east of the AoI. The specimen was confirmed by NMK (Entomology department, Jirka Hava) to be a new species on 19 July 2016.

Four herpetofauna SoCC were recorded (three reptiles and one amphibian). Turkana toad (*Amietophrynus turkanae*) is a range- restricted amphibian species previously only known from two localities, Loiyangalanii on the south-eastern shores of Lake Turkana and the Ewaso Ng'iro River in the Samburu Game Reserve. Its presence in the AoI therefore represents a range extension. The Turkana toad is listed as DD by the IUCN and listed as Protected by Kenyan legislation. Three reptiles recorded as part of the baseline studies within the AoI qualify as SoCC. These species are protected under national legislation (KWCMA, 2013) and are not considered to be range restricted or globally threatened by the IUCN Red List.

Fourteen bird SoCC including species listed as CR and EN by the IUCN were recorded. Rüppell's vulture and white-backed vulture are both listed as CR by the IUCN. Two bird species listed as EN by the IUCN were recorded in the AoI, namely lappet-faced vulture and steppe eagle. A high diversity of raptor species was recorded over the course of the baseline surveys, including Palearctic migrant species such as black kite, Eurasian hobby, lesser kestrel, pallid harrier, steppe buzzard and steppe eagle.

Large mammals and free roaming wild ungulates have largely been extirpated (made locally extinct) from the AoI, with the exception of those remaining within Nasolot NR and South Turkana NR. The exception are African elephant and hyena species which were confirmed to be present along the Malmalte to Turkwel corridor.

[21] Froese, Rainer and Pauly, Daniel, eds. (2013). "*Haplochromis turkanae*" in FishBase. February 2013 version

Outside of the reserves the mammal community consists primarily of small species such as hedgehogs, hares and ground squirrels. Medium sized mammal species that have been confirmed outside of reserves in the AoI over the course of baseline studies include carnivorous/omnivorous mammals, such as African civet, large-spotted genet, serval, jackals, bat-eared fox, spotted hyena and striped hyena; as well as ungulates including dik-dik and lesser kudu. Four mammal species of conservation concern were confirmed within the AoI during the baseline surveys. Three of these species are listed as EN in the KWCMA (2013) and identified as priority species for conservation by KWS (leopard, striped hyena and African Elephant). The African elephant is also listed as EN by the IUCN, whilst striped hyena and leopard are both listed as NT.

Two fish species of conservation concern were recorded during the baseline survey. Taking into account the aquatic habitat characteristics and the available time and access for the baseline field survey, there is potential for additional species of conservation concern to be confirmed in the Malmalte and Turkwel Rivers with increased survey effort.

6.10 Ecosystem Services

Ecosystem services consist of all the natural products and processes that contribute to human well-being, and the personal and social enjoyment derived from nature (Landsberg, et al., 2013). For example, arid and semi-arid areas provide important services, including soil formation and conservation, which plays a role in preventing desertification and support of certain vegetation species (e.g. acacia), which directly provide a range of services, such as fuelwood, food, materials for construction, forage for livestock, and support of wild fauna (Safriel et al., 2005).

Ecosystem services are the benefits that people and/or a project (the beneficiaries) obtain from ecosystems (IFC PS1). The benefits gained can either be physical or psychological, and can be obtained actively or passively, directly, or indirectly (IFC, 2012). The benefits of ecosystems are passed on to beneficiaries at many levels. These include:

- Local scale – ecosystem services may be the basis for rural livelihoods and subsistence. For example, grasses and shrubland in an otherwise arid landscape are an important grazing resource for livestock, which provides both cash income and food for low-income families;
- Regional scale – prevention of erosion and desertification through maintenance of natural vegetation conditions; and
- Global scale – ecosystems regulate climate and act as a reservoir of carbon storage and also regulate biodiversity, which underpins biological production of all types, including agriculture.

Ideally, a project should maintain the value and functionality of priority ecosystem services[22] to those beneficiaries directly dependent upon them. This should be achieved through the direct management and control measures that a project can impose. Ecosystem services whose beneficiaries are at the global scale and, to a lesser extent, the regional scale and are therefore outside the influence of the direct management and control measures that the Project can impose, are not covered by this assessment.

Kenyan legislation and policies pertaining to biodiversity conservation and wildlife management do not specifically define what constitutes an ecosystem service. However, they are mentioned in the national Wildlife Policy in the context of sustainable economic development (Ministry of Forestry and Wildlife, 2012), and as features of protected areas that should be conserved (KWCMA, 2013). The National Biodiversity Strategy and Action Plan (NBSAP) (Ministry of Environment and Natural Resources, 2000) provides for the conservation and sustainable use of natural resources that provide the basic source of livelihood for an estimated 80% of the country's population, including food, firewood, construction materials and medicines. All of these are ecosystem services.

For the purposes of this assessment, the definitions of different types of ecosystem services are based on those developed by the Millennium Ecosystem Assessment (MA, 2005) (Table 6.10-1).

Table 6.10-1: Ecosystem Services Categories (MA, 2005)

Broad categories	Definition
Provisioning services	Supporting human needs (e.g., traditional hunting grounds, medicinal plants and minerals, water sources, wild foods, firewood, and construction materials).
Cultural services	Aesthetic, spiritual, recreational and other cultural values (e.g., sacred sites, traditional meeting areas, traditional knowledge, and sense of place).

[22] Priority ecosystem services are those services on which project impacts may affect the livelihoods, health, safety, or culture of the ecosystem service beneficiaries, and those services that could prevent the project from achieving planned operational performance (Landsberg et al., 2011).

Broad categories	Definition
Regulating services	Control of the natural environment (e.g., maintenance of key ecological processes, groundwater recharge, erosion control, and water quality).
Supporting services	Natural processes essential to the resilience and functioning of ecosystems (e.g., primary production, soil formation and conservation, and nutrient cycling).

Using the definitions of ecosystem services provided above, this baseline describes the ecosystem services, and the benefits that local people derive from them, in the AoI, as presented in the biodiversity baseline (Section 6.9). This baseline also identifies the services on which the Project will depend for its operational performance.

The ecosystem services AoI is spatially defined as the area within which there is a demand for ecosystem services by communities/ beneficiaries (the Social AoI, see Section 6.12). These services are supplied by ecosystems within or surrounding the Project footprint (the Biophysical AoI).

6.10.1 Approach

The approach follows the guidance and tools developed by the World Resources Institute (Landsberg et al., 2013). The process includes:

1) Identifying the suite of ecosystem services within the AoI;
2) Identifying priority ecosystem services; and
3) Establishing the baseline for those priority services in the AoI. This is done by:
   - Identifying the ecosystems that supply them, and the capacity of those systems to supply priority services; and
   - Identifying the beneficiaries who use those services, and the current demand for them.

6.10.1.1 Identifying Ecosystem Services

Ecosystem services provided in the AoI were identified using the following data sources:

- Literature review – online search for literature on ecosystem service provision in Turkana County. Sources consulted include:
  - *The Prevalence of Wild Food Knowledge Among Nomadic Turkana of Northern Kenya* (Watkins, 2010);
  - *Usufruct Rights to Trees: The Role of Ekwar in Dryland Central Turkana, Kenya* (Barrow, 1990);
  - *Trees - Ecosystem services: provisioning services and cultural services provided by trees in Turkana* (Booth et al., 2016); and
  - *Impacts of pastoralists on woodlands in South Turkana, Kenya: Livestock-mediated tree recruitment* (Reid & Ellis, 1995);
- Field notes – during the various primary data gathering surveys by the Golder's biodiversity team, notes were taken on ecosystem services, including aspects such as:
  - Movements and activities of pastoralists and make-up of livestock herds;
  - Harvesting and collection of firewood by local inhabitants;

- Sources of water especially the presence of hand-dug wells;
- Presence or absence of agricultural activities; and
- Presence of beehives in luggas.

- Focus group meetings – questionnaires specifically on ecosystem service use were provided to the social team for use in focus group meetings with local stakeholders in order to determine how ecosystem services currently contribute to stakeholders' livelihoods, health, safety or culture. The questionnaires were developed through discussions with various relevant technical disciplines including biodiversity, cultural heritage, social and water.
- The identification of ecosystem services also relied on supplementary baseline data gathered from various specialist inputs, including information on:
  - Biodiversity (e.g., flora, fauna, habitats);
  - Cultural heritage (e.g., sacred trees, medicinal plants, traditional belief systems);
  - Landscape and visual (e.g., aesthetic values);
  - Socioeconomics (e.g., land use, livelihoods, community organisation);
  - Soils, terrain and geology (e.g., land cover, natural resources); and
  - Water quality and quantity (e.g., water regulation and supply).

6.10.1.2 Prioritising of Ecosystem Services

The ecosystem service prioritisation exercise was carried out systematically, with reference to guidance for conducting an ecosystem services review (Landsberg et al, 2013). The objective of the prioritisation exercise was to identify the priority ecosystem services within the Project AoI, which would then become the receptors upon which the Impact Assessment was focussed.

There are two type of priority ecosystem services:

1) Type I: comprising those services on which the Project impacts could affect beneficiaries' livelihoods, health, safety, or culture; and
2) Type II: comprising those services that could prevent the Project from achieving operational status (IFC, 2012, Landsberg et al., 2013).

Type I priority ecosystem services were identified by recognising potential Project-induced drivers of ecosystem change or disturbance (in the sense that the Project may affect the ecosystem that supplies that priority service and alter its capacity to do so). Type I ecosystem services were prioritised according to the Project impact by answering three key questions (Landsberg et al., 2013);

1) Could the Project affect the ability of others to benefit from this ecosystem service?
2) Is the ecosystem service important to beneficiaries' livelihoods, health, safety or culture?
3) Do beneficiaries have viable alternatives to this ecosystem service?

The importance of each identified ecosystem service to the local community, their level of dependence upon the supply of the ecosystem service, and its specific function, was also further established via engagement with the wider Golder Project team as appropriate (i.e., socio-economic, cultural heritage, biodiversity and surface water specialists). The identification of the availability of viable alternatives for the supply of ecosystem services, including local access to those alternatives (based on land cover mapping, stakeholder interviews etc.) was also considered, supplemented with information derived from other relevant baseline studies conducted for the Project.

Type II priority ecosystem services were identified by recognising the Project's operational requirements (as defined in the Project Description (see Section 5.0). Type II ecosystem services were then prioritised according to operational risks to Project performance by answering the following two key questions (Landsberg et al., 2013);

1) Could this ecosystem service change in ways that could affect operational performance?

2) Does the Project have viable alternatives to this ecosystem service?

Supporting information is provided in Annex I, including:

- details of the outcomes of the prioritisation exercise done for Type I and Type II ecosystem services; and
- details of the local and scientific names of plant species used for food, medicine and construction/crafting purposes.

6.10.2 Results

This section presents a summary of the services supplied by the ecosystems identified in the AoI, as well as the outcome of the prioritisation exercise carried out for each identified ecosystem service supplied within the AoI.

6.10.2.1 Beneficiaries of Ecosystem Services

Turkana County is characterised by clustered settlements, of which Lokichar is one of the main urban centres. In West Pokot County, the main urban centre is Kapenguria in West Pokot Sub-County, which also acts a trading centre.

Rural areas are settled by nomadic pastoral communities that move frequently in search of water and pasture for their livestock (Turkana County Government, 2013; as referenced in the social baseline, Section 6.12).

The pastoralist Turkana and Pokot communities of northern Kenya migrate as part of their livelihood, moving their homes and animals to find natural resources in the arid natural environment. Rural settlements are often dispersed along luggas, with the community taking their name from the lugga closest to the location (social baseline, Section 6.12).

It would however be inaccurate to consider the movements of the Pokot or Turkana pastoralists as truly nomadic in the sense of random movements governed by rainfall and forage availability. The reality is that both the Pokot and Turkana pastoralists have well defined grazing strategies and patterns combined with intricate concepts of ownership that are more well defined in drier areas (Barrow, 1988). The Turkana and Pokot pastoralists have evolved well-managed ecological strategies that enable them to use the vegetation on a sustainable basis through exploiting different economic niches (grazers, including cattle, sheep, and donkeys, and browsers, including camels and goats), as well as diversified food procurement strategies (Brainard, 1981 in Barrow, 1990). As described by Ellis et al. (1987, in Barrow 1990), these strategies include:

- Use of large diverse ranges;
- Access to productive dry season ranges, including trees;
- High mobility and low to moderate stocking rates;
- High to moderate stock units per person;

- Use of wild fruits and tree foods; and
- Low labour input, rain-fed or flood sorghum gardening.

Trees and other woody species are recognised by the people as being especially important because they can survive and produce even through the long dry seasons. Ethnobotanical knowledge reflects the extent of the dependence of local people on woody vegetation, which is used for dry timber for wood fuel and charcoal; building timber for houses, fencing, and thatching; food for livestock, particularly in the dry season; wild fruits and foods for people; veterinary medicines for a variety of livestock diseases; human medicines for a variety of diseases; making of household utensils; amenity for shade to act as a meeting place and a variety of cultural activities; water purification; and ceremonies (Barrow, 1990).

For the purposes of defining different groups of beneficiaries using ecosystem services that could potentially be affected by the Project, the following beneficiary categories were set:

- Mobile pastoralists using the AoI on a transient basis; and
- Residents in locations that will host Project infrastructure e.g. Kochodin and Lokichar.

Although ecosystem services provided by the Turkwel Gorge Reservoir are included in this baseline description since they occur within the AoI, no potential Project impacts are currently anticipated on these ecosystem services or their beneficiaries since the proposed infrastructure and activities as described in Section 5.0 (Project Description) are not expected to directly or indirectly impact the ecosystems suppling these services.

6.10.2.2 Supply and Prioritisation of Services

The following sections provide some narrative around provisioning, regulating, cultural and supporting ecosystem services supplied in the AoI. As *Supporting* ecosystem services have no specific/direct beneficiaries, and impacts to these are captured within the *Provisioning, Regulating* and *Cultural* categories for the Project, they are not included in the prioritisation exercise.

The results of the prioritisation exercise for Type I and Type II ecosystem services are detailed in Annex I. Type I and Type II ecosystem services, and reasoning behind their classification as priority/non-priority ecosystem services are discussed in the following sections.

6.10.2.2.1 Provisioning Services

The AoI provides numerous priority provisioning ecosystem services for beneficiaries; in particular, grazing/browsing resources for livestock, wild foods, medicinal plants, firewood and charcoal, freshwater supply and construction materials for homes and livestock.

6.10.2.2.1.1 Food – Cultivated Foods

Honey-producing beekeeping enterprises exist within the vicinity of the Turkwel Gorge Reservoir, in the western extent of the AoI. Beekeeping is practised by approximately 3% of survey respondents in that region and is a form of livelihood for those beneficiaries (mostly men).

The cultivated honey is a dietary and livelihood supplement and as such is important to beneficiaries' livelihoods and/or health. The availability of supply is dependent on the condition of the ecosystem and its capacity to supply the ecosystem service. Beneficiaries are unlikely to have viable alternatives to this ES, being generally unable to source or purchase the same foods elsewhere; therefore, the ES is considered a Type I priority ES (Annex I).

6.10.2.2.1.2 Food – Grazing/Browsing Resources for Livestock

Some beneficiaries in the AoI practise transhumance, a type of pastoralism or nomadism in which livestock are moved seasonally between fixed summer and winter pastures (Barrow, 1988). Generally, the hilly western areas of Turkana County are much wetter than the rest of the county. Broadly, livestock (particularly cattle) are grazed in the lowlands after the rains to make use of the annual flush of grass. This may only last for a few months and then the stock will gradually move to the west and to the hills to make use of the dry season grazing and browsing areas. In the dry season, valuable dry season fodder in the form of pods and leaves from various trees, such as *Acacia tortilis* (English: umbrella thorn acacia; Turkana: *ewoi*) will be sought.

The ecosystem service forms an important dietary and livelihood supplement and as, such, is important to beneficiaries' livelihoods and/or health. Any change in land cover, land access and demand (due to influx) as a result of the Project may impact the capacity of the ecosystem to supply the service. Beneficiaries are unlikely to have viable alternatives to this ecosystem service, being generally unable to source or purchase the same foods elsewhere; therefore, the ecosystem service is considered Type I priority (see Annex I).

6.10.2.2.1.3 Food – Capture Fisheries

Communities surrounding the Turkwel Gorge Reservoir (Chepokachim Sub-Location) engage in fishing. Focus group responses indicated that they acquired these fishing skills from the Luo community who moved to the area at the time of the reservoir/ dam construction. Fishing is practised for domestic consumption and if there are many fish, the excess is sold. This Ecosystem Service is not considered a priority for impact assessment (see Annex I).

6.10.2.2.1.4 Food – Wild Foods

A large variety of plant foods are collected from the vegetation communities throughout the AoI. Morgan (1981) identified 53 species of wild plants that are included in the Turkana diet. Parties of women harvest wild fruits from tree species, such as *Cordia sinensis* (English: grey-leaved saucer berry, Turkana: *edome*) and *Salvadora. persica* (English: mustard tree; Turkana: *esekon*). The most important wild food plants are *elim* (*Diospyros scabra*), *ekalale* (*Ziziphus mauritiana*), *ewoi* (*Acacia tortilis*), *eipa* (*Maerua oblongifolia*), and *eregai* (*Acacia reficiens*). *Eregai* is seen as particularly important because when this plant is plentiful, the livestock have enough to eat and, therefore, the people also have enough food and living conditions improve. In terms of priority, *ewoi* and *ekalale* are the most important trees for beneficiaries in the AoI, producing leaves and flowers for livestock and fruits for people during the dry season.

The importance of wild food products is evidenced by the effort that is taken to render some of them edible. For example, the fruits of *Balanites orbicularis*, *Boscia coriacea* (Turkana: *edung*) and *D. glabra* (Turkana: *edapal*) need to be boiled several times before they can be eaten (Morgan, 1981). The pods of the ubiquitous *Acacia tortilis* (English: umbrella thorn acacia; Turkana: *ewoi*) are collected and ground into flour known as '*apoonet*'.

Pollination is recognised as a priority *Regulating* ecosystem service because of some beneficiaries' reliance on wild fruits and seed pods as a source of food for themselves and livestock (see Section 6.10.2.2.2 for discussion of Regulating services). Honey from wild bees is opportunistically collected in the rest of the AoI.

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

Wild foods are considered a priority ecosystem service, as availability will be affected as a result of reduced supply areas. The availability of supply is dependent on the condition of the ecosystem and its capacity to supply the ecosystem service. Wild foods are an important component of beneficiaries' diets, and beneficiaries are unlikely to have viable alternatives to this ecosystem service, being generally unable to source or purchase the same foods elsewhere (see Annex I).

6.10.2.2.1.5 Medicinal Plants

As doctors, clinics and hospitals are mostly absent from the remote areas through which the pastoralists move, and within which most residential communities are located, medicinal plants are considered to be very important, both to the people and the livestock. The EOPS Phase II ecosystem services baseline (Golder, 2018d) listed 22 species as medicinal, whilst Morgan (1981) mentions 67 species used by the Turkana. Dependence on medicinal plants has not been quantified in this or the social baseline, but is believed to be high, with most stakeholders interviewed making mention of the use of an array of species for various purposes (Cultural Heritage baseline - Section 6.13).

Important species include *emus*, *echuchulka*, *amuroekile*, *elim* (*Diospyros scabra*), *locham* and *ekamongo* (*Leptadenia hastata*), which are variously used for treating stomach complaints, coughs and eye ailments, or as antiseptics and animal medicines. Some species, such as *esokon* (*Salvadora persica*) and *eipa* (*Maerua oblongifolia*) are used as toothbrushes and are harvested and sold by women in places such as Lokichar as a source of income. Medicinal plants appear to occur across all the vegetation communities identified in the AoI. No areas were identified as being of particular importance for the supply of medicinal plants during focus group meetings conducted as part of the ecosystem service prioritisation process. The availability of supply is dependent on the condition of the ecosystem and its capacity to supply the ecosystem service.

Medicinal plants are considered a priority ecosystem service according to the Project impact, since beneficiaries are unlikely to have viable alternatives to this ecosystem service, being generally unable to source or purchase alternative traditional medicines or western medicines elsewhere (see Annex I).

6.10.2.2.1.6 Biomass Fuel (Firewood and Charcoal)

Household cooking is fuelled by firewood, usually collected by women, from already dead trees. As mentioned, the cutting down of trees for firewood or charcoal manufacture is generally not permitted; nevertheless, the use of timber for charcoal manufacture is likely putting pressure on trees. Research in the region has shown that, typically, once all of the dead firewood within walking/carrying distance of permanent settlements has been collected, people tend to revert to harvesting live trees within walking/carrying distance of their homesteads, resulting in a radius of deforestation extending around permanent settlements (Amyunzu, 1991; Olang, 1982; Reid & Ellis, 1995). Information received during the 2016 cultural heritage baseline data collection programme suggested that there are penalties for anyone that cuts down a tree, particularly if the tree is *ewoi* (*Acacia tortilis*), *edung* (*Boscia coricea*), *esanyanait* (*Acacia elatior*), *ekalale* (*Ziziphus mauritiana*) or *esokon* (*Salvadora. persica*).

Biomass fuel is considered a priority ecosystem service according to the Project impact, as its availability will be affected as a result of reduced supply areas, as well as changes in the condition of the ecosystems that supply the service due to increased demand. Biomass fuel is an important component of beneficiaries' livelihoods as well as their health, and beneficiaries are unlikely to have viable alternatives to this ecosystem service, being generally unable to purchase fuel elsewhere. In addition, the increased use of alternative areas where this ecosystem service is supplied, could compete with existing users and exacerbate degradation of vegetation communities supplying this ecosystem service (see Annex I).

6.10.2.2.1.7 Biological Raw Materials (Construction Materials, Utensils, Ceremonial Articles, Animal Skins)

Many plants are used for construction of houses and shelter (Annex I). The most important are *eregai* (*Acacia reficiens*), *epetet* (*Acacia nubica*), *edung* (*Boscia coriacea*), and *ebucharatet*. Branches from *Salvadora persica* are used for construction of shelters, and *Hyphaene sp*. trunks are used as poles (Booth et al., 2016).

Wood from *edome* (*Cordia sinensis)* is used for making traditional carved sticks with curved heads, and *ekicholong* (*Commiphora* spp.) (Turkana seat/head rest). Wood from *Commiphora spp*. is used for making traditional cups and bowls for drinking, and *ekicholong* (Booth et al., 2015). *Hyphaene sp*. leaves are used for weaving baskets and mats, and making rope (Booth et al., 2015). *Ekalale* (*Ziziphus mauritiana*) branches are used for making bows and stools, as well as for fencing. (Booth et al., 2015). Wooden utensils are constructed from the *ekurichanait* tree (*Delonix elata*), including plates (*atuba*), cups (*elepit*) and jugs (*aguarum*) (Booth et al., 2015). Animal skins are used in the fabrication of traditional clothing and their sale also forms a source of livelihood for pastoralists.

Biological raw materials are considered a priority ecosystem service according to the Project impact, as their availability will be affected as a result of reduced supply areas while availability of supply is dependent on the condition of the ecosystem and its capacity to supply the ecosystem service. They are an important component of beneficiaries' livelihoods (utensils, skins), health and safety (home construction) and culture (utensils, ceremonial articles). Beneficiaries are considered unlikely to have viable alternatives to this ecosystem service, largely due to uncertainty as to whether the use of an alternative source would compete with existing users, and whether the supply of the alternative resource could meet the needs of the affected beneficiaries (see Annex I).

6.10.2.2.1.8 Freshwater

Nomadic pastoralist beneficiaries in the AoI typically obtain freshwater from the environment via rainfall, wells and from rivers in the AoI such as the Turkwel and Kalabata. Away from rivers, beneficiaries are traditionally reliant on using hand-dug wells in luggas as sources of drinking water; many hand-dug wells and installed wells are still in use. During the biodiversity baseline survey, migrating pastoralists were observed digging shallow wells in lugga sands shortly after a passing rainstorm.

Alternative water sources are provided for pastoralists by the Operator at points throughout the AoI via tanked water supply points.

Freshwater supply is considered a Type I priority ecosystem service for pastoralists and AoI community members, since the availability of freshwater for drinking may be affected by groundwater abstraction. There is a reliance of many beneficiaries in the AoI on the Operator for the provision of tanked fresh water supply points, with no alternative sources of fresh water in similar quantity or quality available to those beneficiaries. This ecosystem service is also considered a Type II priority ecosystem service, as the operational success of the Project is reliant on abstraction of its construction water requirement from groundwater and has no viable alternative to this ecosystem service.

However, freshwater supply is not considered a priority ecosystem service for Turkwel Dam communities, since the Project is not expected to affect the ability of others to avail of this ecosystem service

Table 6.10-2: Summary of Supply of Provisioning Ecosystem Services Within the AoI

Ecosystem Service	Supplying Ecosystem	Definition of Service
Provisioning		
Cultivated foods	■ *Acacia-Commiphora* bushland/thicket ■ Riparian forest ■ Ephemeral stream woodland	■ Sorghum gardens are kept by a proportion of residents in the Turkwel Gorge Reservoir region of the AoI. ■ Beekeeping is practised by a small proportion of residents in the Turkwel Gorge Reservoir region of the AoI. ■ The smoke from burning *Cordia sinensis* (English: grey-leaved saucer berry, Turkana: *edome*) wood is used as a preservative for milk (Tullow, 2016; Stave et al., 2007).

Ecosystem Service	Supplying Ecosystem	Definition of Service
Food – Grazing/ browsing resources for Livestock	▪ *Acacia-Commiphora* bushland/thicket ▪ Riparian woodland ▪ Ephemeral stream woodland	▪ Cattle, sheep, goats, camels, and donkeys graze and browse throughout the AoI based on seasonal patterns. ▪ Riparian vegetation (leaves and seed pod litter) in the luggas provide a vital food source for livestock. ▪ The riparian woodlandss along the Turkwel and Malmalte Rivers are considered to be some of the most important dry season grazing areas for the Turkana people (Barrow, 1988). ▪ Riparian vegetation in luggas provide shade for young goats and cattle. The luggas also are used as migration corridors by herders when moving between grazing areas and when moving to water.
Food – capture fisheries	▪ Turkwel Gorge Reservoir	▪ Fishing for domestic consumption and any excess is sold (Focus group discussion, Chepokachim Sub-Location)
Food – wild foods	▪ *Acacia-Commiphora* bushland/thicket ▪ Riparian woodland ▪ Ephemeral stream woodland	▪ Beneficiaries use various fruits and seeds (e.g. doum palm fruit), berries and wild honey as supplements to their staple diet (Watkins, 2010). ▪ Honey production takes place at various locations in the AoI. Honey production is reliant on a readily available source of water and the flowers of trees and shrubs found in the riparian forests. ▪ Opportunistic hunting of dik-dik, hares, ground squirrel, small birds for meat, mostly by children
Medicinal plants	▪ *Acacia-Commiphora* bushland/thicket ▪ Riparian woodland ▪ Ephemeral stream woodland	▪ Numerous medicinal plant species are used by the Turkana. ▪ Species include *Salvadora persica* (English: mustard tree; Turkana: *esekon*), which is used as a toothbrush (Figure 6.10-1); *Euphorbia turkanensis*, which is used as a treatment for cuts and burns; and *Euphorbia tirucalli* (English: pencil cactus), which is a poisonous species that can be used to induce abortion (driver, *pers. comm.* during biodiversity surveys). ▪ *Vahlia viscosa* is used in the treatment of jaundice (Morgan, 1981). ▪ Roots of *Salvadora persica* are used to treat malaria. The roots are soaked in water and then juice is drunk to prompt vomiting (Booth *et al.,* 2015).
Biomass Fuel	▪ *Acacia-Commiphora* bushland/thicket ▪ Riparian woodland ▪ Ephemeral stream woodland	▪ Firewood is the primary energy source for cooking both traditional foods and purchased grain-based foods (e.g., maize meal, millet). ▪ Charcoal production occurs throughout the AoI. The charcoal is mostly sold to generate income. Generally, however, the Turkana do not cut down trees because they are a valued resource with strong cultural ties. Therefore, charcoal tends to be produced from already dead trees, or in areas close to larger settlements.

Ecosystem Service	Supplying Ecosystem	Definition of Service
Wood and fibre	■ *Acacia-Commiphora* bushland/thicket ■ Riparian woodland ■ Ephemeral stream woodland	■ Thorny branches from various species, typically *Acacias*, are used in construction of temporary bomas for protecting livestock. ■ Wood from *Cordia sinensis* (Turkana: *edome*) is used for making traditional carved sticks with curved heads, and *ekicholong* (Turkana seat/head rest). ■ Wood from *Commiphora* sp. is used for making local cups and bowls for drinking, and *ekicholong* (Booth *et al.,* 2015). ■ Branches from *Salvadora persica* are used for construction of human shelters (Booth *et al.,* 2015). ■ *Hyphaene* sp. leaves are used for weaving baskets and mats and making rope; and trunks are used as poles for construction (Booth *et al.,* 2015). ■ *Ziziphus mauritiana* (English: Chinese date; Turkana: *ekalale*) branches used for making bows for arrows, and fencing (Booth et al., 2015). ■ *Delonix elata* (English: Creamy Peacock Flower, Turkana: *ekurichanait*) is used to make all Turkana wooden utensils, including plates (*atuba*), cups (*elepit*) and jugs (*aguarum*) (Booth et al., 2015).
Freshwater	■ Luggas ■ Groundwater	■ Away from rivers, drinking water is largely sourced from shallow groundwater supplies in luggas via hand-dug wells. During baseline biodiversity field surveys, migrating pastoralists were observed digging shallow wells in lugga sands shortly after a passing rainstorm. ■ The Operator provides water to pastoralists at various locations, including Ngamia 1. This water is derived from groundwater. ■ Villages that are situated close to rivers obtain drinking water directly from the rivers. ■ Wells for the supply of drinking water (for stock and settlements) are available throughout the AoI.

Figure 6.10-1: *Salvadora persica* (English: Mustard Tree; Turkana: *Esekon*). The fruit from this tree is eaten by the Turkana People whilst the roots are used as medicine and the branches are used as toothbrushes.

6.10.2.2.2 Regulating Services

Regulating ecosystem services are not necessarily priority based in terms of the Project impact. However, many of the regulating services are important to the operation of the Project. The baseline regulation of water flow and timing, erosion control, filtering water and flow regulation are crucial to the Project efficacy over the short, medium and long term.

6.10.2.2.2.1 Regulation of Air Quality

Riparian forest, ephemeral stream woodland and *Acacia-Commiphora* bushland/thicket vegetation may contribute to extraction of atmospheric chemicals (e.g., near roadways).

The Project is unlikely to push the regulation of air quality across a sustainability or regulatory threshold, and emissions are expected to be within the standards required by the IFC. This ecosystem service is not considered to be in short supply relative to demand in the AoI, given the baseline of very little industrial or commercial enterprises in the area. Regulation of air quality is therefore not considered to be a Type I priority ecosystem service in terms of Project impact for this assessment.

However, stakeholders might perceive that the Project could affect air quality, in which case the Project would be reliant on this ecosystem service to continue to be maintained throughout its lifetime to maintain its social license to operate, making regulation of air quality a Type II priority.

6.10.2.2.2.2 Regulation of Water Flows and Timing

The Project footprint crosses luggas (ephemeral streams). These hydrological systems regulate water run-off, influence groundwater recharge, and maintain the water storage potential of the landscape. In particular, riparian forest, ephemeral stream woodland and the sandy lugga substrate contribute to the retention of water and regulation of water quality during dry seasons when rainfall is limited.

Regulation of water flows and timing is considered a priority ecosystem service as Project impacts may affect the ability of others to benefit from this ecosystem service, and beneficiaries have no viable alternatives to the natural regulation and timing of water flows, such as pumped/piped water supply. Changes in run-off may affect the capacity of the ecosystem to regulate flows (and control erosion).

6.10.2.2.2.3 Regulation of Disease

The arid, desert environment limits the availability of suitable conditions for malaria vectors. Although this is an important ecosystem service, it is not considered priority in terms of the Project impact, as the Project is unlikely to push the regulation of disease across a sustainability or regulatory threshold, and the extent of loss of the chief supplying ecosystem (*Acacia-Commiphora* bushland/thicket) is negligible in the context of the available resource in the AoI.

6.10.2.2.2.4 Soil Stability and Erosion Control

Vegetation clearance for the Project may increase the vulnerability of the surrounding soils to the erosive forces of wind and floods. However, due to the general lack of topsoil and mitigation of risks to soil erosion proposed (see Chapter 6.3), the Project is not expected to impact on this ecosystem service in such a way that the ability of others to benefit from this service would be affected. Therefore, this ecosystem service is not considered a priority for this assessment.

6.10.2.2.2.5 Pollination

All beneficiaries of food-based provisioning services are reliant on pollination of the plant species that produce wild foods eaten by people and/or provide grazing/browsing opportunities for livestock, as well as pollination of subsistence crops so that seeds can be harvested and used for the following season's planting.

The Project is unlikely to significantly impact any pollinator species (bees, birds, bats) and so this ecosystem service is not considered Type I priority based on the Project impact.

Table 6.10-3: Summary of Supply of Regulating Ecosystem Services Within the AoI

Ecosystem Service	Supplying Ecosystem	Definition of Service
Regulating		
■ Regulation of air quality	■ *Acacia-Commiphora* bushland/thicket ■ Riparian woodland ■ Ephemeral stream woodland	■ Leaves of trees, shrubs and forbs trap air pollutants, especially near permanent settlements, and along roadsides.
■ Regulation of water flows	■ *Acacia-Commiphora* bushland/thicket ■ Riparian woodland ■ Ephemeral stream woodland	■ The AoI spans the Turkwel, Kalabata, Kerio, Turkwel Dam Basin and Malmalte River catchments. These hydrological systems regulate water run-off, influence groundwater recharge, and maintain the water storage potential of the landscape.

Ecosystem Service	Supplying Ecosystem	Definition of Service
		■ Riparian vegetation and sandy luggas retain water and regulate water quality during dry seasons when rainfall is limited.
■ Regulation of disease	■ *Acacia-Commiphora* bushland/thicket	■ The arid, desert environment limits the availability of suitable conditions for malaria vectors.
■ Soil stability and erosion control	■ *Acacia-Commiphora* bushland / thickets ■ Riparian woodland ■ Ephemeral stream woodland	■ Vegetation cover within the AoI reduces soil loss and prevents erosion.
■ Pollination	■ *Acacia-Commiphora* bushland/thicket ■ Riparian woodland ■ Ephemeral stream woodland	■ Local people and their livestock are seasonally reliant on the pods of *Acacia* spp. for food, and the fruits produced by many other species. ■ Users of grazing resources and gatherers of edible plants are reliant on pollination services for the maintenance of vegetation communities and associated resources.

6.10.2.2.3 Cultural Services

Cultural ecosystem services are the non-material benefits people obtain from nature, such as recreation and associated physical and mental health benefits, tourism, spiritual experiences and sense of place, and educational and inspirational values. Cultural ecosystem services are often intangible.

6.10.2.2.3.1 Spiritual Values

Intangible value from ecosystem services is derived from the natural setting and the trees that support a traditional way of life. Each settlement has traditional elder trees that are important meeting points. Trees are vital to the Turkana way of life, and the importance of trees is strongly expressed culturally. People and places are named after trees, shady trees act as meeting places, trees provide traditional medicine. Trees also play a vital and integral role in many initiation ceremonies, such as birth, marriage and various feasts (Barrow, 1988). Trees that have important cultural associations cannot be cut down without serious consequences.

Edung (*B. coricea*) is key in Turkana community cultural life. During initiation ceremonies, the seeds are boiled for several hours and used to seal the process through being eaten by the elders presiding over the initiation as a sign of final blessing to the initiates. The same is true for marriage ceremonies and when a mother has given birth. In both cases *edung* is consumed as the final meal served to the elders and the mother when she is ready to come out of seclusion from the home.

Construction activities and the presence of the Project in the landscape will affect beneficiaries' sense of heritage and identity and disturbance of their surroundings. There is no alternative to this ecosystem service and, as such, it is considered a Type I Priority. In addition, the Project could be reliant on the availability of this ecosystem service remaining constant throughout its lifetime in order to maintain its social privilege to operate, so this ecosystem service is also considered a Type II Priority.

6.10.2.2.3.2 Education and Inspirational Values

The Turkana landscape inspires folklore and contributes to beneficiaries' sense of heritage and identity. The landscape lends itself to the entire Turkana way of life, including the practising of pastoralism and the passing of knowledge on seasonal grazing patterns from generation to generation.

Construction activities and the presence of the Project in the landscape will affect beneficiaries' sense of heritage and identity. There is no alternative to this ecosystem service and, as such, it is considered a Type I Priority. In addition, the Project could be reliant on the availability of this ecosystem service remaining constant throughout its lifetime in order to maintain its social license to operate, so this ecosystem service is also considered a Type II Priority.

Table 6.10-4: Summary of Supply of Cultural Ecosystem Services Within the AoI

Ecosystem Service	Supplying Ecosystem	Definition of Service
Cultural		
■ Spiritual values (Sacred trees)	■ *Acacia-Commiphora* bushland/thicket ■ Riparian woodland ■ Ephemeral stream woodland	■ Trees are vital to the Turkana way of life and play a pivotal role in cultural practices. ■ Cultural sites include the trees (particularly *Maytenus* sp.) beneath which the men of the community and elders gather to discuss community issues, politics, marriages, community affairs. It is taboo for women to sit beneath these trees. Cutting of these trees is also not permitted. ■ Initiation ceremonies for boys occur at certain locations in the AoI. ■ Important trees including *Acacia tortilis* (English: umbrella thorn acacia; Turkana: *ewoi*), *Hyphaena coriacea* (English: Lala palm), *Cordia sinensis, Ziziphus mauritiana, Dobera glabra* (Turkana: *edapal*) and *Faidherbia albida* (English: Ana tree) are particularly protected by custom (Barrow, 1986; Soper, 1984).
■ Educational and inspirational values	■ *Acacia-Commiphora* bushland/ thicket ■ Ephemeral stream woodland ■ Riparian woodland	■ The Turkana landscape inspires folklore and contributes to beneficiaries' sense of heritage and identity. ■ People are named for the place where they were born, e.g. under the big Acacia by the lugga

6.10.2.2.4 Supporting Services

Supporting ecosystem services provide living spaces for, and maintain the diversity of plants and animals, and thereby provide the basis of all ecosystems and their services (Food and Agriculture Organisation (FAO), 2019). Supporting ecosystem services provided in the AoI include primary production, and sustainable water cycling.

Since *Supporting* ecosystem services have no specific/direct beneficiaries, and impacts to these are captured within the *Provisioning, Regulating* and *Cultural* categories for the Project, they were not included in the prioritisation exercise, and are simply summarised here for completeness.

Table 6.10-5: Summary of Supply of Supporting Ecosystem Services Within the AoI

Ecosystem Service	Supplying Ecosystem	Definition of Service
Supporting		
■ Nutrient cycling / primary production	■ *Acacia-Commiphora* bushland/thicket ■ Riparian woodland ■ Ephemeral stream woodland	■ Throughout the AoI, these ecosystems provide grazing and browsing resources for livestock and wildlife. ■ Riparian habitats in the AoI support crop production through provision of water and rich alluvial soils.
■ Water cycling	■ Luggas ■ Riparian woodland ■ Turkwel catchment and lake Turkana ■ Ephemeral stream woodland	■ Non-perennial luggas direct surface water flow during times of high rainfall toward the various catchments. ■ Riparian habitats throughout the AoI play a part in sustainable water cycling. ■ The Turkwel and Kalabata catchments form major components of the regional hydrological cycle.

6.10.2.3 Landcover Classification and Ecosystem Services Supply

Based on the landcover classification that was conducted for biodiversity baseline (Section 6.9) and the priority ecosystem services identified above, levels of ecosystem service provision (high, moderate and low) were assigned to specific vegetation communities (as defined in Table 6.10-6) in order to link priority services to the ecosystem that supplies them and its current capacity to do so through an assessment of the condition of that ecosystem. The landcover classification did not cover the entire AoI but focussed more specifically on the Project footprint. The levels of priority ecosystem service provision surrounding the infield area are presented in Figure 6.10-2, which shows high levels of ecosystem service provision in the Ngamia, Amosing and Ekales areas. These high levels of ecosystem service provision include those from areas of ephemeral stream woodland ecosystems including the Kalabata, which remain in good condition. Ecosystem service supply is generally low (with some small high-level areas) in the northern portion of the AoI. This is likely due to drier conditions and the scarcity of large trees in these areas. The riparian vegetation communities in these areas are dominated by species like the shrubby *Acacia reficiens*, whereas the luggas around the Ngamia and Amosing areas are dominated by taller *Acacia tortilis* and mixed Acacia communities.

Table 6.10-6: Level of Priority Ecosystem Service Provision Within the AoI, Based on Landcover Classification

Land cover classification	Linked ecosystems	Linked priority ecosystem services	Level of provision of priority ecosystem services
■ Acacia and mixed acacia riparian vegetation (luggas)	Riparian forest Ephemeral stream woodland, Kalabata ephemeral river (lugga), Turkwel, Malmalte Rivers.	Provisioning (cultivated foods, grazing and browsing resources for livestock, wild foods, medicinal plants, biomass fuel, biological raw materials, fresh water)	High

Land cover classification	Linked ecosystems	Linked priority ecosystem services	Level of provision of priority ecosystem services
		Regulating (air quality, water flows and timing) Cultural (spiritual values, education and inspirational values)	
■ Cultivated lands	Malmalte River	Provisioning (cultivated foods)	High
■ Arid woodland / grassland ■ Mountain bush ■ Mountain shrub and grassland	*Acacia-Commiphora* bushland/ thicket	Provisioning (grazing, medicinal, wood and fibre) Regulating (air quality, water flows and timing). Cultural (spiritual values, educational and inspirational values)	Moderate
■ Plain desert shrubland ■ Non-vegetated areas	*Acacia-reficiens/sanseveria/ Boswellia* woodland/ bushland/ shrubland / thicket	Provisioning (grazing, building materials)	Low

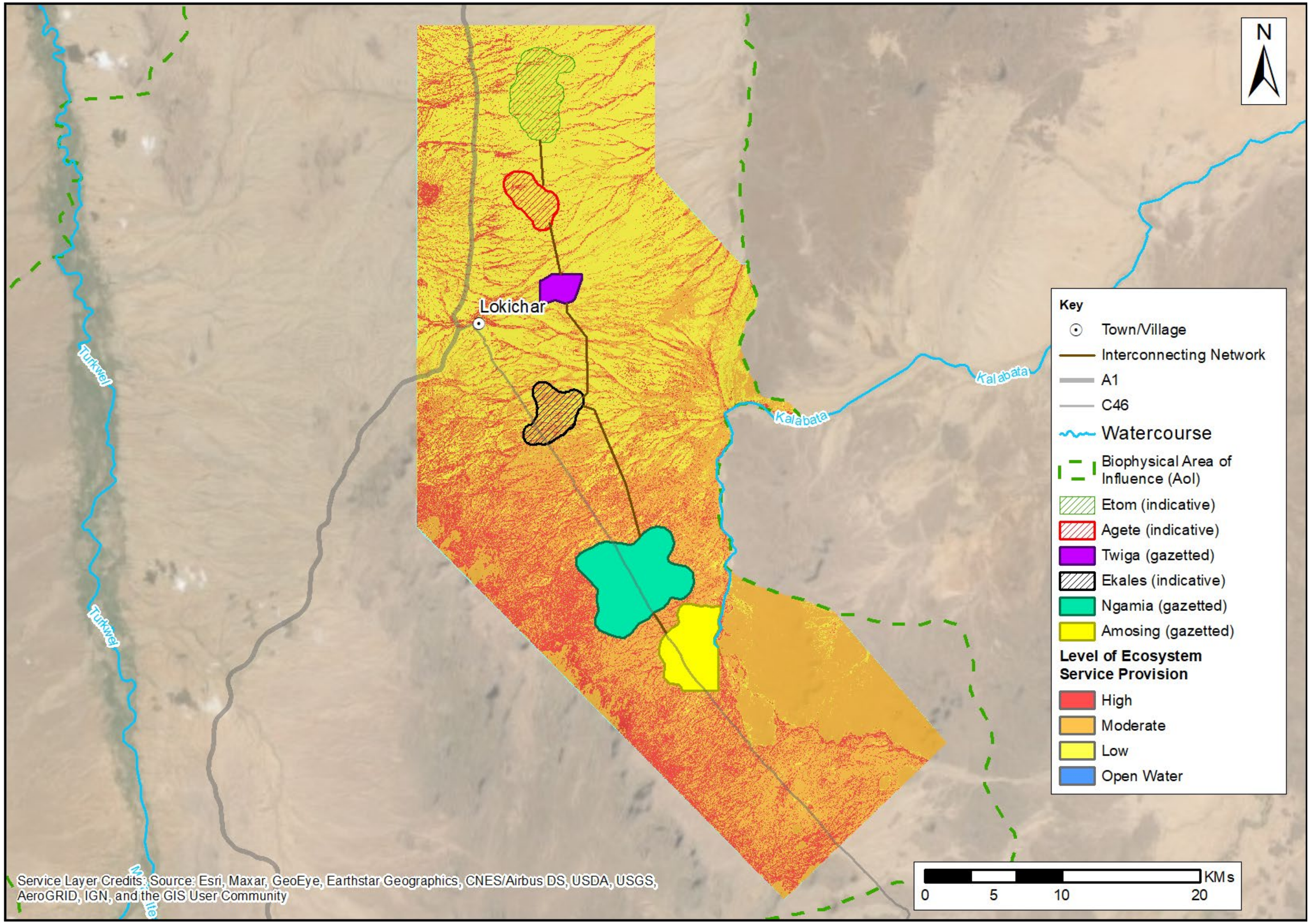

Figure 6.10-2: Level of Provision of Priority Ecosystem Services surrounding the infield area Based on Landcover Classification

6.11 Landscape and Visual

6.11.1 Introduction

The landscape and visual baseline desk study has been undertaken to:

- Establish the key characteristics of the landscape and their relative sensitivity within the AoI; and
- Assess the visual baseline by characterising baseline visibility from key locations within the AoI.

The methodology employed for this assessment is primarily based on UK guidance (GLVIA, 2013), in the absence of Kenyan Legislation. The study has used a Landscape and Visual Assessment Area (LVAA) to ascertain the area from which infrastructure associated with the Project may be visible, comprising a 10 km buffer around aboveground Project facilities.

6.11.2 Secondary Data

The following resources were used for the assessment:

- The following aerial imagery used to analyse the terrain and landscape features:
  - Pleiades, 0.5 m resolution, date of capture: December 2016;
  - Pleiades, 0.5 m resolution, date of capture: February 2015: and
  - Aerial Imagery, 1.0 m resolution, date of capture: 2018;
- A virtual landscape created using numerous topographic datasets supplied by the Operator and analysed to provide the most realistic representation of the landscape[23]:
  - 1 m DTM (Digital Terrain Model) – sourced from the Pleiades Satellite. Date of capture: 1 April 2015;
  - 10 m DTM – sourced from the Prism Satellite. Date of capture: 20 March 2014; and
  - 90 m SRTM (Shuttle Radar Topography Mission) Topography – sourced from National Aeronautics and Space Administration (NASA) on 9 December 2002;
- Baseline Vegetation/land-cover of the Upstream area generated using Sentinal-2 satellite imagery at a 10 m resolution;
- Protected Area dataset from Integrated Biodiversity Assessment Tool (IBAT) supplied by the Operator, November 2018;
- The following Points of Interest (PoI) within the AoI sourced from Visit Turkanaland website (January 2019), County Government of West Pokot website (March 2019) and KWS (March 2019) to determine potential receptor locations of visitors, tourists and travellers to the region:
  - Rift Valley, also known as the Great Rift Valley, spans over 6,000 km. It contains a mosaic of landscapes, including lakes, volcanoes, crustal rifts, mountains and wide valley plains. It is famous for humanoid remains found near Lake Turkana in an area known as the “Cradle of Mankind”. Tourism in the areas includes safaris, hiking, golfing and walking;

[23] No Digital Surface Models (DSM’s) were used in the Geographical Information System (GIS) analysis due to lack of landscape coverage. DSMs are topographic coverages containing all elements of the landscape, including vegetation and trees

- Lake Turkana National Parks World Heritage Area encompasses the Northern Island, Central Island of Lake Turkana and the adjacent Sibilioi National Park. The Central Island supports varied wildlife including egrets, storks and cormorants;
- The South Turkana NR is characterised by a savanna rangeland ecosystem, and supports a variety of wildlife including elephant, buffalo, gazelle and warthog (Edebe et al., 2010);
- The Nasolot NR is a remote reserve situated in a rugged and mountainous location, located north of Mount Melo. The reserve supports a variety of important wildlife including elephant, lion, leopard, spotted hyena, buffalo and hippo (KWS, 2019); and
- Turkwel Gorge Reservoir and Dam is located on the Turkwel River and serves several purposes to include hydroelectric power production, irrigation, tourism and fisheries.

Protected areas and PoIs are presented in Figure 6.11-1.

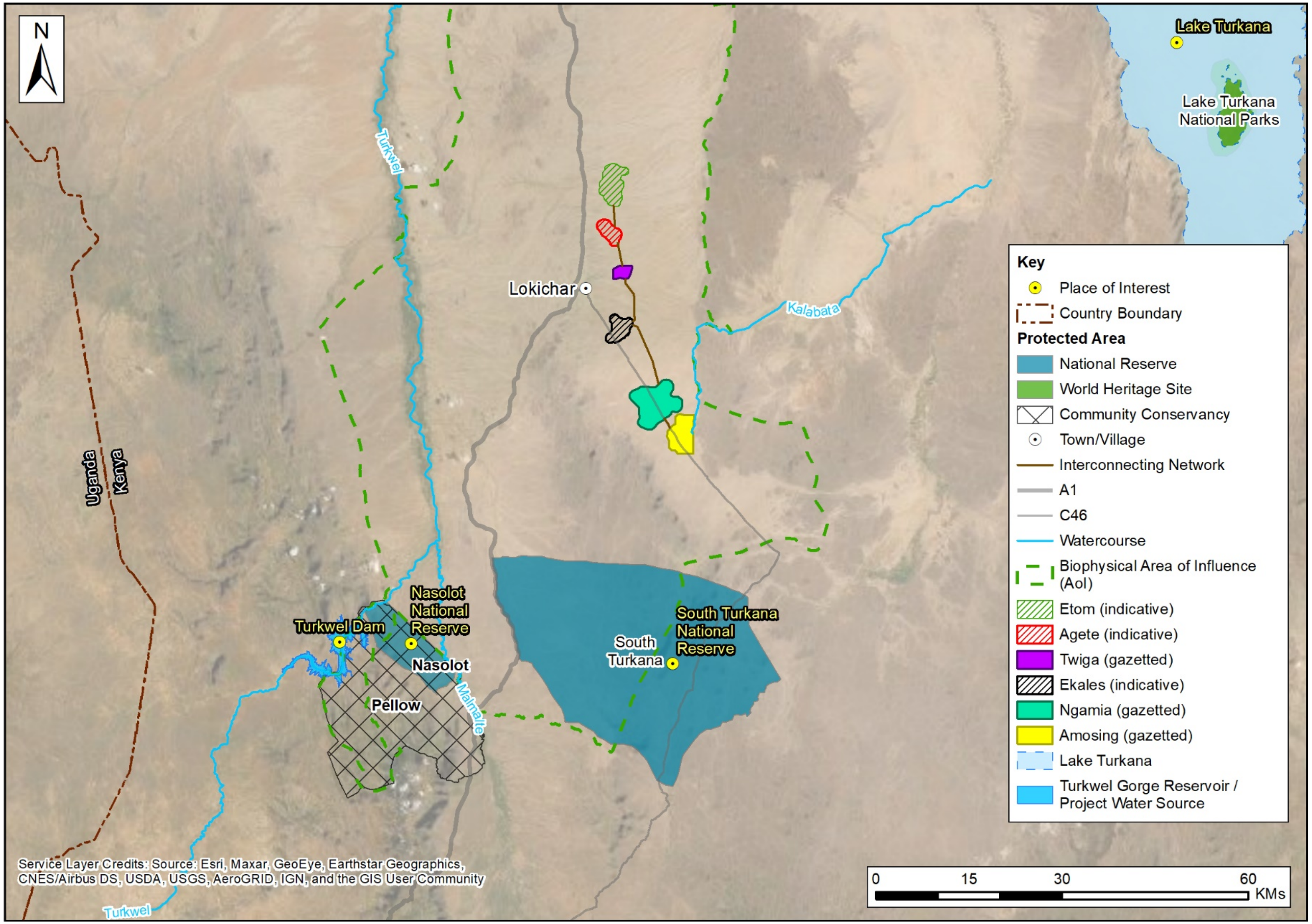

Figure 6.11-1: Points of Interest

6.11.2.1 Methods

6.11.2.1.1 Landscape Character

Landscape character is a distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another. The landscape assessment is a process of identifying and describing variation in the character of the landscape.

Areas displaying similar characteristics are referred to as 'Landscape Character Areas' (LCAs). LCAs are made up of recognisable patterns or elements (physical and perceptual) that occur consistently in a particular area and define its character, or 'sense of place'.

The process of assessing the landscape character was based on a review of available aerial photography and topographical maps as well as previous studies, in terms of:

- Natural elements;
- Human-made elements;
- The topographical character of the site and its surroundings and potential occurrence of landform;
- Features of interest;
- The presence of water bodies;
- The general nature and level of disturbance of existing vegetation cover (as presented in Drawing 6.9-2); and
- The nature and level of human disturbance and transformation evident.

ArcGIS 10.8.1 was used to process the data to determine the landscape character. The terrain datasets were used to create a realistic terrain within the LVAA. The DTMs were mosaicked to produce a 5 m cell resolution coverage of the LVAA. The landscape characterisation was digitised using the baseline vegetation and landcover dataset.

6.11.2.1.2 Visual

Secondary data was assessed for the following within the AoI during an initial desk-based review, to ascertain the baseline visual characteristics:

- Settlements and homesteads;
- Luggas and vegetation types forming riparian habitat;
- Access routes, such as roads and trackways;
- Artificial lighting; and
- Terrain characteristics.

6.11.3 Primary Data

The LVAA comprises the area from which infrastructure associated to where the proposed development may be visible.

6.11.3.1 Visual Methods

An initial visual analysis was completed to create a preliminary Zone of Theoretic Visibility (ZTV) to inform the photo capture locations for baseline characterisation. Then during three field surveys between 2017 and 2021, photographs were taken from a selection of representative field viewpoints. Photographs were taken during the following field visits:

- In June and July 2017 in the Ngamia and Amosing areas;
- In March 2019 for the Twiga, Ngamia and Amosing areas; and
- In May 2021 for the Ekales and Etom areas (it was not possible to obtain photos in the Agete area due to logistical restrictions caused by COVID).

6.11.4 Results

6.11.4.1 Landscape Character

The elevation of the LVAA ranges from 635 masl to 1,300 masl. The Turkana region is predominantly flat, sandy desert, intermingled with scattered scrub and thicket, increasing to denser scrub and thicket on the alluvial rivers, plains and hills. Several settlements are located within the area, ranging in size from permanent major settlements such as Lokichar, to standalone homesteads which are scattered across the landscape.

LCA boundaries do not necessarily indicate an abrupt change in landscape characteristics; the transition between the different areas may be gradual, especially the boundaries between the undulating scrub bushland LCA and the dense bushland scrub LCA. These categorisations are not related to whether habitats are natural or modified.

The sensitivity of the landscape was assessed in relation to its capacity to accommodate change without unacceptable adverse effects on the existing landscape character. The extent to which a landscape can accept such change is dependent on the physical characteristics of the landscape and the scale and nature of the change.

Four LCAs were identified within or adjacent to the LVAA. Figure 6.11-2 presents the LCAs:

- LCA 1 – Semi-desert:
  - Defined by a broad sandy plain with scattered stunted bushland and ephemeral streams. Vegetation is generally characterised by low shrub and stunted bushland. Occasional luggas lined by riparian vegetation. The land use of the area is generally used for rough grazing by livestock.
- LCA 2 – Dense bushland:
  - Defined by an increased density of vegetative growth in the southern and western hills, occurring on rocky, laval hillsides, consisting of low shrub cover with a few emergent bushes, the LCA occupies the southern extent of the LVAA. Acacia/Commiphora deciduous bushland and thicket contains average vegetation heights of up to 4 to 5 m.
- LCA 3 – Rocky Habitat/Stunted Bushland:
  - Defined by sparse cover of shrub species found on the eastern, southern and western hills. The area comprises rocky outcrops of up to 1,100 m, with minimal human and fauna activity.
- LCA 4 – Alluvial woodland:
  - This area is defined by the extent of the floodplain of the watercourses, namely the Kalabata River. The riparian woodland is dominated by *Acacia tortilis* with heights reaching 4 to 5 m. Wooded ephemeral streams contain a high diversity of trees and shrubs, reaching heights of up to 8 to 12 m. As a result, the views in this LCA are characteristically limited due to the density of riparian woodland.

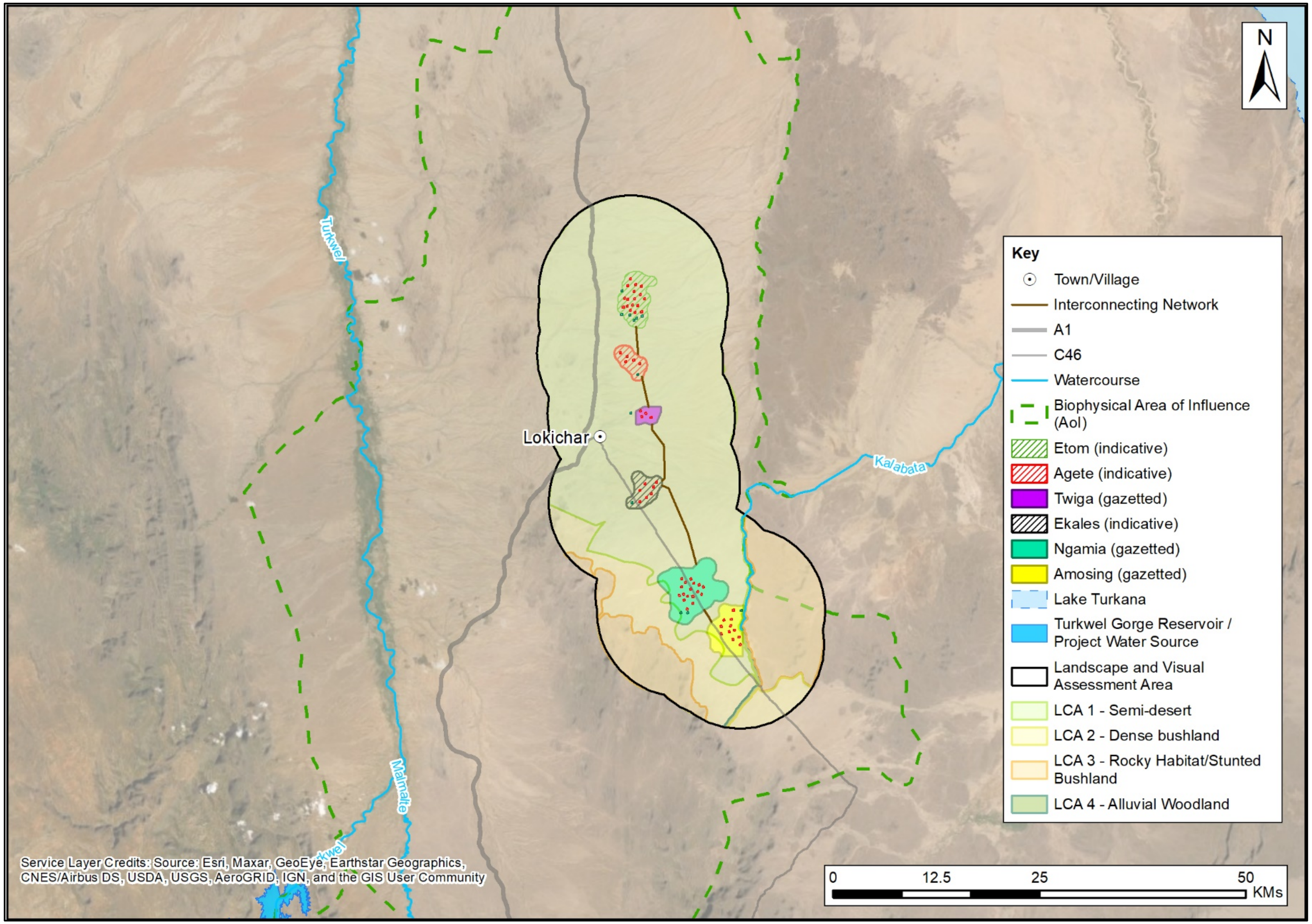

Figure 6.11-2: Landscape Character Areas Within the LVAA

6.11.4.2 Visual Baseline

Eighteen viewpoints were identified to cover the LVAA and to provide a representative sample of the landscape and typical views experienced by the local population.

Table 6.11-1 presents results from field survey work in June and July 2017, March 2019 and May 2021. Photographs and locations of photographs are presented in Drawings 6.11-1 to 6.11-5, as indicated in the table footnotes.

Table 6.11-1: Baseline Photo Representative Location

Area	Photo Location #	Location Description
Twiga	PL-1 [(a)]	■ The photo was taken in an easterly to southerly direction. ■ The line of sight contains scattered trees and low-lying vegetation. The topography is flat to slightly undulating.
	PL-2 [(a)]	■ The photo was taken in an easterly to southerly direction. ■ The line of sight contains scattered trees and low-lying vegetation, with a wide lugga corridor dissecting the line of sight. The topography is flat to slightly undulating.
Ngamia	PL-3 [(b)]	■ The photo location occurs at 415 masl. The photo was taken in a southerly direction. ■ The photo conveys scattered to dense trees with sparse undergrowth.
	PL-4 [(b)]	■ N-2 displays the scattered shrub and extensive low-lying undergrowth and scattered tall trees. It has an elevation perspective at 746 masl. ■ The line of sight displays trees on the horizon line.
	PL-5 [(b)]	■ The photo location occurs on an elevation of 752 masl. ■ The vegetation is sparse with trees dissecting the line of sight in the foreground and in the background.
	PL-6 [(b)]	■ The location occurs at an elevation of 681 masl. ■ The overlying vegetation is sparse, the horizon line is dissected with scattered trees.
	PL-7 [(b)]	■ N-5 occurs at a distance of 525 m from NG-1. It was visible in the viewshed analyses. The photo location occurs at an elevation of 528 masl. ■ The overlying vegetation is sparse, the horizon line is dissected with scattered trees.
	PL-8 [(b)]	■ The location occurs at an elevation of 725 masl. ■ Trees follow a lugga corridor and form the view from the location.
	PL-9 [(b)]	■ The location is at an elevation of 731 masl. ■ The vegetation is scattered shrub.
	PL-10 [(b)]	■ The photo location occurs at an elevation of 765 masl.

Area	Photo Location #	Location Description
		■ The line of sight is heavily dissected in both the foreground and the background with trees.
	PL-11 [(b)]	■ The location was taken in a westerly to north-easterly direction, at an elevation of 731 masl. ■ The foreground has sparse vegetation, a line of trees along a lugga corridor fill the horizon view.
Amosing	PL-12 [(c)]	■ The location occurs on an elevation of 705 masl. ■ The landscape is dissected by scattered trees, grading into a dense cluster in the background and horizon.
	PL-13 [(c)]	■ The location occurs on an elevation of 726 masl. ■ It displays a line of lugga trees grading across to more scattered trees and shrubs. Low-lying hills form in the partial line of sight. ■ A collection of homesteads was evident at the time of the visit.
	PL-14 [(c)]	■ The location occurs on an elevation of 730 masl. ■ The photo was captured in an easterly direction. ■ A collection of homesteads was evident at the time of field survey.
	PL-15 [(c)]	■ The photo was taken in a northerly direction, at an elevation of 723 masl. ■ A lugga dissects the view line.
	PL-16 [(c)]	■ Location occurs on an elevation of 700 masl. ■ Tall trees dissect the line of sight in the foreground with a further line of trees grading in the background to the horizon. The photo location occurred is beside the lugga.
	PL-17 [(c)]	■ The photo displays a sparse landscape, with few trees in the vicinity. Tall trees from the line of line to the horizon.
	PL-18 [(c)]	■ The location was taken from the A1 Lokichar road, facing in an easterly direction. The road comprises a bare earth track.
Etom	PL-19	■ Photo was taken from ET03 wellpad. It shows the fence, with relatively few trees and sparse vegetation.
	PL-20	■ Photo was taken from ET03 wellpad. It shows the fence, with relatively few trees and sparse vegetation.
	PL-21	■ Photo was taken from ET03 wellpad. It shows the fence, with relatively few trees and sparse vegetation.
Ekales	PL-22	■ Photo was taken from EK-03 wellpad. The fence is visible relative to the surrounding scattered trees.

Area	Photo Location #	Location Description
	PL-23	■ Photo was taken along C46 road, adjacent to a lugga. Landscape shows scattered tall trees and vegetation.
	PL-24	■ Photo was taken along C46 road, adjacent to a lugga. Landscape shows scattered tall trees and vegetation.
	PL-25	■ Photo was taken along C46 road, adjacent to a lugga. Landscape shows scattered tall trees and vegetation.

a) Location of photograph and photograph image is presented in Drawing 7.11-1
b) Location of photograph and photograph image is presented in Drawing 7.11-2
c) Location of photograph and photograph image is presented in Drawing 7.11-3

6.11.5 Discussion

This baseline presents the following key landscape and visual findings in the LVAA:

- The terrain is generally flat in the LVAA, with the exception of several elevated positions across the landscape. These are particularly associated with LCA- 3 (Rocky Habitat/Stunted Bushland) near Lokichar, offering open panoramic views of the surrounding areas, with greater exposure to potential development facilities.
- Natural barriers of existing dense vegetation and trees exist along the ephemeral luggas and the riparian environment of the Kalabata River which offer a natural barrier to visibility throughout the LVAA.
- Where vegetation is not present, the area is generally comprised of open sandy plains (with some scattered stunted bushland), presenting dust potential from vehicle movements and construction activities.
- Land use is largely formed of undesignated open plains, used by nomadic pastoralists and for rough grazing by livestock.
- Settlements are scattered throughout the LVAA and predominantly comprise of semi-permanent, individual residential dwellings of simple construction (homesteads), larger concentrated settlements and permanent major settlements (e.g., Lokichar).
- Roads in the LVAA are generally formed of compacted bare earth tracks, with the exception of stretches of tarmacked surfaces on the A1 road, which passes down from Lokichar towards Kainuk.
- With respect to artificial lighting, minimal light pollution occurs within the LVAA as the area does not have a built-up nature. Light sources are located at Lokichar; the nearest urban centre to the Project facilities, which is located approximately 7.5 km to the south-west of the Twiga oil field.

6.12 Social

The socio-economic baseline characterises the baseline situation nationally, regionally and locally using primary and secondary data. The Project is of a sufficiently significant scale that effects could be felt nationally. The discussion (Section 6.12.2) describes, where relevant, the national baseline first, then regional and local information.

This baseline comprises nine sub-categories:

- Administrative divisions and governance structure;
- Demographics;
- Infrastructure and services;
- Economics and livelihoods;
- Land use and ownership;
- Community health and safety;
- Education;
- Social maladies; and
- Social capital, security and conflict.

The **COVID-19** pandemic, which has affected Kenya since March 2020, had resulted in a total of 176,622 cases, including 3,428 fatalities, as of 17 June 2021 (WHO, 2021; NDMA, 2021c). The information presented in this baseline provides an overview of the social trends prior to the onset of the COVID-19 pandemic. Whilst up-to-date information has been included where possible, the pandemic in ongoing and the situation is constantly evolving. As such, the full extent of the effect of COVID-19, and the longer-term implications on many of the themes in this baseline, are not yet fully understood.

6.12.1 Methods

6.12.1.1 Secondary Data - General Socio-Economic Data

A wide range of secondary material has been gathered and consolidated between 2015 and early 2021. This includes resources available from the GoK and reports by Non-Governmental Organisations (NGOs), and multi-lateral organisations such as the United Nations (UN) and other development organisations. Where possible, quantitative information has been collected from organisations, such as the Kenyan NDMA. During fieldwork, researchers have also sought to collect data directly from key informants that have been interviewed.

Golder has also reviewed and drawn on data and information collected by the Operator, KJV[24] and other consultants as part of the E&A activities.

Secondary material for all social baseline topics is referenced throughout the baseline, a full list of references cited is included as part of the ESIA.

6.12.1.2 Secondary Data – Community Health

The approach used that describes the baseline health status in relation to the proposed Project was based on an approved methodology endorsed by the IFC that supports the IFC Performance Standards on environmental and social sustainability. This approach uses 12 Environmental Health Areas (EHAs) to support the systematic

[24] 2021 fieldwork activities were initiated and undertaken by Africa Oil Kenya BV, as a member of KJV.

analysis of health. It provides a variety of biomedical and key social determinants of health (WBG, 2009). In addition, the IPIECA updated guidance on health impact assessment in the oil and gas industry was used as this provides specific guidance to the upstream industry.

The desktop review for community health focused on the national, county and (where available) local level secondary health literature in the public domain. The desktop work was used to describe the broad health status of the population in the region, based on a systematic review of the 12 EHAs.

6.12.1.3 Primary Data - General Socio-Economic Data

Field visits to West Pokot and Turkana Counties have been completed as part of the socio-economic baseline data collection for the Project.

A preliminary scoping visit took place in May 2015, which included brief travel to Turkana but was limited to data supplied by the Operator.

In June 2016, the field work campaign was initiated with a two-day workshop held by Golder, bringing together the different social baseline survey teams for the general socio-economic research, community health and safety, and security and conflict sub-categories. The objective of the workshop was to align research objectives and plan for Key Informant Interviews (KIIs) and focus group discussions. After the workshop, the socio-economic survey team trialled semi-structured questionnaires during KIIs and focus groups. Eight trial interviews were conducted, which allowed for adjustments in semi-structured questionnaires and survey approaches.

Following the trial interviews, primary data collection took place during nine field visits between 2016 and 2021.

- The first 15-day trip took place from 22 June to 5 July 2016. Two teams conducted a total of 54 meetings with government officials, NGOs, Civil Society Organisations and residents living near operations. The meetings sought to obtain information primarily from the administrative units that are most likely to be affected by the Project. However, comparative information was also collected from government officials from those administrative units farther away in Turkana County, who are unlikely to be directly affected, as well as with NGOs and representatives of development organisations with a broader understanding of the entire county and neighbouring counties in Kenya. This comparative data and information are useful in understanding socio-economic trends in other parts of the County to compare with those areas closest to the AoI.
- During the first week, both teams focused on KIIs and focus groups located in the Turkana County capital, Lodwar. Researchers sought a balance of national and county government officials and ministries. Lodwar is also the main office location for many of the international NGOs and regional civil society organisations (CSOs) with a regional mandate in Turkana. During the second week, the two teams separately travelled to the sub-county centres of Lokichar in Turkana South Sub-county and Lokori in Turkana East Sub-county.
- The second trip consisted of a specialised team focusing on security and conflict issues. The team travelled extensively in Turkana and West Pokot Counties, paying particular attention to border areas, migration corridors and areas of historical tension between the two ethnic groups. Between 27 July and 9 August 2016, 17 meetings were held and included KIIs with government officials responsible for security and focus group discussions with traditional leadership and elders.
- A trip that took place from 10 to 19 May 2017 sought to fill critical gaps in baseline information from the initial fieldwork. One survey team conducted 25 additional KIIs.

- A trip was undertaken from 24 January to 5 February 2019 to update information on Turkana County and expand qualitative survey to areas of West Pokot. Three survey teams conducted 72 KIIs or focus group meetings.
- In April 2019, an additional trip was completed with a primary objective of mapping traditional leadership for engagement. KIIs and focus group meetings during this trip have contributed additional information.
- In June 2019, a trip was undertaken from 11 to 15 June to further investigate aspects of West Pokot. One survey team carried out 12 primary survey meetings.
- A hydrocensus was undertaken by KJV between 29 March and 3 April 2021 to collect data on the location, number and estimated demand of water users in the Upstream Area. This field work was completed by KJV and the resulting data was provided to Golder.

The following limitations were encountered during primary general socio-economic data gathering:

- Secondary data for both Counties, especially data at a Sub-county level, was either not available or difficult to obtain. This was due to the relative remoteness of the areas, historical marginalisation from other parts of the country and the nature of pastoralist livelihoods that makes primary data collection of demographic and other information logistically challenging;
- Administrative units have changed as a result of the recently changed Kenyan Constitution;
- Government administrative units and traditional governance units are often inconsistent which can compromise collection of primary data; and
- Many administrative units have the same name (e.g., Lokichar *Division*, *Location*, *Sub-location*, *Settlement* and *Ward*), and data sources do not always explicitly state which administrative unit they refer to.

6.12.1.4 Primary Data - Land

Primary baseline data relating to land use in areas affected by the Project footprint was collected between 2015 and 2021 by the Operator, KJV, Golder and AECOM, involving a combination of field survey work engagement with communities and stakeholders and desk-based analysis of aerial imagery. This work aimed to identify which areas of land are used by members of the nearby settlements, for what purposes, where people live and graze their livestock or use land for other activities, and how locations of habitation and land use change over time, including in different seasons. The baseline field surveys and analysis of aerial imagery covering the Project footprint, including the gazetted field areas, are presented by field area in Table 6.12-1 and in Figure 6.12-1 .

Table 6.12-1: Land Baseline Data Collection

Area	Lands Baseline survey work
Twiga field area	■ November 2015: baseline survey of a larger area encompassing the Gazetted Twiga field area, incorporating analysis of aerial imagery; ■ November 2018: baseline survey of the Gazetted Twiga field area, incorporating analysis of aerial imagery taken February 2018; and ■ July 2019: baseline survey of the Gazetted Twiga field area. ■ April/May 2021: KJV survey of the Twiga field area.
Ngamia field area	■ November 2015: survey of “Zone C” which covered a northern part of the Ngamia field area, incorporating analysis of aerial imagery; ■ December 2015: survey of Ngamia field area, covering 90% of the Gazetted Ngamia field area, incorporating analysis of aerial imagery;

Area	Lands Baseline survey work
	■ March 2016: survey of 3 km radius around Ngamia 8 wellpad, covering additional parts of the Ngamia field area to the Dec 2015 survey; ■ September 2016: EOPS Phase II baseline data survey of areas around Ngamia 1, Ngamia 3 and Ngamia 8 wellpads, covering 20% of the Gazetted Ngamia field area; ■ May 2017: EOPS Phase II baseline data survey of areas around Ngamia 1, Ngamia 3 and Ngamia 8 wellpads, covering 20% of the Gazetted Ngamia field area; ■ November 2018: baseline survey of whole of the Gazetted Ngamia field area, incorporating analysis of aerial imagery taken February 2018; and ■ July 2019: baseline survey of whole of the Gazetted Ngamia field area. ■ April/May 2021: KJV survey of the Ngamia field area, including ten wellpads (Ngamia 1 to Ngamia 6 and Ngamia 8 to Ngamia 11) and the settlements of Nakukulas and Lokicheda.
Amosing field area	■ November 2015: covered larger area including the Gazetted Amosing field area, incorporating analysis of aerial imagery; ■ September 2016: EOPS Phase II baseline survey which covered 16% of the Amosing field around the Amosing 1 wellpad; ■ May 2017: EOPS Phase II baseline survey which covered 16% of the Amosing field around the Amosing 1 wellpad; ■ November 2018: baseline survey of whole Amosing field area, incorporating analysis of aerial imagery taken Feb 2018; and ■ July 2019: baseline survey of the Gazetted Amosing field area. ■ April/May 2021: KJV survey of Amosing field area, including seven wellpads (Amosing 1 to Amosing 7).
Ekales	■ April/May 2021: KJV survey of Ekales field area, including three wellpads (Ekales 1 to Ekales 3).
Agete	■ April/May 2021: KJV survey of Agete field area.
Etom	■ April/May 2021: KJV survey of Etom field area.
Interconnecting flowline routes between fields	■ July 2019 baseline survey of interconnecting flowlines; and ■ Analysis of aerial imagery (early 2018 and July 2019) of interconnecting routes. ■ April/May 2021: KJV survey of interconnecting land between field areas.

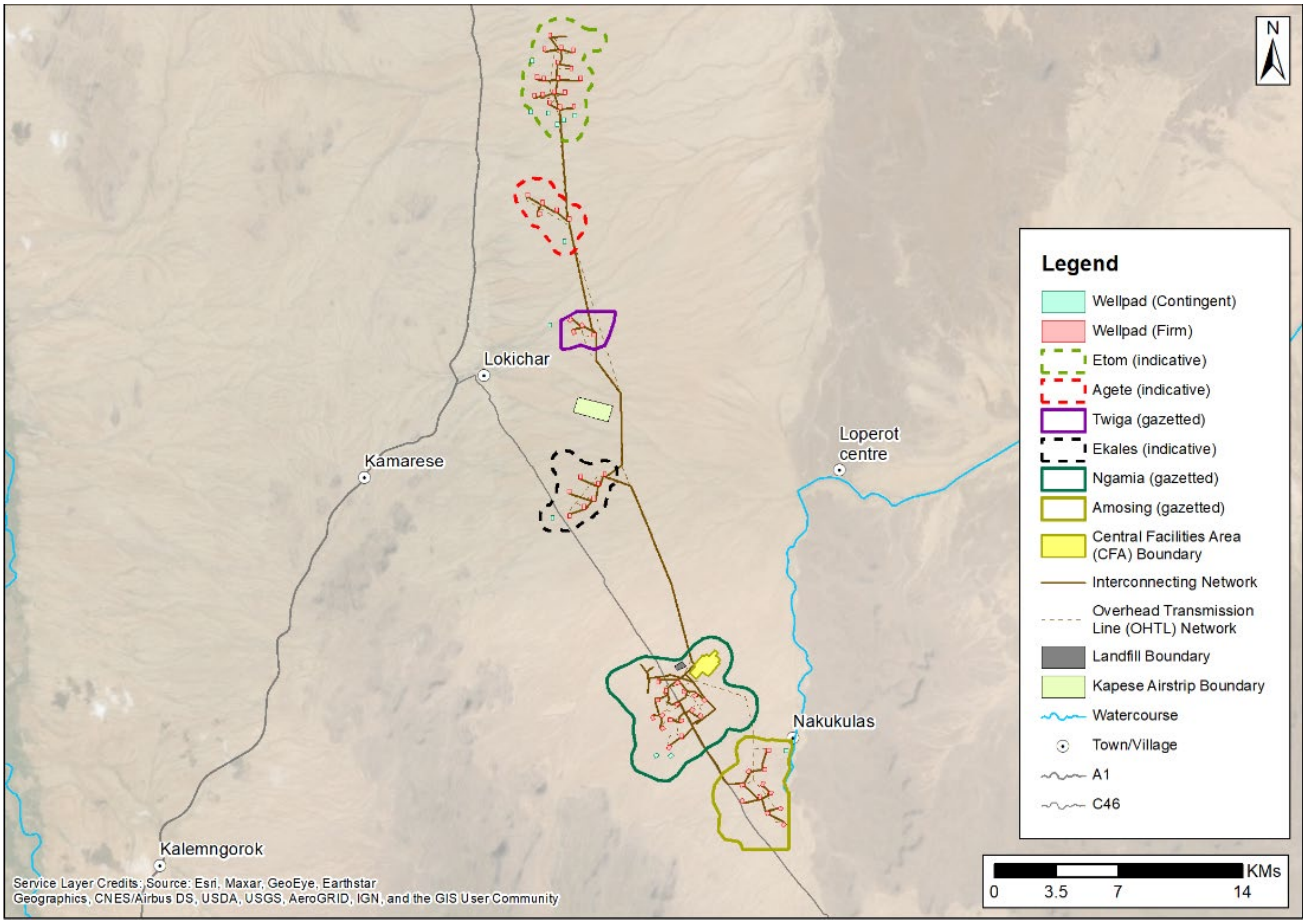

Figure 6.12-1 Gazetted areas (Twiga, Ngamia and Amosing) and indicative gazetted areas.

6.12.1.5 Methodology for Baseline Field Surveys Related to Land

The methodology for the baseline field surveys between 2015 and 2019 involved the following:

- Field areas were divided into 500 m x 500 m grid squares;
- Satellite/ Light Detection and Ranging (LiDAR) images were examined to identify signs of recent animal shelters and homesteads;
- GPX[25] files on field areas were loaded onto handheld Global Positioning System (GPS) devices for use in the field;
- The Operator's Social Performance Team (SPT) representatives contacted Location or Sub-location Chiefs in advance to advise them of the fieldwork;
- Fieldwork was undertaken by the Operator's lands team and Turkana-speaking members of the SPT along with Golder or AECOM representatives;
- Each grid square was systematically surveyed on foot or in vehicles, depending on the terrain;
- Features such as homesteads, animal shelters, graves and community assets were recorded as GPS coordinates, photographed and details recorded. A similar classification of homesteads was used in all the baseline surveys from 2015 to 2019.

[25] GPS data saved in exchange format

- When land users or households occupying homesteads were met in the field, discussions were held to obtain information on land use and land users. In addition, discussions were held with local elders in the vicinity of the field areas to check and confirm the understanding of current and recent land use patterns and trends;
- Where *Adakar*[26] or *Arumum*[27] (see Section 6.12.2.2 for more information on traditional social units) were identified in the field, coordinates of the overall Adakar and Arumrum perimeters were taken and estimates made of the number of households currently present. Discussions were also held with local elders to obtain more information about the Adakar and Arumrum such as the number of households present, when they were established, where the people were from, where they live at other times and the factors influencing establishment and locational decisions; and
  - Findings from the field work were recorded as GPS data and in Lands Baseline Fieldwork reports, covering topics such as: Land tenure, administration and ownership;
  - Land use and land-based livelihoods;
  - Community linkages to land;
  - Homestead locations and recent trends;
  - Use of natural resources such as cultural and economic trees, significant luggas;
  - Services and infrastructure facilities; and
  - Cultural assets and sites (discussed in section 6.13).
- The methodology for the KJV surveys in 2021 involved the following:
  - Identification of households within the defined spatial scope, comprising all well field areas the C46 between Amosing and Lokichar, the settlements of Nakukulas and Lokicheda, and the locations of interconnecting infrastructure (including the A1 from Lokichar to Etom); and
  - Recording of the location of households and producing a brief description of their status (e.g. occupied/unoccupied, long-term/short-term, construction material) and some contextual information about livelihoods.

6.12.1.6 Primary Data - Community Health

A preliminary scoping visit took place in April 2016. The objectives of the field activity were to gain a high-level impression of the health status in the South Lokichar Basin and define what health services were available; understand the availability and quality of health data; identify key informants; and obtain a broad understanding of the potential health areas of concern.

A field visit was carried out from the 21 to 30 November 2018 with the objective of gaining a more detailed understanding of the baseline health status and define what health services were available. The trip also sought to further our understanding of the availability and quality of health data. Field activities were initiated with a participatory key informant meeting with the County Health Management Team (CHMT). Secondary data, which is routinely collected through the District Health Information System (DHIS) from all public health facilities, was obtained and reviewed for both Turkana and West Pokot Counties. This data provides an evidence base for longitudinal monitoring of key health indicators and the performance of the health system in general. Available

[26] An *Adakar* is a clustering of *awi* or homesteads. Sometimes referred to as *"cattle camps"* even if the herd does not specifically contain cattle. Golder's research indicates that *adakar* is often used interchangeably with the term *kraal*, a term more commonly used in South Africa.

[27] An *Arumrum* is a larger convergence of families than an Adakar, with households living together for an extended period of time for reasons of security and collaboration.

public health services were evaluated to gain an understanding of the health infrastructure and health issues in the AoI. This was facilitated using an assessment tool adapted from the WHO Service Availability and Readiness Assessment Index, including an evaluation of the following variables:

- Quantity and skills of healthcare personnel;
- Availability and range of general health services;
- Availability of services;
- Referral networks and the quality and cost of access to the health system, and
- The most common diseases or burden of disease at the facility.

The fieldwork included an additional 18 KIIs and focus group meetings. Focus group meetings were evenly split by gender.

The following limitations were encountered during primary community health data gathering:

- The health baseline was developed primarily using information from key informant health professionals, however, it was more difficult to secure interviews with other health actors, such as NGOs and private/independent entities;
- There is limited data at the Sub-county level. While the current data may be adequate to support the ESIA process, further data will be required to support monitoring and to support design for community-based health management plans and the evaluation of the effectiveness of these interventions; and
- Security challenges and key informant availability led to cancellations in certain instances.

Additional information was gathered in June 2021 through consultation with the local County and Sub-County Disease Surveillance Coordinators (CDSC and SCDSCs) in order to capture details regarding the impacts of the COVID-19 pandemic. An 'Influence of Covid' health questionnaire was distributed to collect information regarding the impact of COVID-19 in Turkana, both at the county level, and at sub-county level for Turkana Central (Lodwar), Turkana South (Lokichar) and Turkana East (Lokori).

6.12.2 Discussion of Baseline Data

6.12.2.1 National Overview

6.12.2.1.1 Administrative Divisions

Kenya has undergone a change in political structure and now operates with a devolved governance system, which means administrative governance has been decentralised into 47 counties. The national government began a devolution process in the wake of interethnic violence after the 2007 elections. The 2010 Constitution substantially remodelled the Kenyan state by creating two layers of government, the National Government and County Governments. Elected governors replaced provincial administration executives that had previously been appointed by the President (Crisis Group, 2017).

While most parts of Kenya view devolution as a positive step, with 77% of the population throughout the country supporting the new model, the context of the Northern Rift Counties is sensitive to past abuses in competitive politics along ethnic lines. The process of devolution is still unfolding. The risks related to devolution are more pronounced in the north, where counties divided along ethnic and sub-ethnic lines are susceptible to winner-take-all contests that have been seen at the national level (Crisis Group, 2017).

Kenya is divided into 47 Counties that are administered by a County Administration under a County Commissioner in each County, who is appointed by and answerable to National Government. At a political level, the County Government is led by an elected Governor. Counties are divided into Constituencies or Sub-counties that are further subdivided into Divisions, Locations and Sub-locations. Constituencies are often synonymous with Sub-counties, but not always, as some Counties include more than one Constituency. Each Constituency is a political unit represented by one Member of Parliament who sits in the National Assembly (Parliament of Kenya, 2018). Sub-counties are also divided into electoral wards, with each Ward represented by a Member of County Assembly (MCA), who sit in the County Assembly.

6.12.2.1.2 Economics and Livelihoods

From the early 2000s, the GoK has achieved sustained economic growth. Notable initiatives, such as free primary education, improved health services and infrastructure developments, were implemented (World Bank 2016).

The economic trends described in this baseline characterise prevailing conditions that existed in Kenya for economics and livelihoods until the outbreak of the COVID-19 global pandemic in 2020. The full extent and nature of the impacts of the COVID-19 pandemic on the economy of Kenya is not yet fully understood, with new information becoming available as the situation evolves. Following the implementation of a variety of control and relief measures across the country at the start of the pandemic, including a daily curfew and reducing VAT, gradual easing of COVID-19 restrictions in 2021 has been ongoing, but poorer households continue to face income deficits and decreased labour demand (NDMA, 2021c).

In the 2020 UN Human Development Report, Kenya ranked 143 out of 189 countries worldwide. The report ranks countries by the Human Development Index (HDI), a composite value that can range between 0 and 1, with 1 being the highest possible development[28]. Kenya ranks above the average for all 46 Sub-Saharan African countries. However, it ranks below the average of all medium human development countries (0.631). Table 6.12-2 compares Kenya's key development indicators with neighbouring countries, as well as the average rankings for the region and the medium human development category.

Table 6.12-2: United Nations Development Programme (UNDP) Human Development Rankings, 2019

Ranking	Country	HDI Ranking	Life Expectancy at Birth (years)	Expected Years Schooling / Mean Years Schooling	Gross National Income (GNI) per capita PPP[29] 2011
Medium Human Development		*0.631*	*69.3*	*11.5 / 6.3*	*6,153*
143	**Kenya**	**0.601**	**66.7**	**11.3 / 6.6**	**4,244**
159	Uganda	0.544	63.4	11.4 / 6.2	2,123
163	Tanzania	0.529	65.5	8.1 / 6.1	2,600
Sub-Saharan Africa		*0.547*	*61.5*	*10.1 / 5.8*	*3,686*
173	Ethiopia	0.485	66.6	8.8 / 2.9	2,207
185	South Sudan	0.433	57.9	5.3 / 4.8	2,003

Source: UNDP, 2020

The rise in Kenya's HDI between 1990 and 2019 has been driven by increases in life expectancy at birth (by 9.2 years), mean years of schooling (by 2.9 years), expected years of schooling (by 3.0 years) and GNI per

[28] HDI classifications are based on HDI fixed cut off points, which are derived from the quartiles of distributions of the component indicators. All of Kenya's neighbouring countries are less than 0.550 or "low human development". Kenya is considered "medium, between 0.550–0.699. High is from 0.700–0.799 and a ranking of 0.800 or greater is considered "very high" human development.

[29] Purchasing Power Parity (PPP) is a method of economic analysis that equates the price of a basket of identically traded goods and services in two countries, allowing for a comparison between countries with different currencies.

capita (84.8%) (UNDP 2018b; UNDP 2020). Table 6.12-3 indicates changes in human development indicators in Kenya since 1990.

Table 6.12-3: UNDP HDI Trends, 1990-2019

	1990	1995	2000	2005	2010	2015	2016	2017	2019
HDI Score	0.468	0.456	0.451	0.490	0.543	0.578	0.585	0.590	0.601
Life expectancy at birth	57.5	53.9	51.8	55.8	62.9	66.7	67.0	67.3	66.7
Expected years of schooling	9.1	8.7	8.4	9.4	10.7	11.7	11.9	12.1	11.3
Mean years of schooling	3.7	4.5	5.3	5.8	6.1	6.3	6.4	6.5	6.6
GNI per capita (2011 PPP$)	2,297	2,130	2,112	2,223	2,467	2,806	2,898	2,961	4,244

Source: UNDP, 2018b; UNDP 2020

Kenya is predominantly rural but is urbanising rapidly. In 2017, 26.6% of Kenyans lived in cities, with an annual urban population growth of around 4.4% in the last decade (World Bank DataBank, 2018). Kenya is a diverse nation with over 40 ethnic groups that are distinguished by two major language groups, Bantu and Nilotic.

It is a prominent member of the East African Community (EAC) and is generally considered the economic, commercial, financial and logistics hub of East Africa (ITA, 2017). Kenya is East Africa's second largest economy and is the eighth-largest economy in Africa, overall. Since 2014, the country has accounted for an average of 18% of regional output growth (Africa Development Bank (AFDB), 2018). Kenya has had long-standing macroeconomic stability, although it faces potential challenges with continued subdued credit growth to the private sector and negative spill-overs from the global economy caused by tighter financial market conditions and global trade tensions (WBG, 2018).

Kenya's Real Gross Domestic Product (GDP)[30] has been high, with annual growth averaging 5.4% in the last five years (WBG, 2018). In 2017, however, Kenya's economy slowed to a real GDP growth of 4.9% due to multiple factors that weighed down economic activities. These included drought conditions, which negatively impacted agricultural output, credit growth slowdown, and election-induced uncertainty. Real GDP growth is expected to recover in the medium term, i.e. by 2020, to 6.1%, due to the impact of improved rains on agricultural output and the dissipation of political uncertainty (WBG, 2018).

As shown in Table 6.12-4, Kenya has a market-based economy that is dominated by the agriculture, forestry, and fishing sector, which is the largest individual sector and contributes a third of the GDP. The largest industry contributors to the GDP between 2011 and 2017, however, were the tertiary industries, which contributed approximately 50% of the GDP, followed by primary and secondary industries.

GDP growth in Kenya has been affected by COVID-19, with a deceleration in 2020 to 1.4% (down from 5.4% in 2019). The outlook, however, is positive, with growth predicted to return to 5% in 2021 and 5.9% in 2022 (AFDB, 2021).

[30] Inflation adjusted measure that reflects the value of all goods and services provided by an economy in a given year, expressed in base-year prices and is often referred to as "*constant-price*" GDP.

Table 6.12-4: GDP by Sector (Percentage of GDP at Current Prices)

Sector	2011	2016	2017	% Change from 2011 to 2017
Primary Industry				
Agriculture, forestry and fishing	29.3	35.6	31.5	7.5%
Mining and quarrying	1.0	0.9	0.8	-20.0%
Primary industries subtotal	***30.3***	***36.5***	***32.3***	***6.6%***
Secondary Industry				
Manufacturing	13.1	10.0	8.4	-35.9%
Electricity, gas and water	2.1	2.6	2.5	19.0%
Construction	4.9	5.5	5.8	18.4%
Secondary industries subtotal	***20.1***	***18.1***	***16.7***	***-16.9%***
Tertiary Industry				
Wholesale and retail trade, repair of vehicles, household goods; restaurants and hotels	10.5	8.7	8.4	-20.0%
Transport, storage and communication	9.8	9.6	9.1	-7.1%
Finance, real estate and business services	15.2	14.7	14.9	-2.0%
Public administration and defence, security	4.7	4.4	4.3	-8.5%
Other services[31]	9.4	7.9	14.3	52.1%
Tertiary industries subtotal	***49.6***	***45.3***	***51.0***	***2.8%***

Source: AFDB, 2018

Tourism is part of the tertiary industry and is a growing sector that has become the second-largest foreign exchange earner in the country (Oxford Business Group, 2017). By 2028, direct contributions from tourism is projected to be $4.9 billion United States dollars (USD) and total contributions are estimated to be $12.9 billion (World Travel and Tourism Council 2017, 2018). The country's numerous parks and reserves, cultural and historic attractions, and 500 km of coastline offer broad appeal for tourists and play an important role in employment and earnings (Oxford Business Group, 2018).

Oil and gas is an emerging industry in Kenya. Exploration efforts in the coastal Lamu Basin began in the 1950s, but commercially viable oil reserves in northern Turkana County were only discovered in 2012 (KCSPOG 2014). Oversight of exploration, development and production of oil and gas in Kenya will be under the review of the newly proposed Kenya Petroleum Regulatory Authority (National Assembly Bills, 2017). Kenya is in the process of setting up the regulator, which will assume the regulatory powers currently under the purview of the National Oil Corporation of Kenya (Standard Media, 2018). In June 2018, parliament passed the Petroleum Bill, which will provide a framework for regulating petroleum contracting, exploration and development (Kenya Civil Society Platform on Oil and Gas, 2018).

[31] Other services include education, health and social work and other services.

In terms of business development for small and medium businesses, Kenya has been improving and is well ahead in comparison with neighbours. The World Bank's annual assessment of the "*ease of doing business*" ranks Kenya 56 out of 190 countries globally (World Bank – Doing Business, 2020). This compares with:

- Uganda – 116 out of 190;
- Tanzania – 141 out of 190;
- Ethiopia – 159 out of 190;
- South Sudan – 185 out of 190; and
- Somalia – 190 out of 190.

In a recent report, *Doing Business 2019: Training for Reform*, Kenya was listed as one of the top ten improved countries in 2017/18. The report notes improved working conditions in:

- Registering property, due to the introduction of an online system to clear land rent rates;
- Getting credit, following the introduction of a new law on secured transactions that created a unified secured transactions legal framework and establishing a new unified and notice-based collateral registry;
- Protecting minority investors, as a result of increased disclosure requirements, regulating the approval of transactions with interested parties and increasing available remedies if said transactions are prejudicial, increasing shareholders' rights and role in major corporate decisions, and requiring greater corporate transparency;
- Paying taxes, with the merging of all permits into a single unified business permit and by simplifying the value added tax schedule on its iTax platform; and
- Resolving insolvency, by facilitating the continuation of the debtor's business during insolvency proceedings, providing for equal treatment of creditors in reorganisation proceedings and granting creditors greater participation in the insolvency proceedings.

In its most recent report, *Doing Business 2020*, improvements were identified in:

- Dealing with construction permits, by making the process more transparent and reducing fees;
- Getting electricity, by modernising existing infrastructure;
- Getting credit, with improved online access;
- Protecting minority investors, by strengthening stakeholder influence on the election or dismissal of external auditors;
- Paying taxes, with improved online access; and
- Resolving insolvency, by improving the continuation of the debtor's business during insolvency proceedings.

The assessment does not necessarily refer to international business, but rather is based upon the ease with which a local limited liability company operating in the largest business city can develop. The purpose is to highlight the extent of obstacles to growing business and to highlight issues for policy makers. The full scores for Kenya are listed in Table 6.12-5.

Table 6.12-5: Kenya Ranking in "*Ease of Doing Business*" Change from 2018 - 2020

Category in Doing Business	Rank 2018 (of 190)	Rank 2019 (of 190)	Rank 2020 (of 190)
Ease of Doing Business (Overall Ranking)	80	61	56
Starting a Business	117	126	129
Dealing with Construction Permits	124	128	105
Getting Electricity	71	75	70
Registering Property	125	122	135
Getting Credit	29	8	4
Protecting Investors	62	11	1
Paying Taxes	92	91	94
Trading Across Borders	106	112	117
Enforcing Contracts	90	88	89
Resolving Insolvency	95	57	50

Source: World Bank – Doing Business, 2018,2019 and 2020.

Employment in Kenya has been strong, with a growing labour force and decreasing unemployment. In 2015/16, an estimated 25.0 million people in Kenya were between the ages of 15 and 64, an increase of 25.6% from a decade earlier (KNBS, 2018a). The number of employed individuals has also risen by 40.9%, while the number unemployed has fallen by 26.3%, during the same period, from 1.9 million to 1.4 million Table 6.12-6. The majority of workers were engaged in full-time employment, making up almost two-thirds (63.2%) of employment.

Table 6.12-6: Historical Employment Indicators for the Population Aged 15-64 (in millions)

Indicator	2005/06	2009	2015/16	Percentage Change from 2005/2006 (%)
Base Population	19.9	20.5	25.0	26
Total Labour Force	14.6	15.8	19.3	32
▪ Employed	12.7	14.2	17.9	41
▪ Unemployed	1.9	1.5	1.4	-26
▪ Economically Inactive	5.3	4.7	5.6	6

Source: KNBS, 2018b

Employment in Kenya roughly corresponds with the size of each economic sector. The service sector is the country's largest employer, followed by agriculture and industry. The service sector employs nearly half of the population (48%) with agriculture employing approximately 40% (FAO, 2018). The industry sector employs the smallest proportion, around 15% of the population.

Employment in Kenya can also be categorised by work in the formal or informal sectors. Informal sectors are characterised by small-scale activities, with easy entry and exit due to fewer regulations, skills from vocational institutions, less capital investment, limited job security and self-employment.

Data presented in Table 6.12-7 shows that in 2017, Kenya's informal sector employed 14.1 million people, over five times the size of its formal sector, which employed approximately 2.7 million people (Kenyan National Bureau of Statistics (KNBS), 2018c). Employment in the informal sector is also more common in rural areas. An estimated 9 million people are employed in the informal sector in rural areas. This is close to double the number found in urban areas. Both formal and informal sectors experienced growth between 2013 and 2017, with the number employed in the formal sector rising by 16% and the number employed in the informal sector rising by 26.4% (KNBS, 2018c). The informal sector has expanded over the years to also include manufacturing activities and information, communication and technology activities (KNBS, 2018c).

Table 6.12-7: Wage Employment by Sector ('000 workers)

Sector	2013	2014	2015	2016	2017	Percentage Change (%)
Formal Sector						
Private	1,600	1,669	1,760	1,817	1,866	17
Public	683	700.8	718.4	736.3	790.2	16
Formal Sector Employment Total	*2,283*	*2,370*	*2,478*	*2,554*	*2,657*	*16*
Informal Sector						
Urban	3,974	4,208	4,458	4,710	5,000	26
Rural	7,176	7,638	8,104	8,600	9,098	27
Informal Sector Employment Total	*11,150*	*11,846*	*12,562*	*13,310*	*14,098*	*26*

Source: KNBS, 2018c

The total population of Kenya in 2018 was 49.7 million people, an increase of 30.4% from a decade earlier (38.1 million) (World Bank Databank, 2018). Half of the total population is below 18 years of age and almost 79% of the population is under the age of 35 (KNBS 2009; ITA 2017).

Data on the extent of the population involved in pastoral systems in Kenya is scant as there is no common standard of measurement (IUAES Commission on Nomadic Peoples, 2014). Data from the decennial Kenya Bureau of Statistics does not disaggregate information on pastoral producers and did not include data from northern Kenya (where most pastoralist districts are located) until 2003. Without accurate data, an understanding of the number of pastoralists and magnitude of pastoral systems in Kenya is extremely difficult to ascertain. Livestock holdings are substantially under-represented and pastoral mobility is poorly captured, especially in relation to livestock production (IUAES Commission on Nomadic Peoples, 2014). An estimate of four data sets, ranging from 2006 to 2013, estimated conservatively that the minimum pastoral population of Kenya may be approximately 10% of the national population of 40 million, or 13% of a rural population of 28 million (IUAES Commission on Nomadic Peoples, 2014).

The total population of poor individuals declined in the last decade, from 16.6 million to 16.4 million, during which time the total national population increased by approximately 10 million. Poverty in Kenya is below the average in sub-Saharan Africa and is amongst the lowest in the East African Community (EAC) (WBG, 2018).

Poverty in Kenya is more prevalent in rural areas than urban areas (Table 6.12-8). About 40% of individuals in rural areas live in poverty, which is about 10% higher than individuals living in peri-urban and core-urban areas (KNBS, 2018d).

Inequality remains a major issue in Kenya, with exclusion and disadvantages based on class, ethnicity, gender, and geographic region (WBG, 2016). Kenya's GINI index[32], which measures economic inequality, dropped from 57.5 in 1992 to a low of 40.5 in 2015 (WBG, 2016). The average measured by UNDP between 2010 and 2017 is 48.5 (UNDP, 2018a). While poverty rates have moderately declined in Kenya from 2005 to 2015, almost two-thirds of the population are below USD $3.20 in 2011 purchasing power parity (PPP) and one-third are below the international poverty line of $1.90 USD in 2011 PPP (Table 6.12-9).

Table 6.12-8: Poverty Measures (2015/2016)

Indicator	Headcount Poverty Measures	Poor Individuals 2015		Poor Households 2016	
		% of Population	Number of people ('000)	% of Population	Number of people ('000)
National	Food Poverty	32.0	14,539	23.8	2,718
	Overall Poverty	36.1	16,401	27.4	3,126
	Hardcore Poverty	8.6	3,908	6.0	682
Rural	Food Poverty	35.8	10,419	28.1	1,808
	Overall Poverty	40.1	11,687	32.6	2,097
	Hardcore Poverty	11.2	3,273	8.7	560
Peri-Urban	Food Poverty	28.9	965	21.5	173
	Overall Poverty	27.5	920	21.1	166
	Hardcore Poverty	6.0	199	4.6	37
Core-Urban	Food Poverty	24.4	3,155	17.7	736
	Overall Poverty	29.4	3,795	20.6	880
	Hardcore Poverty	3.4	436	2.0	85

Source: KNBS, 2018c

Table 6.12-9: Poverty Indicators (2005 and 2015)

Indicator	Poverty Headcount (%)		Poverty Gap (%)	
	2005	2015	2005	2015
US$ 1.25 - 2011 PPP poverty line	22.7	14.9	7.5	4.0
US$ 1.90 - 2011 PPP poverty line	43.6	35.6	16.1	11.3
US$ 3.20 - 2011 PPP poverty line	68.7	63.7	33.0	27.5

Source: World Bank, 2015

[32] **GINI index** measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution.

Poverty in Kenya, like other African countries, is concentrated in rural areas. Inequality in Kenya can be attributed to historical factors, such as natural resource endowments, political patronage, and policy choices biased towards urban areas (WBG, 2015). As a result, various ethnic groups and regions in Kenya have lagged behind in terms of political participation and access to resources for socio-economic development. The World Bank identified the key drivers of economic decline in rural Kenya as: 1) corruption and/or collapse of formal institutions, resulting in compromised service delivery; 2) physical security and poor education issues; 3) unequal land distribution system; and 4) impact of HIV/AIDS, which places extreme burden and high dependency ratios on rural households to care for the sick (WBG, 2015).

6.12.2.1.3 Community Health and Safety

Kenya is implementing a devolved system of governance through which the health service has been fully decentralised to 47 Counties. At the national level, health leadership is provided by the Ministry of Health (MoH). The country's health care is organised in a four-tiered system as summarised in Table 6.12-10, which has replaced the previous six levels defined under the Kenya Essential Package for Health (KEPH) (Ministry of Health, 2014a; Ministry of Health, 2014b). Counties manage and supervise community health units, primary care units and County hospitals. The national referral facilities are semi-autonomous units managed by a board under the supervision of the Ministry of Health (MoH). Other semi-autonomous national health actors include the Kenya Medical Supplies Agency which procures and provides drugs, and other medical and non-medical supplies to all public health facilities, the National Hospital Insurance Fund which finances or subsidises medical bills for members and their dependants, the Kenya Medical Research Institute (KEMRI), the National AIDS Control Council, and public medical training colleges (Ministry of Health, 2014a; Ministry of Health, 2014b).

Table 6.12-10: Tiers of the Health Care System in Kenya

Tier	Description (Current classification)	KEPH Level (Old classification)	Catchment
I	**Community health units:** Serve as the first level of care and virtually comprises all community-based demand creation activities, that is, the identification of cases that need to be managed at higher levels of care	I Community	5,000
II	**Primary care units:** This level is made of all dispensaries, health centres and maternity homes for both public and private providers and is essentially the first level of contact with a health facility	II Dispensaries	10,000
		III Health Centres	30,000
III	**County referral services:** These are County referral hospitals operating in, and managed by a given County and comprise the former level 4 and level 5 district hospitals	IV District Hospitals	100,000
		V Provincial Hospitals	1,000,000
IV	**National referral services:** These consist of facilities that provide highly specialised services and include all tertiary referral facilities.	VI National Hospitals	Entire Country

Source: Kenya Health Sector Human Resources (HR) Strategy 2014-2018

Kenya currently has four national hospitals - Moi Teaching and Referral Hospital (MTRH) in Eldoret and the Kenyatta National Hospital, Mathare Psychiatric Hospital and National Spinal Injury Hospital all located in Nairobi.

Kenya has a routine Health Management Information System (HMIS) to record, generate and manage health information to guide evidence-based decision making in the provision of health and related services at the national, County and local levels. However, a weak health information system has been identified as one of the key challenges of the country's health sector including an inadequate capacity of HMIS staff, unskilled personnel handling data, lack of integration, many parallel data collection systems, and poor coordination, amongst others. The District Health Information Software 2 (DHIS2) software is used to support the HMIS.

There are wide disparities that exist in health status across Kenya and these are closely linked to underlying socio-economic, gender and geographical differences. The burden of disease in Kenya remains predominantly communicable diseases, although there is a growing burden of non-communicable diseases and injuries. As shown in Figure 6.12-2, at the current trend, it is projected that non-communicable and communicable diseases will have an equal burden of disease nationally by 2025, after which the burden from non-communicable diseases will dominate.

The information presented in this baseline provides an overview of the community health trends immediately prior to the onset of the COVID-19 pandemic. Whilst up-to-date information has been included where possible, the pandemic in ongoing and the situation is constantly evolving. As such, the full extent of the effect of COVID-19, and the longer-term implications, on community health are not yet fully understood. The NDMA (2021c) report states that COVID-19 has resulted in poor health-seeking behaviour, with fewer people visiting health facilities for treatment, and has disrupted the continuity of essential health and nutrition services, particularly in more remote regions. The pandemic also affected Kenya’s economy and in June 2021, the World Bank approved $750 million of development policy financing to support Kenya’s recovery efforts and improve public investment spending, with priorities on supporting the healthcare sector.

Although Africa has not been affected as much as some other regions, since the COVID-19 pandemic started in January 2020, it remains at high risk with many countries now seeing an upsurge in cases as the 2021 winter period approaches. The Africa Centres for Disease Control is reporting that death rates in sub-Saharan Africa are significantly above the global average of 2.2%, with a Lancet study finding that more than half of patients who needed intensive care in Africa died, compared to the global average of less than a third. This may be further compounded by low testing rates in more remote or rural settings where cases or deaths may go unrecognised. Kenya’s death rate per 100,000 people was 6.7, which is low compared to South Africa (recorded as 100 per 100,000 people but known to be underreported). This relatively low death rate may reflect that cases and deaths in rural areas go under reported or may result from the relatively young population and other protective factors.

Malaria remains a public health problem in Kenya with around 70% of the population at risk of the disease. *Plasmodium falciparum* is the predominant parasite (WHO, 2015). The major *Anopheles* species are *An. gambiae*, *An. arabiensis*, *An. funestus*, and *An. merus*. The country is divided into four malaria epidemiological zones as shown in Table 6.12-38 (KNBS, 2010; NMCP, 2016).

The National Malaria Control Programme in Kenya is responsible for the design and implementation of malaria control strategy. The core vector control strategies are the distribution of long-lasting insecticidal nets (LLINs), indoor residual spraying in targeted areas, and larval source management.

Statistics from the Kenya Malaria Indicator Survey (KMIS) in 2015 indicated a national malaria prevalence of 8% among children, a decline from 11% in 2010) (NMCP, 2016). The burden of malaria (as assessed by microscopy) has shifted to older children with a prevalence of 11% among children aged 10-14 years, 10% among children aged 5-9 years and 5% among children aged under-5 years (NMCP, 2016).

HIV/AIDS is a global epidemic, with Kenya ranking among the six high burden countries in the world with an estimated 1.5 million people living with the virus in 2018 (National AIDS Control Council, 2018). The epidemic has evolved, since the first case was diagnosed in 1984, to become one of the major causes of morbidity and mortality in the country, placing tremendous demands on the health system and the economy (UNAIDS, 2014). Following years of intervention, the prevalence has recorded a decline from a high of 10% in the late 1990s, to the current 4.9% (2018 estimate). New HIV infections in Kenya have fallen by 77% from their peak in 1993, and AIDS-related deaths have been reduced by 74% from their peak in 2003, as access to antiretroviral treatment increased. Data from the Kenya AIDS Response Progress Report 2018 shows that the country recorded 52,800 new HIV infections and 28,200 AIDS-related deaths in 2017 (National AIDS Control Council, 2018). A recent spike in number of new infections among young people is threatening to wipe the gains that have been made. The epidemic exhibits extreme geographical and gender disparities. National estimates indicate that 65% of new HIV infections occur in nine of the 47 Counties, mostly in the Western region (National AIDS and STI Control Programme (NASCOP) and National AIDS Control Council (NACC), 2015). There is higher prevalence among women at 6.9%, compared to men at 4.2% (National AIDS Control Council, 2018). Heterosexual contact is the primarily route of transmission. The prevalence is higher among most-at-risk populations particularly female commercial sex workers (29.3%), gay men (18.2%) and people who inject drugs (18.3%) (National AIDS Control Council, 2018).

Kenya indicators 2018 (NASCOP Program Data 2018):

- 1.5 million people living with HIV;
- 4.9% adult HIV prevalence;
- 52,800 new HIV infections;
- 28,200 AIDS-related deaths;
- 75% adults on antiretroviral treatment; and
- 84% children on antiretroviral treatment.

Table 6.12-11 shows the leading causes of disease burden in Kenya as measured by Disability Adjusted Life Years (DALYs[33]). HIV/AIDS is the leading cause, followed by perinatal conditions, malaria, lower respiratory infections and diarrhoeal diseases (Institute for Health Metrics and Evaluation (IHME), 2016). Between 2005 and 2016, the burden of disease due to HIV/AIDS and malaria reduced by over half (60%) (IHME, 2016). Tuberculosis, on the other hand, recorded a significant increase of 18%. The burden from mental illness also increased.

Table 6.12-11: Leading Causes of Disease Burden (DALYs) in Kenya (2016)

Rank	Disease/Morbidity	% of DALY	%Change (2005-2016)
1.	HIV/AIDS	24.2	-60% (decrease)
2.	Perinatal conditions	10.7	-10% (decrease)
3	Malaria	7.2	-59% (decrease)
4	Lower respiratory infections	7.1	-22% (decrease)
5.	Diarrhoeal diseases	6.0	-28% (decrease)
6	Tuberculosis	4.8	+18% (increase)
7.	Road traffic accidents	2.0	-
8.	Congenital anomalies	1.7	-
9.	Violence	1.6	-

[33] DALYs refer to time lost due to incapacity arising from ill health.

Rank	Disease/Morbidity	% of DALY	%Change (2005-2016)
10.	Depressive disorders	1.5	+30% (increase)

Source: IHME Burden of Disease estimates 2016

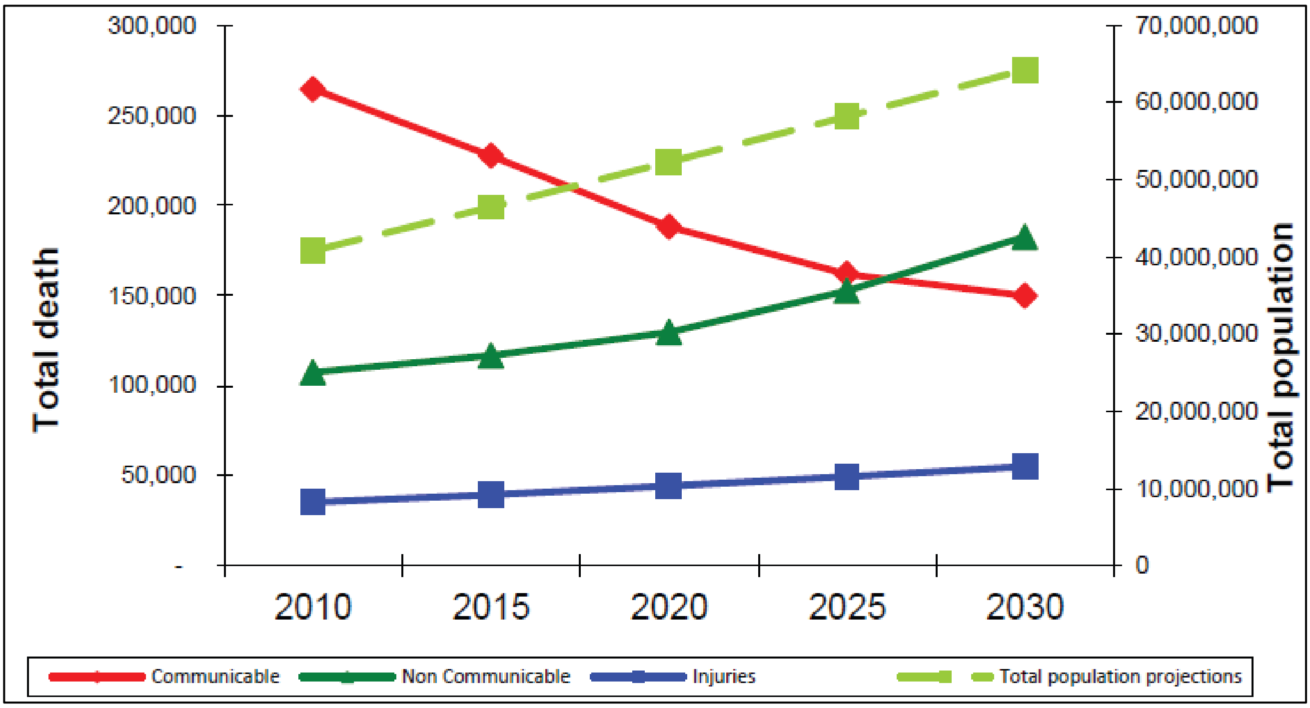

Figure 6.12-2: Projections of Disease Burden in Kenya, 2011-2030

Source: Health Sector Strategic and Investment Plan 2013-2017

The leading risk factors for disease burden in Kenya are malnutrition, unsafe sex, water-sanitation-hygiene (WaSH) related factors, air pollution, alcohol/drug abuse, high blood pressure, dietary and occupational risks, tobacco use and high blood sugar (Figure 6.12-3) (IHME 2019).

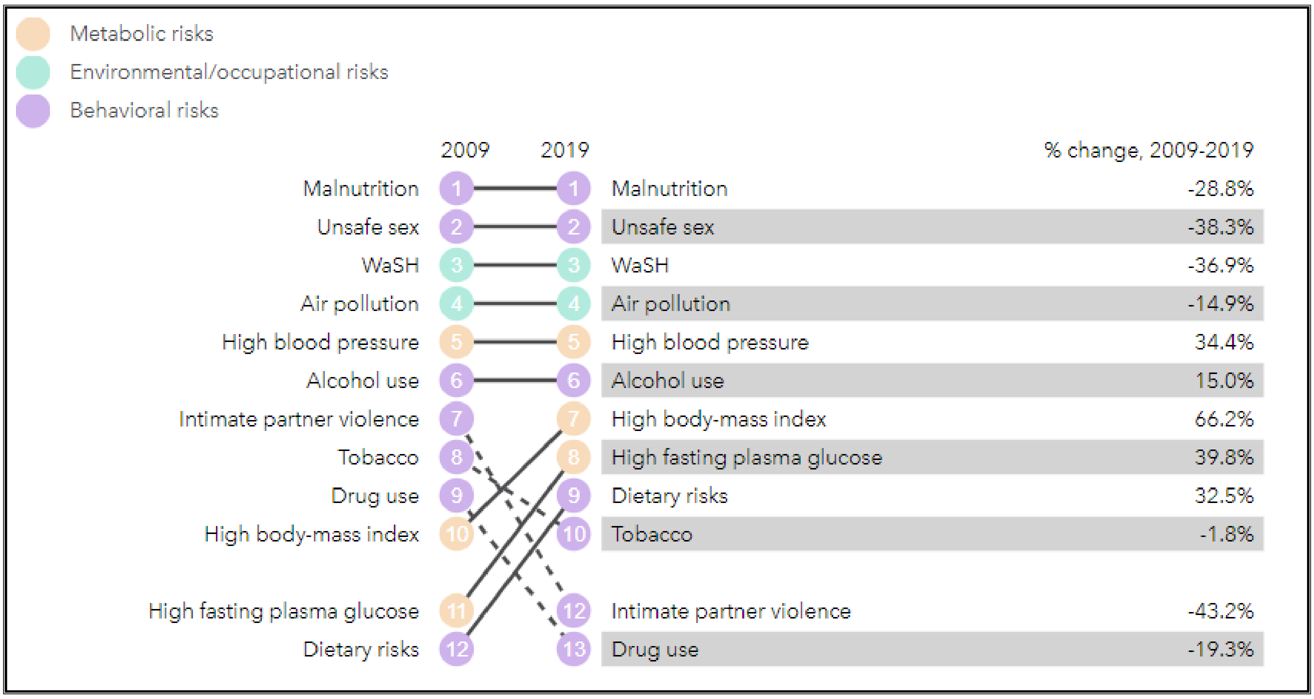

Figure 6.12-3: Leading risk factors for disease burden in Kenya, 2019

Source: IHME Burden of Disease estimates 2019

Although overall emergency healthcare access is high, there are notable differences between counties. Access to the health care services in the counties of Turkana, Wajir, Bomet, Narok, Manderaa, Tano River and Kwala are generally poorer than other counties with smaller health facility densities and budgets (Ministry of Health and WHO, 2016). Health facility density is considered a crude indicator of access to outpatient services and is expressed as number of facilities per 10,000 population. While Kenya's MoH has increased health facility density from 1.9 per 10,000 population in 2013 to 2.2 per 10,000 in 2016, it has not achieved its target of 2.5 per 10,000 population (Ministry of Health and WHO, 2016).

Access to quality healthcare is a constitutional right in Kenya but millions of Kenyans cannot afford to pay for healthcare services. While public health insurance became available in 1966, only an estimated 20% of Kenyans have access to some sort of medical coverage (World Bank, 2014).

6.12.2.1.4 Education

Kenya has made strides in improving access to education, abolishing tuition fees for primary education in 2003 and secondary education in 2018. Enrolment has subsequently increased, with the net enrolment ratio for primary education rising from 76.5% to 81.8% from 2008 to 2012 (UNESCO, 2018). Enrolment in secondary education has also risen from 28.9% in 2008 to 51.3% in 2016 (The Conversation, 2017). Over half (51%) of adults aged 25 and over have attained a primary education, while only 29% have attained lower secondary education and 22% have attained upper secondary education (UNESCO, 2017).

Despite progress, challenges remain for students transitioning from primary to secondary school, especially those from low-income households. It is considered that additional school fees can prevent many children from attending secondary school, as the unit cost of education generally negatively correlates with secondary school enrolment (Mutegi et al. 2017).

The full extent and nature of the impacts of the COVID-19 pandemic on the provision of education in Kenya are not yet fully understood, with new information becoming available as the situation evolves. The NDMA reported that schools re-opened nationwide in January 2021, among concerns that prolonged closures were contributing to increased teen pregnancies, poor nutrition and permanent dropouts (NDMA, 2021c). In both Turkana and West Pokot, difficulties in accessing e-learning due to lack of equipment, connectivity or understanding was highlighted as a particular constraint on education during the COVID-19 pandemic (NDMA, 2021a; NDMA, 2021c). The NDMA (2021b) also report that disruption to education as a result of COVID-19 has resulted in increased gender-based violence, child labour and substance abuse among students in West Pokot.

6.12.2.1.5 Land Administration and Management

As explained in the Resettlement and Livelihoods Restoration Framework (Annex I), the Constitution of Kenya (2010), and the Sessional Paper No.3 (2009) on the National Land Policy, land in Kenya is classified as Public land[34], Private land[35], or Community land[36]. Land in the Project footprint area is classified as Community Land and remains unregistered and is recognised as belonging to all people of Turkana. It is understood that there is no privately or publicly owned land in the Project footprint area.

Article 63 of the Constitution states that "*Community Land shall vest in and be held by communities identified on the basis of ethnicity, culture or similar community of interest*". Community Land includes land that is lawfully registered to a specific community, and community land that has not been formally registered to a community or "unregistered community land". Article 63 states that "*Any unregistered Community Land shall be held in trust by county governments on behalf of the communities for which it is held*". Beyond Kenya's recognised forms of land tenure, people recognise that land is a shared resource and one that can be characterised as common property. In this sense, land in the Project footprint area is recognised as unregistered Community Land that belongs to all people.

Elsewhere, in addition to unregistered Community Land, land may be classified (or held) as either private or public land. The majority of private or public land is located in urban settings outside the Project area such as Lodwar (the Turkana County capital) and urban settlements such as Lokichar.

All land areas affected by the Project footprint are classified as unregistered Community Land. As noted above, Article 63 of the Constitution of Kenya (2010) states that "*any unregistered Community Land shall be held in trust by County governments on behalf of the communities for which it is held*". In the case of the Project in Turkana, land is owned by the people. People recognise that Community Land is a shared resource and one that can be characterised as common property.

6.12.2.2 Administrative Divisions and Governance Structure

Turkana County is one of 47 county governments in Kenya and, measuring 77,000 km^2, it is the second largest county in the country, covering 13% of the country. Turkana County shares international borders with Ethiopia to the north, South Sudan to the north-west and Uganda to the west. Within Kenya, the County borders West Pokot and Baringo Counties to the south-west, Samburu County to the south-east and Lake Turkana in the east all the way to the Ethiopia border. Marsabit County forms the entire opposite shore of Lake Turkana.

West Pokot County is situated in the North Rift along Kenya's western border with Uganda. It borders Turkana County to the north and north-east, Trans Nzoia County to the south, and Elgeyo-Marakwet County and Baringo

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[34] Public land: *(a)* land which at the effective date was alienated government land as defined by an Act of Parliament in force at the effective date; (*b*) land lawfully held, used or occupied by any State organ, except any such land that is occupied by the State organ as lessee under a private lease; (*c*) land transferred to the State by way of sale, reversion or surrender; (*d*) land in respect of which no individual or community ownership can be established by any legal process; (*e*) land in respect of which no heir can be identified by any legal process;(*f*) all minerals and mineral oils as defined by law; (*g*) government forests other than forests to which Article 63 (2) (*d*) (i) applies, government game reserves, water catchment areas, national parks, government animal sanctuaries, and specially protected areas; (*h*) all roads and thoroughfares provided for by an Act of Parliament; (*i*) all rivers, lakes and other water bodies as defined by an Act of Parliament; (*j*) the territorial sea, the exclusive economic zone and the sea bed; (*k*) the continental shelf; (*l*) all land between the high and low water marks;(*m*) any land not classified as private or community land under the Constitution; and (*n*) any other land declared to be public land by an Act of Parliament (i) in force at the effective date; or (ii) enacted after the effective date.

[35] Private land: comprising: (*a*) registered land held by any person under any freehold tenure; (*b*) land held by any person under leasehold tenure; and (*c*) any other land declared private land under an Act of Parliament.

[36] Community Land: (a) Land lawfully registered in the name of group representatives under the provisions of any law; (*b*) land lawfully transferred to a specific community by any process of law; (*c*) any other land declared to be community land by an Act of Parliament; and (*d*) land that is— (i) lawfully held, managed or used by specific communities as community forests, grazing areas or shrines; (ii) ancestral lands and lands traditionally occupied by hunter-gatherer communities; or (iii) lawfully held as trust land by the County Governments.

County to the south-east and east, respectively. West Pokot County measures 9,169.4 km^2, stretching a distance of 132 km from north to south (West Pokot Spatial Plan, 2019).

6.12.2.3 Local Administration

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

The primary focus of socio-economic baseline is the two Sub-counties of Turkana South and Turkana East in Turkana County, plus the four Locations adjacent to the Turkwel Gorge Reservoir, the proposed water abstraction point. These Locations are part of three Sub-counties in West Pokot, Pokot West, Pokot North and Pokot Central.

West Pokot County has four Sub-counties, 13 divisions, 61 locations and 222 sub locations (West Pokot Spatial Plan, 2019). Sub-counties for Turkana and West Pokot are shown in Figure 6.12-4. Figure 6.12-5 shows the Project AoI, including the key Locations that were the primary focus of the baseline research.

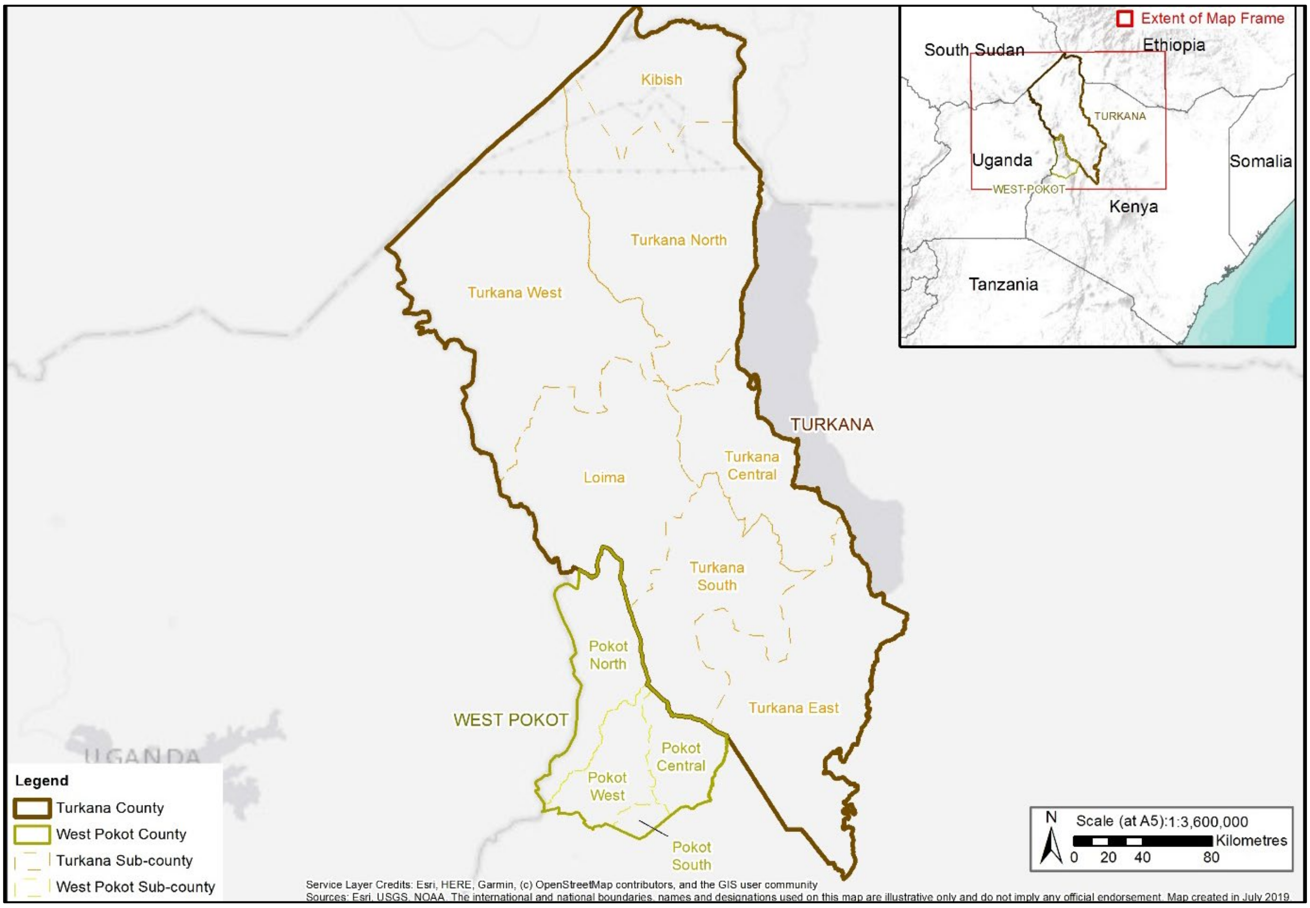


Figure 6.12-4: Administrative Sub-counties for Turkana and West Pokot County

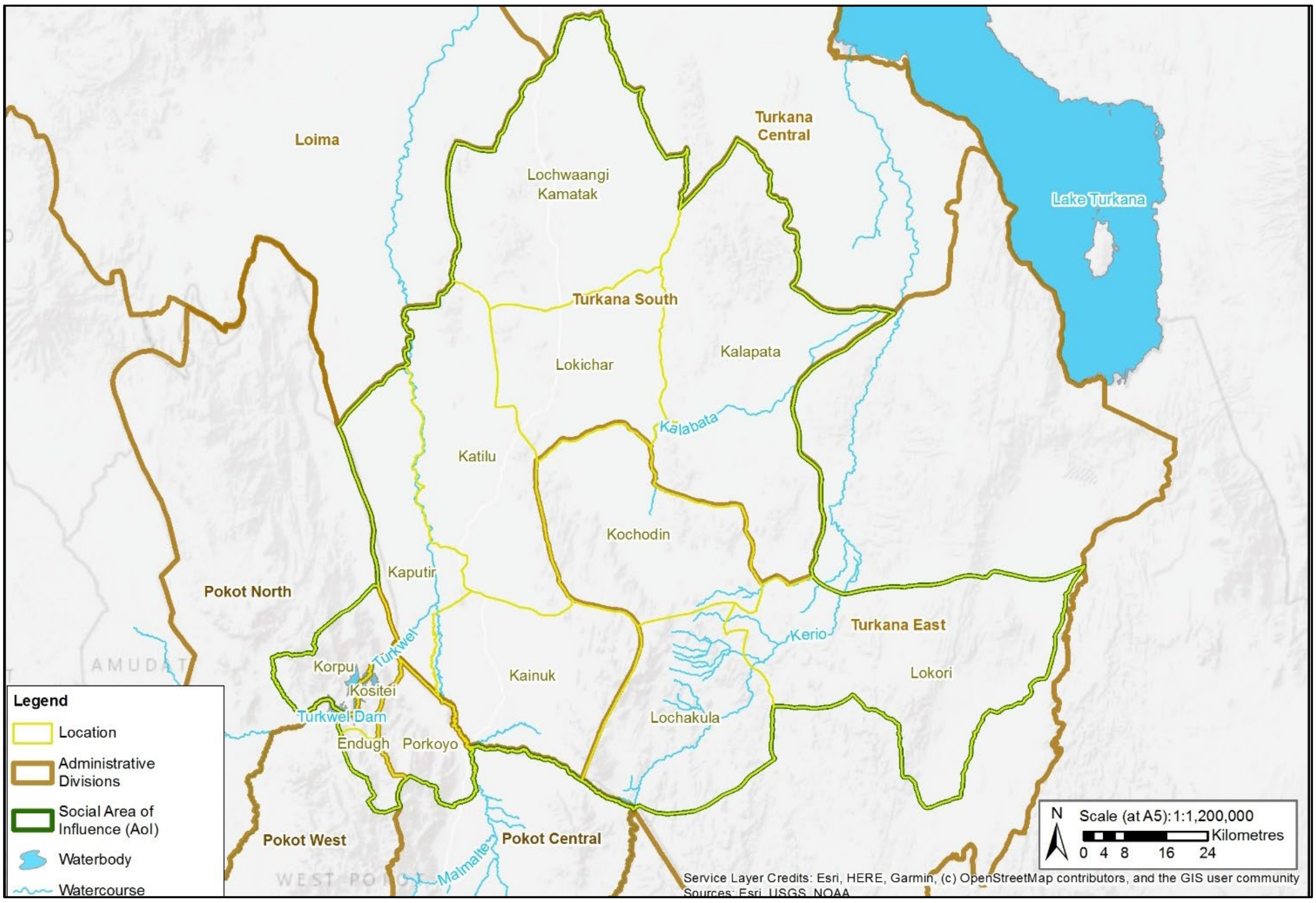


Figure 6.12-5: Project AoI and Key Locations for Baseline Research

A Constituency (often coinciding with the boundary a Sub-county) is represented by one Member of Parliament (MP), who sits in the National Assembly. Each electoral Ward is represented by an MCA in the County Assembly. There are 30 electoral Wards (Table 6.12-12) in Turkana and there are an additional ten MCAs nominated by political parties, making a total of 40 MCAs in the Turkana Country Assembly. There are 20 electoral Wards in West Pokot (Table 6.12-13).

Table 6.12-12: Wards by Sub-County in Turkana County

Sub-county	Number of Wards
Turkana South	5
Turkana East	3
Turkana Central	5
Loima	4
Turkana West	7
Turkana North (and Kibish[37])	6

[37] In this table, Kibish has a special status as the table shows the number of Wards per Sub-county. Kibish was given the status as a Sub-county in 2011 and is considered a special Sub-county. While having this status as a Sub-county, it administered by the same Deputy County Commissioner as Turkana North under the National Government. Under the County Government, Kibish is a single Ward, which has the same boundary as the Sub-county. Kibish has its own Sub-county Administrator. This is often confusing as Kibish has some administrative roles overseen by Turkana North. The Sub-county itself has 3 Locations and 7 Sub-locations with 8 Major Rural Settlements. A map showing Divisions would show Kibish as part of Turkana North.

Sub-county	Number of Wards
Total Number of Wards	30

Table 6.12-13: Wards by Sub-County in West Pokot County

Sub-county	Number of Wards
Pokot West	6
Pokot South	4
Pokot Central	4
North Pokot	6
Total Number of Wards	20

The Kibish Sub-county, located in the northern part of Turkana County on the border with Ethiopia and South Sudan, was created in 2011 by the National Government as a special Sub-county. Kibish consists of three Divisions, but two overlap with Turkana North Sub-county. The Independent Electoral and Boundaries Commission (IEBC) is expected to clarify this situation during its next consideration of the boundaries. This will clearly demarcate a border between Kibish and Turkana North Sub-county (KII, 25 June 2016).

Divisions, Locations and Sub-locations are part of a national government administrative structure. This overlaps with the Sub-county structure, however a Ward is part of the newly instituted devolution process. Sub-county Administrators and Ward Administrators are part of the county government administration structure. The Constitution of Kenya (2010) set up these two levels of government, making a shared mandate between the national government and counties (Turkana County Government, 2013). A full list of the administrative units included in the AoI are listed in Table 6.12-14 to Table 6.12-16.

Table 6.12-14: Sub-County Administrative Units in the AoI: Turkana South

Turkana South			
Division	***Location***	***Sub-location***	***Ward***
Lokichar	Lokichar	Lokichar	Lokichar
		Kapese	
	Lochwaangi Kamatak	Lochwaangi Kamatak	
		Napusmoru	
	Kalapata	Kalapata	Kalapata
		Loperot	
		Nakalei	
Kainuk	Kainuk	Kainuk	Lobokat
		Kakongu	
		Loyapat	

Turkana South			
Division	***Location***	***Sub-location***	***Ward***
	Kaputir	Kalomwae	Kaputir
		Nakwamoru	
		Lorogon	
Katilu	Katilu	Katilu	Katilu
		Lokapel	
		Kalemngorok	
		Kanaodon	

Table 6.12-15: Sub-County Administrative Units in the AoI: Turkana East

Turkana East			
Division	***Location***	***Sub-location***	***Ward***
Lokori	Lokori	Lokori	Lokori/Kochodin
		Kangitit	
		Lotubae	
	Kochodin	Kochodin	
		Lopii	
	Lochakula	Lochakula	
		Kakulit	
		Lokwamosing	

Table 6.12-16: West Pokot County Administrative Units in the AoI

Division	Location	Sub-location	Ward
Pokot West Sub-County			
Sook	Kositei	Kasitei	Endugh (Turkwel Special Ward)
		Chepokachim	
	Endugh	Chewarany	Endugh
		Kriich	
		Cheptram	
North Pokot Sub-County			
Kasei	Korpu	Songok	

Division	Location	Sub-location	Ward
		Sirwach,	Kasei (Turkwel Special Ward)
		Chepkondol	
		Kachawa	
Central Pokot Sub-County			
Sekerr	Porkoyo	Parek	Sekerr (Turkwel Special Ward)
		Nasolot	
		Sarmach	
		Porkoyo	

It was noted through KIIs with Assistant Chiefs and Ward administrators in these areas that there has been a "*special*" Ward demarcated for the Turkwel area. This Turkwel Ward was formed to enable improved governance of the settlements in the Turkwel area that are not easily accessible to the ward administrators in the larger wards of Endugh, Kasei and Sekerr. Turkwel Ward has its own Ward Administrator and incorporates settlements in Sub-locations spanning across the three Sub-counties (KII – Ward Administrators, 11 June 2019).

Reorganisation associated with changes from the 2010 Constitution has caused some challenges in understanding roles and responsibilities among various levels of different government authorities, however, representatives of national and county government structures report that they have cooperated successfully in this time of transition to a devolved government. Golder sought to gather data from representatives of both structures, specifically Assistant County Commissioners (national government officials), who oversee Location Chiefs and their Assistant Sub-location Chiefs, and county officials, such as Sub-county Administrators and Ward Administrators.

New legislation within the Decentralised Administration Bill is expected to further structure administrative units under the County Government into "*Villages*". This is expected to be different to the structure described above. In the new system, each village will have a Land Administrator that will work with Ward Administrators to be the "*person on the ground*" with knowledge of land issues and potential disputes (KII, 9 May 2017). Below the Ward Administrators, new Village Administrators will be created, and these individuals will work with a Village Council.

In Turkana County, a preliminary list of Villages is available. In total, there will be 156 Villages to be administered by Wards as part of the evolving devolved County government. The proposed Villages were organised based on population and geographic size. Data used to develop this structure are linked to the data from the Independent Electoral and Boundary Commission (KII, 31 January 2019).

Table 6.12-17 represents the preliminary list of Villages under consideration in the Turkana locations.

Table 6.12-17: Preliminary List of Villages per Ward in Turkana East and South

Turkana South		
Ward	**Village**	**Number of Villages**
Lokichar	Lokichar Kapese Kasuroi/Lokaburu/Nalemsekon	6

Turkana South		
Ward	**Village**	**Number of Villages**
	Napusumoru/Kekorisogol Lochwaa/Locheremoit Kakalel/Sopel/Kaaroge	
Kalapata	Kalapata Loperot Nakaalei Kootoro Lomeleku	5
Lobokat	Kainuk Kakong Loyapat Namambu/Naakujit	4
Kaputir	Nariomoru/Nakwamoru Lorogon Kaputir Kotamarukon	4
Katilu	Katilu Lokapel Kalemngorok Kanaodon Korinyang	5
Turkana East		
Lokori/Kochodin	Lokori Lotubae Kochodin Lochakula Kangitit Nakukulas Lokwii	7
Kapedo/Napeitom	Lomelo/Katiir Napeitom Kamuge/Ngilukia Kapedo/Silale Nadome/Ekipor	5
Katilia	Katilia Elelea Parkati	5

Turkana South		
Ward	**Village**	**Number of Villages**
	Lopeduru Lomunyen - Akwaan	
Total No. Villages		41

Source: (KII, 1 February 2019)

The composition of the Village Council will be 5 to 7 elders from the population, with the Chair of the Village Council being the Administrator (KII, 10 May 2017). The Village Council will seek to bring together leadership from both settled and mobile administrative units into one advisory group. This group will be tasked with helping to manage resources and advise on security issues (KII, 31 January 2019).

The new system is intended to alleviate work that is currently managed by Location Chiefs in the National government and Ward Administrators in the County Government (KII, 2 February 2019).

6.12.2.4 Changes Driven by Devolution

Research highlights mixed views on devolution, as the National Government transfers more responsibilities to the county governments.

Devolution is said to have brought services and decision-making closer to people, in contrast to the pre-devolution situation where much of the decision-making was done from Nairobi. Some have also seen an increase in the number of early childhood development (ECD) facilities and the construction of health dispensaries and health centres. Devolution is also said to have had an impact on infrastructure, with more roads being paved and streetlights being put in population centres. It is also said to have improved security through inter-county peace initiatives (KII, 28 June 2016).

However, key informants in the NGO sector observe similar trends to those above, prior to devolution, in which diversity is concentrated in urban areas. While there is agreement that some services have improved, the disparity in terms of services for those close to urban areas and those even 5 km away from urban settlements is still large. In some situations, poorer people are being pushed farther away from urban areas as land in and around towns, such as Lodwar, become used for non-communal purposes (KII, 27 June 2016).

6.12.2.5 Settlement Categorisation

Stakeholder engagement undertaken by the Operator during E&A phase identified key settlements within the AoI. Table 6.12-18 lists the key major settlements in Turkana County and their relationship to other national and county government administrative units.

Table 6.12-18: Urban and Rural Settlements

Sub-county	Location	Sub-location	Urban/Major Rural Settlement	Ward
Turkana South	Lokichar	Lokichar	Lokichar (urban) Lokichar Moruongor internally displaced person (IDP) camp Nalemsekon Kamarese Kaakali	Lokichar
		Kapese	Kapese	

Sub-county	Location	Sub-location	Urban/Major Rural Settlement	Ward
			Lomokamar Kasuroi	
		Lochwaangikamatak	Lochwaangi Kamatak Kaaroge Locheremoit Napusimoru	
	Kainuk	Kainuk	Kainuk Lorogon	Lobokat
	Kalapata	Loperot	Loperot Nalemkais	Kalapata
		Nakalei	Nakalei	
	Katilu	Kalemngorok	Kalemngorok	Katilu
		Katilu	Katilu	
	Kaputir	Nakwamoru	Kaputir	Kaputir
		Lorogon	Lorogon	
Turkana East	Lokori	Lokori	Lokori (urban) IDP Lokori	Lokori/Kochodin
	Kochodin	Kochodin	Nakukulas Lokicheda	
		Lopii	Lopii	

In West Pokot County, the main urban centre is Kapenguria in West Pokot Sub-County. It also acts a trading centre. The improvement of market centres and establishment of new ones is a priority in West Pokot, due to their contribution to the economic development of the county (West Pokot Spatial Plan, 2019).

6.12.2.6 Traditional Social Units

6.12.2.6.1.1 Turkana

Within the AoI in Turkana (Figure 6.12-5), the majority of land is unregistered Community Land. Generally, it is recognised that unregistered Community Land is owned[38] by all people of Turkana and is held in trust by Turkana County Government on behalf of the people who hold customary rights to the land. The Turkana have specific geographical affiliation with land including *ere* and *ekitela* or territorial Sections.

Key terminology related to the Turkana traditional social units include:

- ***Awi (pl*: *ng'awiyei) or household:*** The most fundamental unit of social aggregation is the family unit, which is headed by a male head of household with one or multiple wives, children and often other

[38] Within the South Lokichar area, the vast majority of land is unregistered community land. Generally, it is recognised that unregistered community land is owned by all people of Turkana and is held in trust by Turkana County Government on behalf of the people who hold informal rights to the land.

dependent women. Households may cluster and travel with two to five other households to form a large *Awi* or *Awi Apolon* (McCabe, 2004);

- ***Ere (pl: ng'irerera):*** describes the ancestral domain of a family. An *ere* may be described by the current household (including grand-parents, siblings and children) as the location from where the family derives and, to a variable extent, may live (seasonally or more permanently for the old, women and children) and graze their livestock. The *ere* is not necessarily a place of permanent abode or settlement in so far that seasonal migration may take the *ere* family away from their *ere*. The *ere* family may claim authority over, and preferential access to, natural resources (e.g. trees and seasonal grazing) located within the *ere*, but this claim does not convey (land) ownership rights and failure to exercise such rights may result in other parties using these resources. As such, Turkana can access land within a family's *ere* for temporary grazing purposes but it is understood that permission must be sought. The person with the right to speak on behalf of people in the *ere* is the man who heads the *ere* family. Borders of the *ere* are usually delineated by features such as a *luggas,* ridgelines, livestock tracks (for moving stock long distances), roads and occasionally certain species of trees. These borders are generally known by everyone living in the vicinity however opinions can vary within an administrative unit over where *ere* boundaries lie and the geographic scale of an *ere*, with *ere* boundaries identified by one person sometimes differing or being superimposed upon an *ere* identified by others.
- ***Ekitela (pl: ng'itela)* or territorial Section:** All herd owners are members of a territorial Section, geographic areas, often with overlapping boundaries (Müller-Dempf, 2014). Sections differ in various ways, such as environmental conditions or characteristics. Though once a territorial unit in a socio-political system, their role is diminished by government administration (Müller-Dempf, 1994);
- ***Emacar (pl ngimacarin)* or Clans*:*** Non-territorial social organisation related to kinship and stock associations. All Turkana are born into the clan of one's father and women join the clan of their husband upon marriage. Clans are exogamous (i.e., a man may not marry a woman from his clan) and membership is symbolised by brands that appear on animals in a herd (McCabe, 2004);
- ***Adakar (pl. ng'adakarin):*** A clustering of *awi* or homesteads sometimes referred to as "cattle camps" even if the herd does not specifically contain cattle. Golder's research indicates that *Adakar* is often used interchangeably with the term *kraal*, a term more commonly used in South Africa; and
- ***Arumrum: (pl. ng'arumrumio)***: New form of social organisation starting from the mid-1990s consisting of a large encampment of multiple herd owners under the leadership of a single man. Concentrically built thorn fences and heavy armament was designed to fend off attacks. (McCabe, 2004). This clustering could include up to 100 households (Eriksen, S, and J Lind. 2009).

The relationship between national, county and traditional leadership is complex and evolving as county governments implement changes toward more devolved government under the new Constitution. Location and Sub-location leadership, Chiefs and Assistant Chiefs, are aided by their Chief's Elders, individuals who live in settlements throughout a Location or Sub-location and assist the Chief in his or her duties. In the Kanamkemer Sub-location in Turkana Central, the Assistant Chief allocated two Chief's Elders for each settlement. These individuals may carry out her functions when she is absent (KII, 24 June 2016).

This system has been observed in numerous other Locations, though the number of Chief's Elders seems to vary. According to one Sub-county Administrator, such Chief's Elders are considered part of traditional governance structures and the traditional, county and national governance systems are interdependent. The Chief's Elders work with *Adakar* or *kraal* elders and Seers (diviners), *Emerons*, who are also part of a traditional government system. While not legally recognised, the main functions of the traditional governance structure relate to pastoralist issues, including the management of security, disaster and pasture management (KIIs, 24

June 2016 and 30 January 2019). A Location Chief further explained that elders work with the Chiefs to understand who has migrated into an area and support the Chief in solving petty domestic issues that can arise, from the household to the wider *Adakar* level. The Seers also work with the Chiefs to foretell the future (KII, 28 June 2016). Chief's Elders in Lokori explained that their role served as a bridge between the settlements within a Chief's Location or Sub-location. They disseminate information from the Chiefs and help to monitor the number of people in each settlement, as well as the number of animals in and around the settlement (Focus Group Discussion, 31 January 2019).

The Decentralised Administration Bill also takes into consideration traditional social units. The planned "*Villages*" will be supported by a Village Council (KII, 23 January 2019). Village Councils, where relevant, will include representatives of the *mobile pastoralists* in a given area. This allows the *mobile groups* to communicate with the Village Administrators. When a group moves, communication between the Village Administrators ensures the effective management of any issues arising from this migration (KII, 31 January 2019).

The tree of men, or "*Ekitoe a Ngikileok*"[39] in the Turkana language, is explained as an "*institution being of an ancient establishment linked to the history of organisation of Turkana People*" (Turkana Council of Elders, 2012). The tree of men is both an institution and a place, being the location where elders from a given area meet and deliberate in the implementation of their work. Many research interviews were held "under the tree of men". This place is also used for ceremonial feasts, initiations and gatherings (Müller-Dempf, 1994). Chief elders in Lokwamosing explained that they gather at the tree of men to solve disputes over stolen animals, adultery, negotiations over a dowry and other offences, such as fighting (Focus Group Discussion, 2 July 2016).

In 2012, a group called the Council of Elders was formed as part of a county initiative to improve communication with rural pastoralists. This organisation has its own administrative structure outlined in a constitution approved in June 2012. According to representatives of the Ministry of Public Service (Decentralised Administration and Disaster Management), the Council of Elders serves as an intermediary between the county government system and traditional governance structure. Even though many members are said to live in more urban and populated settlements, they derive their strength from consulting elders based in *Adakar* and who sit under the tree of men (KII, 28 June 2016). However, while closely connected to *Adakar*, the Council of Elders does not directly represent the mobile pastoralists (KII, 29 January 2019).

The Council of Elders Constitution explains that they promote the principles of Turkana leadership, from the basic social unit of family to communal leadership (Turkana Council of Elders, 2012). Unlike other tribes in East Africa that follow kinship organisation in the form of lineages, the Turkana can be described as a gerontocracy – governed by old people. In the family unit, this means the head of the household has the authority. In the community, it is the elders. These positions are not only old men, but rather individuals who also have wealth, and who display generosity and wisdom. This does not mean that the power of elders is unquestioned; those who do not perform well can be ignored and replaced through public opinion (Müller-Dempf, 1994).

Members of the Council of Elders are separate from the Chief's Elders, who primarily focus on the tasks related to the Location and Sub-location, which are overseen by the national government. However, the Chairman of the Council of Elders explained that there are frequently topics that require cooperation (KII, 26 June 2016).

Chief's Elders in Lokwamosing Sub-location explained their different roles and responsibilities in the *Adakar*. Specifically, they said that Chief's Elders do not deal with land and water management issues, which are managed by the *Adakar* elders. They only get involved in difficult cases that require government intervention, particularly issues related to security and peace around the *Adakars* (Focus Group Discussion, 2 July 2016). A member of the Council of Elders in Turkana East Sub-county explained that members in his area know leaders from *Adakar* in a given place. He identified at least five traditional leaders – *Adakar* elders – who are linked to

[39] Sometimes referred to as *Ekitoe a Ngikasukou*, literally tree of old men or elders.

specific clans and sections. He said the inclusion of territorial section leaders is important for the discussion of issues around land, as they have a good understanding of the importance of *ere* and how grazing patterns are managed in different and overlapping territorial sections (KII, 4 July 2016). Similarly, in another example of how government leaders work with traditional elders, the Katilia Ward Administrator in Turkana East described how they cooperate closely with *kraals* in the area by inviting the leadership and ex-warriors to participate in peace talks (KII, 3 July 2016).

6.12.2.6.1.2 West Pokot

Traditional governance structure in West Pokot County is based on the Pokot ethnic group, which predominates the county population. The terminology differs to that of Turkana but there are similarities in decision-making processes and communication.

All information in the list below is from a KII with a Pokot cultural specialist on 4 February 2019. Key terminology related to Pokot traditional social units includes:

- ***Kau or household***: This is the family unit headed by a male head of household, with one or multiple wives, children and often other dependent women. Households may cluster and travel with two to five other households to form a large *Kau*;
- ***Manyatta (plural, mongot)***: A group of *Kau* or households with familial ties. These Mongot could be mobile units or small settlements (or villages). A *Mongot* representative is chosen by the settlement to attend the traditional parliament or gatherings on behalf of the village. These *Mongot* representatives are selected by members of the settlement, based on their effective communication, good judgement, intelligence and quick thinking;
- ***Clan:*** Non-territorial social organisation related to kinship and stock associations. All Pokot are born into the clan of one's father and the women join the clan of their husband upon marriage. There are 36 main clans in Pokot. Each clan has sub-clans, with 330 sub-clans in total. Clan heritage plays a part in determining roles within the traditional structure, with clan lineage associated with certain divine powers that are bestowed on individuals. For example, certain clans have been associated with the abilities of *Kirwook* and *Werkoy*. Certain clans also play specific functions at large gatherings, like *Kokwo* or *Mpoy*;
- ***Kirwook (Judges)***: This is a group of powerful and influential individuals who are perceived to have been bestowed with divine power from their deity. They are the ultimate authority in the traditional leadership structure. Individuals come from various clans and they are considered to have been gifted with wisdom, sense of justice and ability to solve problems. They command respect from all other sectors of the traditional structure. The clans associated with the abilities of a *Kirwook* are *Siwotoy* (buffalo), *Sotot* (sun), *Ngisurot* (rain), *Kasera* (dove), *Pkomor* (wild pig) and *Soko* (lion);
- ***Karoyok (Intestine readers):*** These individuals are believed to have the ability to read prophecies from animal intestines when animal sacrifice is done. If called upon, they usually provide guidance to the *Kirwook* leaders;
- ***Werkoy or "Laibon" (Seers)***: These are individuals who are believed to be gifted with spiritual insight and prefer to remain unknown (invisible) due to security reasons. Thus, they live apart from the settlements, mostly in the mountains and, if needed, they come to provide the *Kirwook* with guidance and knowledge. They have to be summoned through a messenger and these people are known in the area. A seer is bestowed their power through clan lineage and only specific clans are known to produce seers. *Werkoy* are uncommon and can be women, depending on their gifts;
- ***Kokwo (Tree of Men) (Elders gathering)***: This is considered the Pokot Parliament where decisions are deliberated on by *Kirwook* Elders. The size and representation of the gathering depends on the magnitude

of the issue to be deliberated. Nearby *Kirwook* Elders (one or two people) and representatives from affected *Mongot* (homesteads) will convene at *Kokwo*. *Kokwo* is convened under special trees significant to the area. These are either fig trees, sycamore trees or tamarin indica trees; and

- ***Mpoy (Gathering of women)***: This gathering occurs to disseminate the information and the decisions made at *Kokwo* to the women. This group has no decision-making authority. However, this group deals with the discipline of men who abuse women. They are allowed to enact justice for any crime a man commits against women. They have power to arrest, fine or beat men, depending on the crime and irrespective of the man's position in society.

The Pokot traditional structure aligns with the national and county administrations through the Location Chiefs and Assistant Sub-location Chiefs. According to a Key Informant on Pokot Culture, the chiefs are government messengers to the community and are seen as administrators of the government arm. Chiefs cannot make important decisions on their own, rather they would consult with a *Kirwook* elder. A village identifies elders based on their wisdom and respect in the community. Most elders are identified based on the powers associated with a *Kirwook.* If someone with this level of respect is not residing in the village, the nearest one is identified and consulted in matters pertaining to the whole sub-location or location. Communities are aware of who the traditional leaders are and will direct Chiefs to the correct person. Thus, there is a linkage between the government administration and traditional leadership (KII, 4 February 2019).

It was further reiterated that the linkage between the government administration and traditional leadership is through the village or settlement elder. This elder is chosen from the community and acts as the liaison between the Assistant Chiefs and the traditional leadership (*Kirwook*). The elders arbitrate over livestock disputes and social affairs such as adultery, abuse or assault. If issues are not of a cultural nature, the elder will refer issue to the Assistant Chief of the Sub-Location (KII with Pokot Cultural Specialist, 15 June 2019).

6.12.2.7 Demographics

The most recent census data from the Kenya Population and Housing Census (KPHC) was conducted in 2019. A summary of that information by Sub-county is presented in Table 6.12-19, including data from the 2009 census for comparison.

Table 6.12-19: Total Population of Turkana County and West Pokot County

	2009 (Census)	2019 (Census)
Turkana County Total	**855,399**	**926,976**
Kibish	NA	36,769
Loima	119,932	107,795
Turkana Central	134,674	185,305
Turkana East	90,466	138,526
Turkana North	129,087[40]	65,218
Turkana South	135,913	153,736
Turkana West	245,327	239,627
West Pokot County Total	**512,690**	**621,241**

[40] 2009 figure includes Kibish.

	2009 (Census)	2019 (Census)
Pokot Central	85,079	119,016
Pokot North	156,011	134,485
Pokot South (includes Kipkomo)	132,100	183,294
Pokot West	139,500	184,446

*Source: Turkana County Government; West Pokot County Spatial Planning, 2018; *Projection figures provided by West Pokot County Planning Unit; Kenya National Bureau of Statistics, 2019.*

In comparison with data from the 2009 census, 2019 figures indicate some differing trends. The census conducted in 2009, counted a total population of 855,399 in Turkana County. This represented 2.2% of the total population of Kenya, which totalled just over 38.6 million people. The census counted a total of 988,592 ethnic Turkana in the whole country, indicating that 86% of the Turkana people reside in Turkana County. By comparison, the population of ethnic Pokot in Kenya was 632,557 and population of West Pokot County was recorded as 512,690 in the 2009 census.

At that time, the population of Turkana County was expected to be over 1 million in 2012, but precise official statistics were not available. Table 6.12-20 provides the projections for population figures in Turkana and West Pokot County based on a predicted and steady population growth rate of 6.4% a year (Turkana County Government, 2013; West Pokot Spatial Plan, 2019).

The County Integrated Development Plan (2018-2022) for Turkana County estimates population growth for the county to be 3.36% per year for men and 3.34% per year for women, with a revised 2017 projection of 1,122,207, rising to 1,366,596 by 2023. In comparison, Kenya's population growth rate in 2020 was projected to be 2.28%. This rate of population growth is very high and, with services unable to expand at the same rate, is unsustainable.

Table 6.12-20: Total Population of Turkana County and West Pokot County

	2009 (Census)	2012 Projection based on 2009 census	2015 Projection based on 2009 census	2017 Projection based on 2009 census	2019 (Census)	2022 Projection based on 2009 census	2023 Projection based on 2009 census	2030 Projection based on 2009 census
Turkana County	**855,399**	1,036,586	1,256,152	1,122,207 (a)	**926,976**	Not available	1,366,596	Not available
West Pokot County	**512,690**	631, 231	700,414	777,180 (b)	**621,241**	987,989 (b)	Not available	1,338,991 (b)

Source: Turkana County Government; West Pokot County Spatial Planning, 2018; West Pokot County integrated Development Plan 2018-2022; (a) revised value (b) Projection figures provided by West Pokot County Planning Unit/West Pokot County Statistics Office.

However, the figures from the 2019 census suggest that projections made, based on the 2009 census, were incorrect. In particular population figures for Turkana County are frequently presented with a note of caution given that there is unreliable data due to the movement of pastoralist communities, making it difficult to count and track population figures. The 2019 data has drawn the attention of the Turkana County Government and raised questions as to the accuracy of the count. In November 2019, the governor sought a response from the central government as to the preliminary indication of a reduction in three Sub-counties: Turkana West (2.3% decrease), Turkana North (38.6% decrease) and Loima (10% decrease). He suggested that the discrepancies are linked with the inability of migrant pastoralists to be enumerated accurately at the time of the census (County Government of Turkana, 2019).

In addition to the figures highlighted by the Turkana officials, the Sub-county figures suggest movement within Turkana County, especially to Turkana East where most of the Project infrastructure is located. This area, in contrast to the Sub-counties that have decreased in population, has shown an increase of over 50%. While these numbers are being called into question, they indicate a shift towards the Project AoI.

No figure for the number of ethnic Pokot or other ethnic minorities living in Turkana County is available and no data obtained in either county disaggregate population by ethnicity. The relationship between ethnic Pokot and Turkana residing in Turkana County is described in more detail in Section 6.12.2.48 on Social Capital, Security and Conflict.

No data from the 2019 census is available for administrative units below the Sub-county. In 2009, the two Turkana Sub-counties in the AoI, there are approximately 225,000 people. Table 6.12-21 and Table 6.12-22 show the results of 2009 census at the Sub-location level.

Table 6.12-21: Population of Turkana South Sub-county

Turkana South					
Division	**Population**	**Location**	**Population**	**Sub-location**	**Population**
Lokichar	67,742	Lokichar	23,452	Lokichar	10,820
				Kapese	12,632
		Lochwangi Kamatak	20,781	Lochwangi Kamatak	14,561
				Naposumuru	6,220
		Kalapata	23,509	Kalapata	8,941
				Loperot	7,384
				Nakalale	7,184
Kainuk	26,247	Kainuk	11,128	Kainuk	7,151
				Kakongu	1,883
				Loyapat	2,094
		Kaputir	15,119	Kalomwae	3,634
				Nakwamoru	9,080
				Lorogon	2,405
Katilu	41,924	Katilu	41,924	Katilu	17,686
				Lokapel	7,475
				Kalemngorok	8,531
				Kanaodon	8,232
Total Population Turkana South Sub-county					**135,913**

Source: 2009 census

Table 6.12-22: Total Population of Turkana East Sub-county

Turkana East					
Division	**Population**	**Location**	**Population**	**Sub-location**	**Population**
Lomelo	25,438	Lomelo	2,900	Lomelo	1,144
				Katir	1,756
		Napeitom	6,305	Napeitom	6,305
		Nadome	4,572	Nadome	2,975
				Ekipor	1,597
		Kamuge	8,651	Kamuge	5,104
				Ngilukia	3,547
		Kapedo	3,010	Kapedo	1,415
				Silale	1,595
Lokori	65,028	Lokori	32,682	Lokori	8,261
				Kangitit	6,400
				Lotubae	18,021
		Kochodin	4,849	Kochodin	2,039
				Lopii	2,810
		Lochwaakula	6,514	Lochwaakula	1,566
				Kakulit	2,029
				Lokwamosing	2,919
		Katilia	20,983	Katilia	7,747
				Elelea	3,907
				Parkati	9,329
Total Population Turkana East Sub-county					90,466

Source: 2009 census

Turkana County is characterised by clustered settlements. Rural areas are settled by nomadic pastoral communities on a temporary basis as they move in search of water and pasture for their livestock (Turkana County Government, 2013). Rural settlements are often dispersed along luggas, with the community taking their name from the lugga closest to the location. This means that such settlements are linear as they grow alongside the luggas.

Lodwar town, Kakuma and Lokichggio are the three main urban centres in Turkana County. In recent years, this list has expanded to include Lokichar in Turkana South, Lokori in Turkana East, Lokitaung in Turkana North, Kalokol in Turkana Central and Lorugum in Loima, which are the only centres reported to have any urban plans (KII, 4 February 2019). Lodwar town had the largest population of the urban centres, with a total of 35,897 people according to the 2009 census. Figures for urban centres are not yet available from the 2019 census. Kakuma is unique in that it hosts a refugee camp sheltering people fleeing from Sudan, Ethiopia, Uganda, Somalia and Burundi (Turkana County Government, 2013).

Multiple efforts have been made to obtain comparative data on demographics in Turkana East and South Sub-counties. While many Location Chiefs do have written documents or the ability to estimate their population, it is clear that hand-written data and statistics should be treated with caution. Some cite the same figures as the 2009 census and others have typed documents without any clear source or data. No data was obtained from Assistant County Commissioners, Sub-county Administrators or Ward Administrators. Efforts to obtain data from County authorities in Lodwar are linked to food aid distribution. However, these figures are based on multipliers related to the 2009 census, not actual data (KII, 31 January 2019) and 2019 data for the Sub-counties suggest that the multipliers were inaccurate predictors of the demographic change.

During KIIs in May 2017, Sub-location Chiefs provided population estimates for their jurisdictions. These figures were explained to be the data used in the distribution of food aid, which is provided throughout the area and based on population size (KII, 17 May 2017). Table 6.12-23 compares the data provided by Sub-location Chiefs with the data from the 2009 census.

Table 6.12-23: Total Population of Key Locations in the AoI

Location	Population (2009 census)	Estimated Population	Sub-location	Population (2009 census)	Estimated Population
Lokichar (TS)	23,452	36,275	Lokichar	10,820	17,068
			Kapese	12,632	19,207
Kochodin (TE)	4,849	6,410	Kochodin	2,039	3,972
			Lopii	2,810	2,438

Source: 2009 census; KII, 17 May 2017

Assuming the Location Chief's estimates are accurate, comparisons can be made with the expected rate of growth from the County Integrated Development Plan, which suggested an approximate increase of 67% by 2017 (Turkana County Government, 2013). Kochodin is the only Sub-location estimated to exceed the expected increase, almost doubling its population size. The Sub-location of Lopii within the Kochodin Location is estimated to have reduced its population by 13%, with insecurity bring the most likely cause. Such predictions contradict the 2019 Sub-county data, which shows Turkana East growing at the fastest rate in the County.

There are many reasons to question the information in the Table 6.12-23. While the rate of growth indicated is close to the projections made after the 2009 census, unpublished reports have suggested that the figures are actually much higher, with some suggesting that the population of areas of Kochodin, including some of the closest villages to the Project field areas, may be over 15,000 people alone. During research in 2019, opinions varied widely among key informants. There was a broad consensus that the population has increased, especially in key areas in the vicinity of existing operations. However, most also agree that there has been a slowing, or even a reversal, of influx after operations were scaled back in 2017 (KII, 29 January 2019). KIIs in 2019 also suggested that migration patterns, in general, show people moving toward larger settlements, making it very difficult to determine if the observed influx into places like Lokichar differs to that observed at other urban areas of the county.

Anecdotal information collected in primary research suggests that population figures shift because of the availability of grazing land and water, as well as security concerns. The Sub-location Chief of Lochwaangi Kamatak in Turkana South said this is the case with the oasis in his area, where water was good for animals but not fit for human consumption (KII, 29 June 2016). The Sub-location Chief of Kakongu, also in Turkana South, described a similar dynamic. In his Sub-location, he said influx of pastoralists can increase the population tenfold in a short span of time. This results in problems as groups fight for water and, in some cases, increases crime, including the theft of animals and even the rape and abduction of girls (KII, 1 July 2016).

In Kamuge Location of Turkana East, the Chief confirmed that, even though the population has increased since the 2009 census, much of the population has temporarily moved to more urban centres, such as Lokori, due to insecurity. This, he explained, creates a situation in which they set up new permanent areas of residence, but still desire the chance to go back to their traditional home or *ere*. In many situations, some members of a household will stay in the population centres, but families will still keep their animals within Kamuge in *arumrum*, the mobile pastoralist groups set up to improve security in rural areas (KII, 1 July 2016).

The population of West Pokot County in the 2009 was estimated to have a rural population of approximately 117,413. The proportion of people living in urban areas was estimated to be 22.9% of the total population. The rest of the population resides in the periphery of towns and in rural settlements, where agriculture and livestock production are dominant activities (West Pokot Spatial Plan, 2019).

Urban areas and high potential agricultural areas have high population distribution and density. The population density for the county was expected to increase from 69/km^2 in 2013 to 85/km^2 in 2017, due to the high population growth.

The AoI includes a small area of West Pokot Sub-county, including the Endugh Ward, Kositei Location and the Kasitei and Chepochachim Sub-locations (refer to section 6.12.2.2). The population of the Endugh Ward is 17,502 (West Pokot Spatial Plan, 2019). Based on the 2018 estimates of the Assistant Chiefs, the population of Kasitei is 1,052 and Chepochachim is 1,080 people (KII, 2 February 2019).

6.12.2.8 Migration

Migration is at the heart of the way most residents of Turkana County live. Raising animals is the main part of social and economic life. Studies of Turkana life written in the 1950s are still relevant today, where a person is said to grow up and pass through the stages of life being accompanied at every stage by livestock. As soon as one is able, boys begin to herd their father’s stock. Girls learn to water, milk, skin and cut up carcasses, cook meat and work skins (Gulliver, 1951). The severe hazard of erratic rainfall is a critical influence on the main economy of the region, predominantly animal husbandry. Those living in Turkana have adopted strategies to exploit scattered resources that vary unpredictably, causing people to adopt flexible strategies of mobility. This mobility of people and their herds is a prerequisite for survival for a large majority of the Turkana people (Müller-Dempf, 1994). One anthropologist with extensive research experience in Turkana said a general rule of thumb is that most Turkana operate on the assumption that two of every five years is “far from being good”, one year is a drought and every ten years there is a catastrophic drought when two or more drought years happen in a row. As a result, Turkana exploit the harsh environment with herd management and adaptability (Müller-Dempf, 1994).

The pastoralist communities of northern Kenya, which includes areas of West Pokot Sub-county, migrate as part of their livelihood, moving their homes and animals to utilise natural resources in the difficult natural environment. This traditional migration is distinct from a second type of migration that is driven by external factors. In Turkana and West Pokot Counties, this includes conflict and a search for security, as well as migration for economic opportunities. The second type of migration, economic migration, may ultimately improve trade, employment, infrastructure and services, but it can also negatively affect “host” communities in relation to environmental, social and health issues.

Primary research illustrated how many households move on a seasonal basis and how varied their routes can be. Pastoralist culture is nomadic, and people migrate with their herds for better grazing lands and to water sources during the different seasons of the year.

As an example of the second type of migration, one Lodwar based NGO explained that there is a trend in rural-to-urban migration, which they attribute to people dropping out of pastoralism because of conflict, prolonged droughts and loss of animals to disease. Such migration generates informal settlements in major towns like Lodwar. This trend was observed as early as the mid-1980s when the UN set up camps to support refugees in Lokichoggio Urban Settlement, Turkana West Sub-county. Refugees supported by these camps were from civil wars in neighbouring countries (KII, 22 June 2016). In Turkana Central, one Sub-location Assistant Chief attributes population increase to displacement of people from post-election violence in 2007, as well as natural causes, like flooding (KII, 24 June 2016). Multiple interviews in 2019 highlighted that infrastructure development, such as roads, and oil discoveries have led to migrants arriving from Kitale, Eldoret and even as far as Nairobi. This influx has a mixed effect, with some reporting that outsiders “bring chaos” (KII, 30 January 2019), while others, particularly in the business community, say that the outsiders bring new ideas and business (KII, 30 January 2019).

As in Turkana, migration in West Pokot is driven by seasonal changes due to the same pastoral culture and lifestyle. Migration of pastoralists and livestock to seek better water sources leads to increased competition for these available resources especially in times of limited rainfall. It was noted during fieldwork interviews that migration into the West Pokot and Turkana borderline areas by Turkana and Pokot respectively have also been the basis of insecurity and conflict in these areas. The level of insecurity and instability increases during times of limited rainfall when migration occurs, and scarce resources increases conflicts between migrants and residents (KII, 14 June 2019).

During 2021, KJV has observed that due to instability along the border of West Pokot County and Turkana County, there has been significant and as yet unquantified movement of pastoralist groups moving closer to Lokichar in search of increased security.

6.12.2.9 Vulnerable Groups

The consideration of “*vulnerable*” groups must be considered in the context of the term throughout Kenya. Article 260 of the 2010 Constitution makes specific provisions for “marginalised groups”, by which it defines marginalised as:

- A community that, because of its relatively small population or for any other reason, has been unable to fully participate in the integrated social and economic life of Kenya as a whole;
- A traditional community that, out of a need or desire to preserve its unique culture and identity from assimilation, has remained outside the integrated social and economic life of Kenya as a whole;
- An indigenous community that has retained and maintained a traditional lifestyle and livelihood based on a hunter or gatherer economy; or
- Pastoral persons and communities, whether they are (i) nomadic; or (ii) a settled community that, because of its relative geographic isolation, has experienced only marginal participation in the integrated social and economic life of Kenya as a whole.

The Constitution further states that “*marginalised group*” means a group of people who, “*because of laws or practices before, on, or after the effective date, were or are disadvantaged by discrimination…*”. By such Constitutional definitions, the Turkana people can be considered marginalised or vulnerable.

Other common criteria for assessing vulnerability are poverty rates. In 2013, the County Integrated Development Plan estimated that 90.8% of the population of Turkana live below the poverty line (Turkana County Government, 2013). Such rates are extremely high and further suggest that the entire County can be considered vulnerable.

Another factor in assessing poverty, sometimes left out of standard measurements of income, are whether households are non-pastoralist, as distinguished from those that still practice pastoralism. This distinction can influence the pattern of poverty, with most poverty being found in settled or town-based ex-pastoralists, casual labourers and traders (Little, 2014).

While it is clear that, by definition in the Constitution, the Turkana people are marginalised, traditional criteria for assessing poverty need to be considered in the pastoral context. When asked about vulnerability during field research, key informants frequently cited common factors that are used for targeting additional aid or humanitarian assistance to individuals within a Location or Sub-location. Commonly cited groups are:

- Orphans and Vulnerable Children (OVCs);
- Elderly;
- Widows;
- People with disabilities; and
- People with HIV.

According to the Assistant Sub-location Chief of Lochwaangi Kamatak, vulnerable groups are sometimes identified using criteria established by groups intending to assist vulnerable groups (KII, 29 June 2016). Taking into account the above anecdotal information, the Resettlement and Livelihood Restoration Framework (Annex I) includes the following criteria for identifying if a household may be potentially vulnerable:

- The household is female-headed;
- The household is elderly-headed (60 years and older);
- The household has one or more physically and / or mentally disabled household members;
- The household has a high number of dependents relative to the number of household members able to generate livelihoods or income;
- The household has particularly low levels of income or limited sources of livelihood, eg. does not own livestock or only owns few livestock.

These criteria are considered to contribute to a household's resilience or ability to restore livelihoods. The Operator considers all pastoralists in the AoI to be vulnerable and marginalised.

The NDMA in Kenya is the governmental body that coordinates all matters relating to drought risk management and establishes mechanisms, either on its own or with stakeholders, that will end drought emergencies in Kenya and promote sustainable livelihoods. The NDMA was established to develop project-based interventions at a time when drought periods were becoming increasingly frequent and intense, directly affecting the household food security and livelihoods of more than ten million people (NDMA, 2017).

The NDMA, working with World Vision and Oxfam, identified vulnerable households by registering poor households on a database in 2012. A system of wealth ranking was used to generate a database of "poor" households. Through this database, they were able to assess the eligibility of households to receive benefits from a cash transfer program as part of a hunger safety net sponsored by the government and the UK Department for International Development (KII, 27 June 2016). An estimated 39,000 households, or roughly 20% of those assessed, were considered to be vulnerable or living on $1 or less per day (KII, 1 February 2019).

The NDMA also produces monthly reports on drought early warning and address socioeconomic indicators related to livestock conditions and market performance (crop prices for maize and beans, terms of trade), vegetation cover, access to water sources and food consumption. The assessment is focused on several livelihood zones, these being Pastoral, Agro-pastoral and Fisheries for Turkana, and Pastoral, Agro-pastoral and Mixed farming for West Pokot.

In terms of vulnerability, pastoralism is considered as the most vulnerable of these livelihood zones given that it is based on a single livelihood (KII, 14 June 2019). The population proportion for this livelihood zone is 60% for Turkana and 33% for West Pokot. NDMA also assess vulnerability based on anticipated natural disaster affecting households, where food and nutrition security indicators report less favourable conditions for pastoral livelihoods, when comparing with the other livelihood zones during both the short and long rains assessment. Table 6.12-24 provides an overview of the differences between livelihood zones assessed by NDMA for Turkana and West Pokot and compares three indicators during short and long rains where pastoral livelihoods zones present less favourable conditions when water consumption or distance to grazing is assessed (in comparison to the other two livelihood zones).

Table 6.12-24: Recent Food Security Trends for Turkana and West Pokot

Indicator	Turkana [a]		West Pokot [b]	
	Short Rains Assessment Feb 2021	Long Rains Assessment July 2019	Short Rains Assessment Feb 2021	Long Rains Assessment July 2019
Livestock body condition	Pastoral: Fair	Pastoral: Good	Pastoral: Fair to Good	Pastoral: Good
	Agro-pastoral: Fair	Agro-pastoral: Good	Agro-pastoral: Fair to Good	Agro-pastoral: Good
	Fisheries: Fair	Fisher folk: Fair	Mixed Farming: Good	Mixed Farming: Good
Water consumption (litres per person per day)	Pastoral: 10 litres (ltr)	Pastoral: 10 litres	Pastoral: 5 to 10 litres	Pastoral: 8 litres
	Agro-pastoral: 20 litres	Agro-pastoral: 20 litres	Agro-pastoral: 10 to 15 litres	Agro-pastoral: 10 litres
	Fisheries: 10 litres	Fisher folk: 10 litres	Mixed Farming: 15 to 20 litres	Mixed Farming: 15 litres
Distance to grazing (km)	Pastoral: 5 to 8 km	Pastoral: 5 km	Pastoral: 4 km	Pastoral: 3 to 4 km
	Agro-pastoral: 3 to 5 km	Agro-pastoral: 4 km	Agro-pastoral: 4 km	Agro-pastoral: 1 to 2 km
	Fisheries: 4 to 6 km	Fisher folk: 4 km	Mixed Farming: 4 km	Mixed Farming: <1 km

Source: [a] Turkana County 2020 Short Rains Food and Nutrition Security Assessment Report, NDMA 2021a; Turkana County 2019 Long Rains Food and Nutrition Security Assessment Report, NDMA 2019a; [b] West Pokot County 2020 Short Rains Food and Nutrition Security Assessment Report, NDMA 2021b; West Pokot County 2019 Long Rains Food and Nutrition Security Assessment Report, NDMA 2019b.

The NDMA 2021a; NDMA 2021b; and NDMA 2021c describe the impact on food security of both the COVID-19 pandemic and desert locust swarm invasions. Restrictions on movement of people, livestock and goods in response to COVID-19 disrupted access to food, whilst the closure of schools restricted access to the school meals programme (NDMA, 2021c). In Turkana, the need to divert limited household income to medical expenses exacerbated food security concerns at a time when household incomes were reduced due to lack of demand for livestock (due to inability of buyers from other counties to access the market) (NDMA, 2021a).

Turkana was impacted by the second wave of desert locust invasion, which destroyed large swathes of pasture – estimated to total approximately 450,447 hectares (ha) (NDMA, 2021a). NDMA also report cases of illness amongst livestock as a result of ingesting locust droppings. West Pokot also experienced damage because of desert locusts, including an estimated 9,980 acres of lost pasture and browse (NDMA, 2021b). Widespread treatment of swarms was undertaken across Kenya, although funding for ongoing treatment to curb the spread of desert locusts was projected to run out by mid-April 2021 (NDMA, 2021c).

The Turkana County Government notes that people with disabilities have been marginalised in all sectors of development within the county. They explain that such people have been treated with disdain and are seen as dependents who cannot add value to developmental processes. There has been a national campaign to recognise that people living with disabilities should not be treated with contempt but should be given equal opportunities, similar to those given to other special interest groups, such as women and young people. A major challenge in Turkana County is that there are only a few institutions that take care of the needs of persons with disabilities (Turkana County Government, 2013).

Vulnerable groups receive aid from a variety of sources, depending on the groups in need. For young people and women, for example, the government has set aside 6.9 million KES (~$65,400 USD). This has assisted over 1,200 registered groups who have aided in the development of business ideas. Managed via the Ward Administrators, the programme awards anywhere from 70,000 KES up to 1.1 million KES (~$700 up to ~$10,400 USD) for projects related to shore management along Lake Turkana (KII, 29 June 2016). Vulnerable people are also assisted by NGOs and organisations, such as the NDMA. The Sub-location Assistant Chief of Kakongu listed the Red Cross and World Vision as known NGOs that have provided assistance to vulnerable groups (KII, 1 July 2016).

6.12.2.10 Infrastructure and Services

In general, by nature of its location, climate and relatively neglected history since independence, the infrastructure and services of Turkana County are poor. However, there are recent signs of improvement. A representative of the German NGO GIZ (Gesellschaft für Internationale Zusammenarbeit) stated that infrastructure and services are improving as a result of the devolved system of government. Health facilities are improving and the distance to health facilities has been reduced. There are more ECD facilities, which has allowed more access to education for small children. Improvements have been generally more noticeable in Lodwar, 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 the lack of security along the A1 highway (KII, 25 June 2016).

West Pokot County infrastructure is similar to that of Turkana County, with poor waste and sanitation systems. Education facilities are also limited, especially for those living as pastoralists. Facilities, including schools, are minimal unless they are funded by churches or NGOs (KII, 31 January 2019).

6.12.2.11 Waste

Uncontrolled waste disposal is a major contributor to environmental degradation in Turkana county. Local authorities collect only 0.2% of the waste generated communities. Only 20,000 households in Turkana County are thought to use latrines. This situation contributes to water, soil and air pollution and poses a health threat to communities (Turkana County Government, 2013). One NGO in Lodwar that has monitored waste management notes an overall lack of facilities to manage waste and poor infrastructure, especially in the informal settlements in the town of Lodwar, which is considered to be the only settlement in Turkana with waste management services. The group reported that, even in Lodwar, there is no legal site to dump waste. There are only two solid waste collection trucks, which collect waste from a limited number of locations in Lodwar town. These trucks make one trip a day and this constitutes the only waste management service in the entire town. The trucks use the existing dump site for waste but have recently received a permit by improving the location and fencing it. The overall lack of waste facilities causes people to dump illegally, including in the Turkwel River, which runs through Lodwar (KII, 22 June 2016).

The Lodwar Water and Sewerage Company (LOWASCO) is the only service to collect and manage liquid waste, which mainly consists of sewage discharge from septic tanks across Lodwar. Most of this sewage comes from hotels and septic tanks (KII, 22 June 2016).

In West Pokot County, there is no sewerage network system. Septic tanks and pit latrines are the most common wastewater disposal systems. A majority of households in rural areas use pit latrines, while urban sanitation comprises septic tanks and pour and flush systems of sanitation. According to the latest survey conducted in the County in 2013, completed by Action Against Hunger (AAH) in collaboration with MoH, West Pokot had latrine coverage of 18%. This has since increased to 48.7%. The number of households with latrines stands at 30,449, representing 33% of the population. There are 156 households using septic tanks for disposal of sewage and wastewater, 1,922 households with ventilated improved pit (VIP) latrines, 28,527 households using pit latrines and a majority of 62,901 households, representing 67% of the population, using bushes (especially in the rural areas) (West Pokot Spatial Plan, 2019).

6.12.2.12 Water

Turkana County has inadequate water for domestic use, livestock and crop irrigation. Rainfall is inadequate and too unreliable to meet demand. About 88% of Turkana’s residents depend on surface and sub-surface dams for water, which often do not hold sufficient water due to the high evaporation rate during the dry seasons. According to the County Government, the main water sources in Turkana are hand dug shallow wells, piped water and river water. Access to quality water is a critical problem for the County, although a recent programme managed by the National Government and United Nations International Children's Emergency Fund (UNICEF) has benefited some communities with new wells dug to improve assess in schools. Some of these wells generated high yields. There is one water supply company, LOWASCO, which operates only in Lodwar. All other areas get their water from the main sources noted above (Turkana County Government, 2013).

The distance to the closest water point varies throughout the County but averages between 5 and 10 km. In urban settlements and some market centres, Water User Associations have developed piping systems that move water closer to settlements. However, this is the exception. In remote areas of the County, people can travel 10 to 20 km to reach their closest water source (Turkana County Government, 2013).

Across Turkana East and Turkana South, the Operator has contracted a supplier to use water bowsers to fill the water storage tanks daily. The Location Chief of Kochodin indicated that there is a government plan to drill a borehole in Nalemsekon for purpose of irrigating 500 acres of land, which has already been fenced. It would benefit about 100 households. One borehole was drilled by the Operator in Nakukulas area and a hand pump in Karuko. The furthest distance people travel in Nakukulas settlement to get water is 500 m (KII, 4 July 2016).

The hydrocensus completed by KJV in 2021 recorded a combination of boreholes, community water tanks and hand dug wells being used by the community for water access. Water supply type and location are presented in Figure 6.12-6.

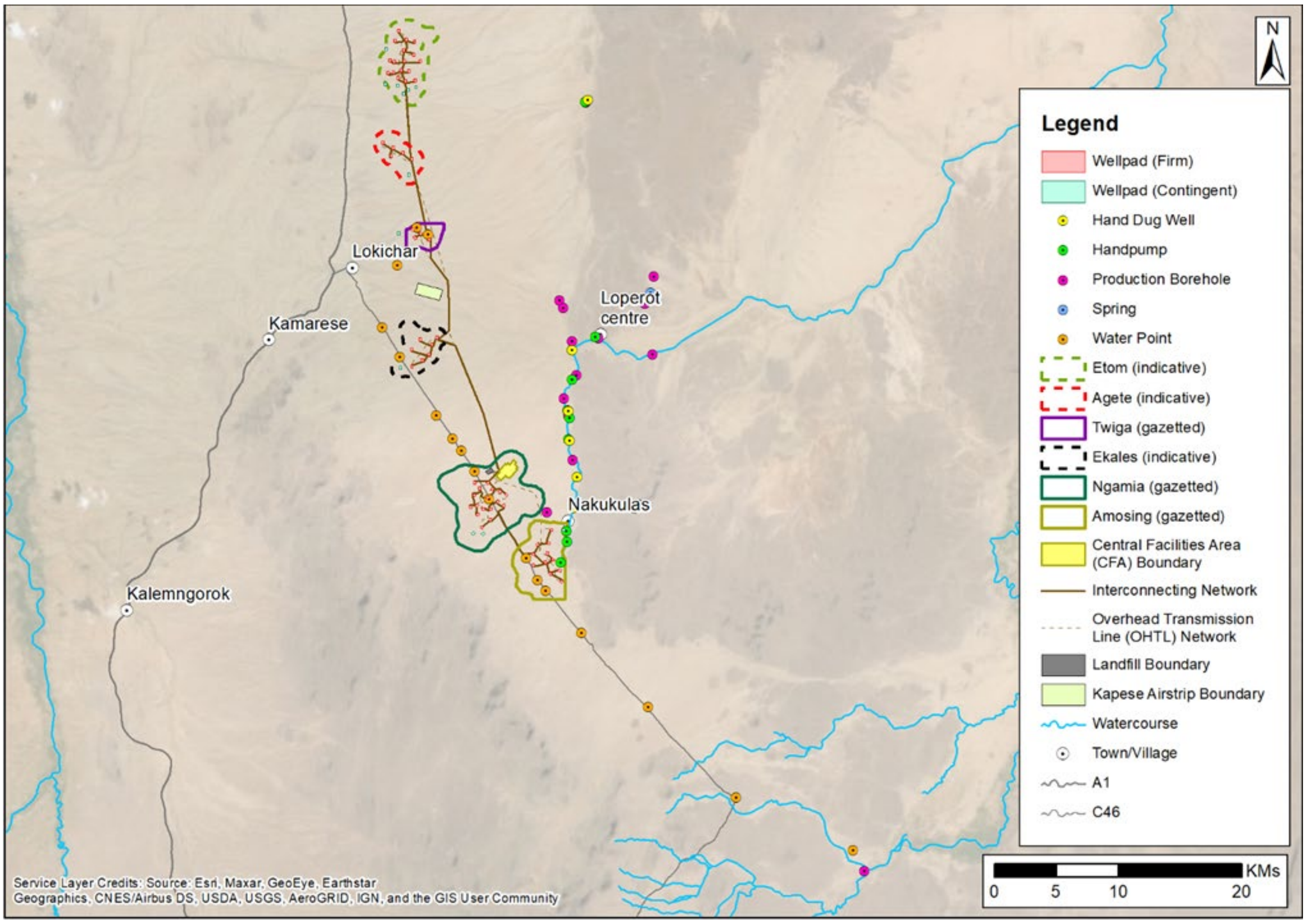


Figure 6.12-6: Water Supply Type and Location, identified during Hydrocensus (2021)

The households in West Pokot County with access to borehole/spring/well water stands at 26,259, which translates to 28% of the population. There are also 8,563 households with access to piped water, while 1,210 households piped water in their dwellings. However, the majority of households (59% of the population) still use rivers/streams as their source of water. The average distance to the nearest water point is 5 km. In summary, water resources in the county are unevenly distributed (West Pokot Spatial Plan 2019).

The Turkwel Gorge Reservoir has a maximum design capacity of 1.5 million cubic metre per day (m^3/d) yield. It is used for hydro-electric power generation. The dam borders North Pokot and West Pokot Sub-counties and falls within the Turkwel Ward of West Pokot Sub-county (KII, 1 February 2019).

In the Kositei Location, Pokot West Sub-county, water is sourced from the Suam River, Malmalte River and the Turkwel Gorge Reservoir itself. There are no boreholes in Kositei Location. However, the closest borehole is in the Kour Sub-location in Pokot North Sub-county and was drilled by POK. People who are close to the water source have regular access, but others can walk for a distance of 8 km, up to 4 hours, to the source. Residents from the most distant village, Kamurio, can walk up to 23 km to fetch water. The people, domestic animals and wild animals all depend on these water sources throughout the year (Focus Group Discussion, 2 February 2019).

6.12.2.13 Electricity

The challenges facing the power sector in Turkana include weak transmission and distribution infrastructure, high cost of power, low per capita power consumption and low Country-wide electricity access. Only 1% of households have access to electricity in the home, even with the close proximity of the Turkwel Reservoir Dam hydroelectric facility (Turkana County Government, 2016). Hydroelectric power only connects to Kainuk, and recent efforts have connected Kalemngorok, Katilu, Kakongu and Lokichar to the main grid. Lodwar settlement is powered by diesel generators and several other projects are underway to connect larger population centres. Within the household, 95% use kerosene and firewood for lighting. Similarly, cooking is done with wood, kerosene and charcoal. Some solar energy has been used for pumping of water and lighting, especially in schools (Turkana County Government, 2016). Kenya Power is also piloting the use of solar energy. It has installed panels at the Lodwar station to complement diesel production. In addition, the Ministry of Energy has installed 98 solar panels on schools and government buildings (Turkana County Government, 2013). Some households near Lodwar were observed to have solar panels and wired electricity, but supply was said to be intermittent and data on such infrastructure was not available.

The Location Chief in Kochodin confirms that there is no electricity supply in the area, with most people using torches for lighting purposes (KII, 4 July 2016).

Wind is seen as a potential resource for the future. This potential has led to the development of the Lake Turkana Wind Power project in neighbouring Marsabit County. This project comprises 365 wind turbines and will connect to the national grid. It is expected to generate 310 MW (approximately 15% of the country's installed capacity). The project has been supplying power to the national grid since September 2018 (Lake Turkana Wind Power website, FAQs section [accessed 15/06/2021]).

In West Pokot County, the main source of energy is fuel wood, which accounts for 90% of the energy needs of the county population. Petroleum energy is another source, accounting for 5% of energy needs. Only 2% of the population accesses electricity and only 10% are connected with power. Electricity power outages are also prevalent in the county. Paraffin, which is another source of energy, is used by 8% of population. Other sources of energy in the county include charcoal and solar. The county has high potential for solar energy, which remains untapped (West Pokot Spatial Plan 2019).

In the Kositei Location, West Pokot Sub-county, there is no electricity in Chepokachim Sub-location, but there is in Kasitei Sub-location, specifically in the Kampi Village (Turkwel camp) and Turkwel Secondary school (KII, 2 February 2019). Electricity is also connected to the Riting Primary School, but the rest of the location's schools and villages are powered by solar power systems provided by the national government and the use of firewood (KII, 30 January 2019).

6.12.2.14 Roads and Transport

The Turkana County road network is poorly developed. There are 5,496 km of existing roads, of which only 489 km are bitumen. Key challenges for road development are seasonal rivers that cut through roads and poor soils that increase the cost of construction and maintenance. Many roads are not passable during rainy seasons (Turkana County Government, 2013).

There are 22 air strips for air transport, 4 of these being tarmacked facilities: Lodwar, Lokichoggio, Kakuma and Kalokol (Turkana County Government, 2013).

The poor condition of roads was mentioned in numerous interviews. The roads are corrugated and badly weathered with potholes. Many sections are impassable in wet conditions and vehicles get stuck for days. In Kalemngorok, livestock traders blame the road conditions on their ability to meet supply orders (Focus Group Discussion, 5 July 2016). In Lokori Ward, the Ward Administrator explained that the dry season allows for greater access to surrounding areas, linking the area to other trading centres not available in the rainy season (KII, 1 July 2016).

In West Pokot County, road transport is the major mode of transport. The road network is relatively well developed. It is predominantly earth and gravel surfaces, which make up 87% of the road network. The gravel surface roads cover a distance of 349 km, while the earth surface roads cover 697 km. The total length of tarmac road is only 151 km. The general status of the road network in West Pokot County is poor. There is an airstrip at Kishaunet but, apart from this, air transport is non-existent (West Pokot Spatial Plan, 2019).

The road network in the Kositei Location, Pokot West Sub-county, is mostly in poor condition. The road to Turkwel from the Kainuk junction is tarmacked but other areas of the road network are not as well maintained. As a result, access to most parts of Kositei Location and the broader Turkwel Special Ward area is very difficult. There is even the use of motorboats to cross the dam as a means of transport (KII, 29 January 2019, 11 June 2019).

6.12.2.15 Media

Radio is one of the few forms of media available in Turkana. Radio Turkana, one of the main stations, covers about 75% of the county and has broadcast information on oil and gas exploration. Coverage of the station is mostly in Turkana East, Turkana South, Turkana Central, and Loima. While this is a commercial entity, it works with charitable organisations to support development initiatives, such as encouraging testing for HIV (KII, 25 June 2016).

There are no newspapers printed in Turkana County, however journalists work as freelancers for Nairobi based media and they report for national media outlets (KII, 1 February 2019).

There are three main local radio stations in West Pokot. Each transmit from the town of Mukutano and the language used is primarily in Swahili and the local Pokot language. These cover the entire County and can also be received in neighbouring Counties like Turkana, Trans Nzoia and Elgeyo Marakwet. Radio is the main and preferred media in rural areas while more urban residents tend to watch national television.

6.12.2.16 Economics and Livelihoods

The majority of people in Turkana County and West Pokot County depend on nomadic pastoralism and crop farming, as well as fishing and weaving for their livelihood. Types of livestock bred in the AoI are cows, goats and sheep (shoats), camels, donkeys, and poultry (mainly chicken). Most of these are indigenous breeds. The Kerio River and Turkwel River are key sources of water to support animal husbandry. Farming is mainly practiced at household level through irrigation along the Rivers Turkwel and Kerio. The main crops produced in Turkana are sorghum, millet, maize, and vegetables, like kales. Fishing is also practiced in Lake Turkana (Turkana County Government, 2013).

The KJV survey in April/May 2021 included brief discussion with households located within the field areas and within settlements. Although the sample group cannot be considered representative, it can offer some context. The following presents what interviewees cited as their source of livelihood:

- In field areas 100% of interviewees cited pastoralism as the source of livelihood (sample number of 42)
- In settlements located along the A1 road, interviewees cited the following percentage split as their source of livelihood (sample number of 54):
  - 37% charcoal burning and pastoralism;
  - 30% trade / pastoralism; and
  - 33% trade / employment.
- In settlements located along the C46 road, up to the A1 junction, interviewees cited the following percentage split as their source of livelihood (sample number of 64):
  - 34% pastoralism;
  - 5% charcoal burning and pastoralism; and

- 58% trade.

In West Pokot County, apart from agricultural and livestock enterprises, transport, trade and small-scale gold mining is increasing in economic importance. The trade in the market centres is increasing, especially at Makutano, Chepareria, Ortum and Marich townships. Small-scale gold mining activities are present in parts of the county and support thousands of people (West Pokot Spatial Plan, 2019).

In response to a drought and increase in food prices that took place in 2010 to 2011, Oxfam led a group of development agencies in trying to improve early warning systems, differentiate between chronic and acute vulnerability and better understand livelihoods, in order to better understand how to respond to emergencies. This generated a division of Turkana County into six zones in a livelihood framework. Each zone is defined as an area within which people generally share the same patterns of access to food, such as they grow the same crops or keep the same types of livestock. They also share the same access to markets. Patterns of livelihood clearly vary from one area to another. Local factors, such as climate, soil and access to markets, all influence livelihood patterns (Oxfam Save the Children, 2012).

West Pokot County has three main livelihood zones, namely pastoral (60%), agro-pastorial (20%) and mixed farming (20%). The county is divided into these zones with the high potential agricultural land being predominantly in the south of the county.

The AoI falls mainly in the Turkana central pastoral (TCP) livelihood zone. Within this zone, 80% of the population rely on livestock to provide the main source of food and cash income. The remaining 20% depend on a combination of self-employment (e.g., charcoal, mat and basket making, brewing), wild food and relief. This zone has relatively less grassland than the Turkana border pastoral (TBP) livelihood zone but is more secure and has better access to key markets in the County, as well as to government services. There is no agriculture, nor any cash crops in the TCP (Oxfam Save the Children, 2012).

Areas on the border of Turkana and West Pokot Sub-counties are part of the Turkwel agro-pastoral (TAP) livelihood zone where some irrigation schemes have been developed (Oxfam Save the Children, 2012).

6.12.2.17 Pastoralism and Agro-pastoralism

Turkana County has about 2.5 million hectares of arable land. Land has been under-exploited for agricultural production. Only 31% of land in the high and medium area is under production, which represents only 5% of the land in the county. ASAL which represents 84% of the land also remains largely underutilised. The agricultural yield is limited by factors like water, soil nutrients and skilled labour, as well as pest, animal disease and post-harvest wastage (Turkana County Government, 2016).

In West Pokot County, pastoral livelihoods are predominantly practiced by the population. The livestock industry contributes to the food and cash needs of the pastoralist and provides employment to 90% of the population of 512,690 (Census: 2009). It is also used as a medium for social exchange in the payments of bride price, fines, and gifts (West Pokot Spatial Plan 2019).

High potential agricultural land is found in three divisions located in the South of West Pokot, these are: Kapenguria, Chepareria and Sigor. While rain fed crop production is possible only in parts of Kapenguria and Chepareria, farming in Sigor depends on irrigation. A large variety of crops is grown, including maize, finger millet, sorghum and beans and the main cash crop production is based on coffee, pyrethrum and cotton. The County Agricultural Office reports that 60% of the farmers in Kapenguria division can be classified as modern farmers while in Chepareria 20% can be classified as modern. Modern farmers use certified seeds, fertilizer, chemicals and to some extent, machinery on their farms. These modern farmers also adopt good crop husbandry practices, which reflects a gradual move towards market-oriented production (West Pokot Spatial Plan 2019).

There is limited quantitative data that allows for socio-economic trend analysis. The NDMA monitors the spread of diseases amongst livestock and some biophysical and socio-economic indicators. NDMA has 9 monitors (reduced from 21 monitors in 2016) in each livelihood zone. Each month, each monitor conducts 30 individual surveys in order to get data for the whole County (KII, 27 June 2016 and 1 January 2019).

Aggregated information is used each month to determine an overall status in the early warning system. Based on the overall aggregated determination, NDMA raises a flag at various state institutions, such as schools, in order to inform residents of the current status (KII, 27 June 2016). NDMA have reported several drought alerts in Turkana since May 2020, with fewer in West Pokot (Table 6.12-25 and Table 6.12-26).

Table 6.12-25: Livelihood Zone and Turkana County Status for Drought Early Warning May 2020 to April 2021

Zone	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Pastoral - All species	Norm	Norm	Norm	Norm	Norm	Norm	Norm	Alert	Alert	Alarm	Alarm	Alarm
Agro-Pastoral	Norm	Norm	Norm	Norm	Norm	Norm	Norm	Norm	Alert	Alert	Alarm	Alarm
Fisheries	Norm	Norm	Norm	Norm	Alert	Alert	Alert	Alert	Alert	Alarm	Alarm	Alarm
County	Norm	Norm	Norm	Norm	Norm	Norm	Norm	Alert	Alert	Alarm	Alarm	Alarm

Source: NDMA Drought reports May 2020 – April 2021

Table 6.12-26: Livelihood Zone and West Pokot County Status for Drought Early Warning May 2020 to April 2021

Zone	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Agro-Pastoral	Norm	Norm	Norm	Norm	Norm	Norm	Norm	Norm	No report	Norm	Norm	Norm
Pastoral	Norm	Norm	Norm	Norm	Norm	Norm	Norm	Norm	No report	Norm	Alert	Alert
County	Norm	Norm	Norm	Norm	Norm	Norm	Norm	Norm	No report	Norm	Norm	Norm

Source: NDMA Drought reports May 2020 – April 2021

NDMA also monitor Terms of Trade (ToT), a livestock price ratio that measures the proceeds from the sale of a goat in relation to the amount of maize that can be purchased. West Pokot experienced growth of its ToT between August and November 2020 meaning that individuals were able to purchase more maize (kilogram (kg)) per every goat sold, before dropping again in the first half of 2021. Turkana shows less variation over the same time period (May 2020 to April 2021[41]). ToT in West Pokot have remained higher than in Turkana throughout that time period (Figure 6.12-7).

[41] No Drought Report is available for West Pokot for January 2021, so no data is available for that month.

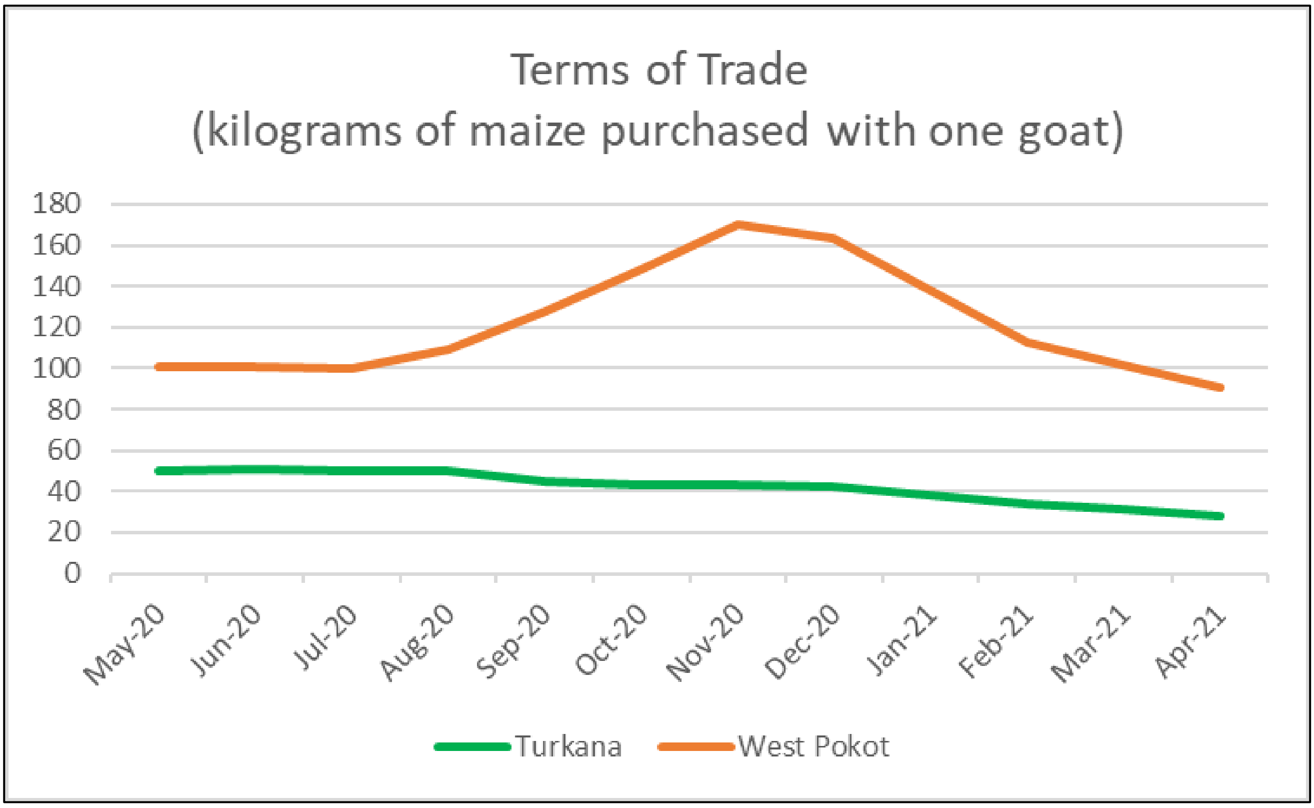


Figure 6.12-7: Price Ratio/Terms of Trade May 2020 to April 2021
Source: NDMA Drought reports May 2020 – April 2021

When comparing long term data in Figure 6.12-8, both counties had a stronger ToT in 2018 than the average recorded during the reporting period from 2015 to 2017. The impact of COVID-19 on these longer term trends is not yet fully understood, although the drought reports indicate that the current ToT in Turkana is slightly below the average between 2016 and 2020, whilst in West Pokot current ToT remains higher than the long-term average.

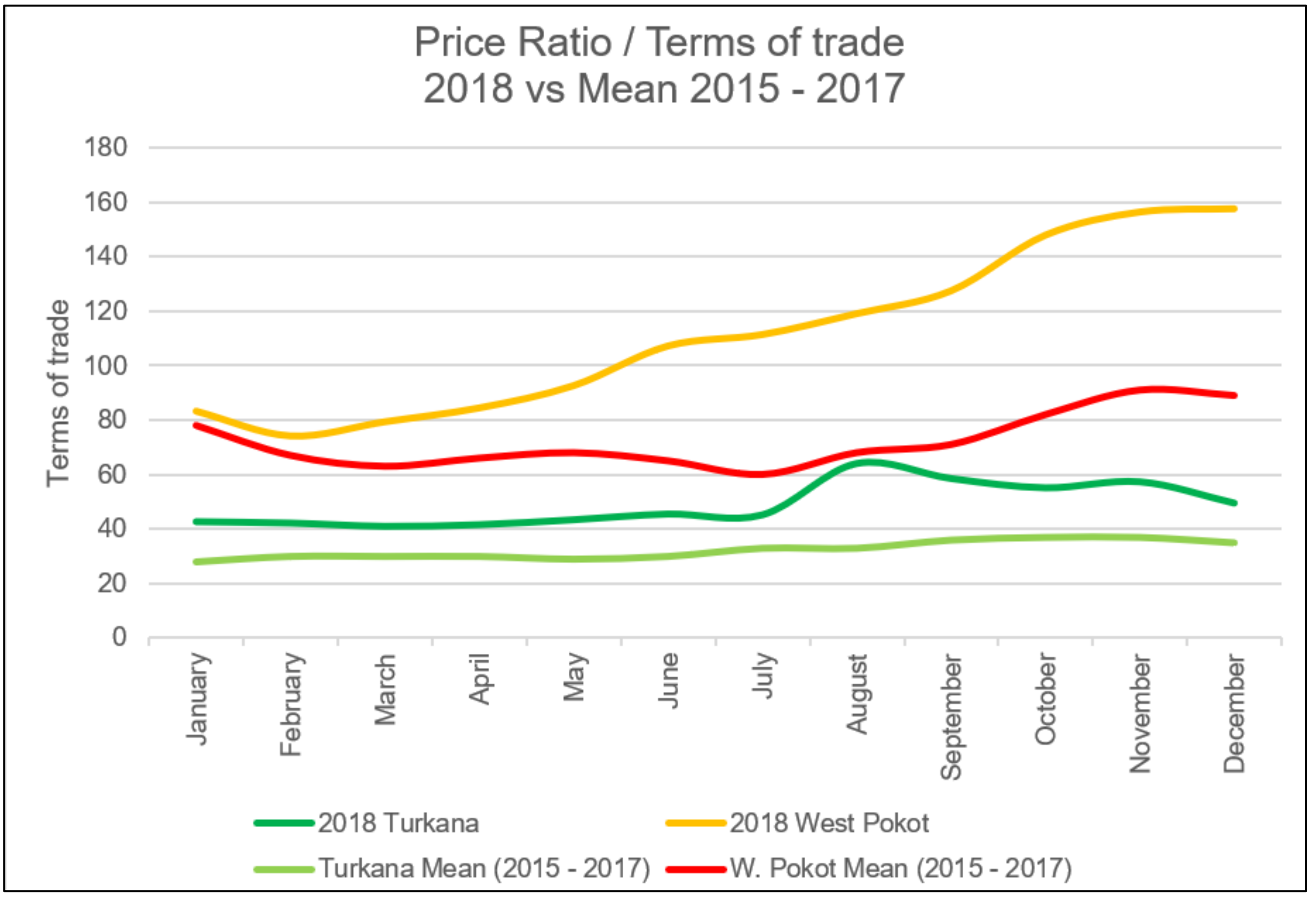


Figure 6.12-8: Long Term Data Price Ratio/ToT 2018 vs Mean 2015 to 2017.

Source: NDMA Drought reports 2015 – 2018.

The ToT is impacted by the cost of other key goods, such as the price of cattle or maize itself. The less favourable ToT reported in Turkana is partly explained by a higher maize price (relative to the maize price reported in West Pokot) during May 2020 and April 2021. A consistently higher price means that individuals in Turkana have received fewer kilograms of maize for each goat sold throughout the reporting period (Figure 6.12-9). Maize prices in Turkana have varied from 65 Ksh to 70 Ksh per kg of maize between May 2020 and April 2021, with an average of 68.5 Ksh for kilogram, compared to an average of 36.5 Ksh per kilogram in West Pokot. In West Pokot, maize prices have seen greater variation, with prices dropping from 45 Ksh in June 2020 to a slow as 27 Ksh in November 2020, before rising back to around 40 Ksh in 2021.

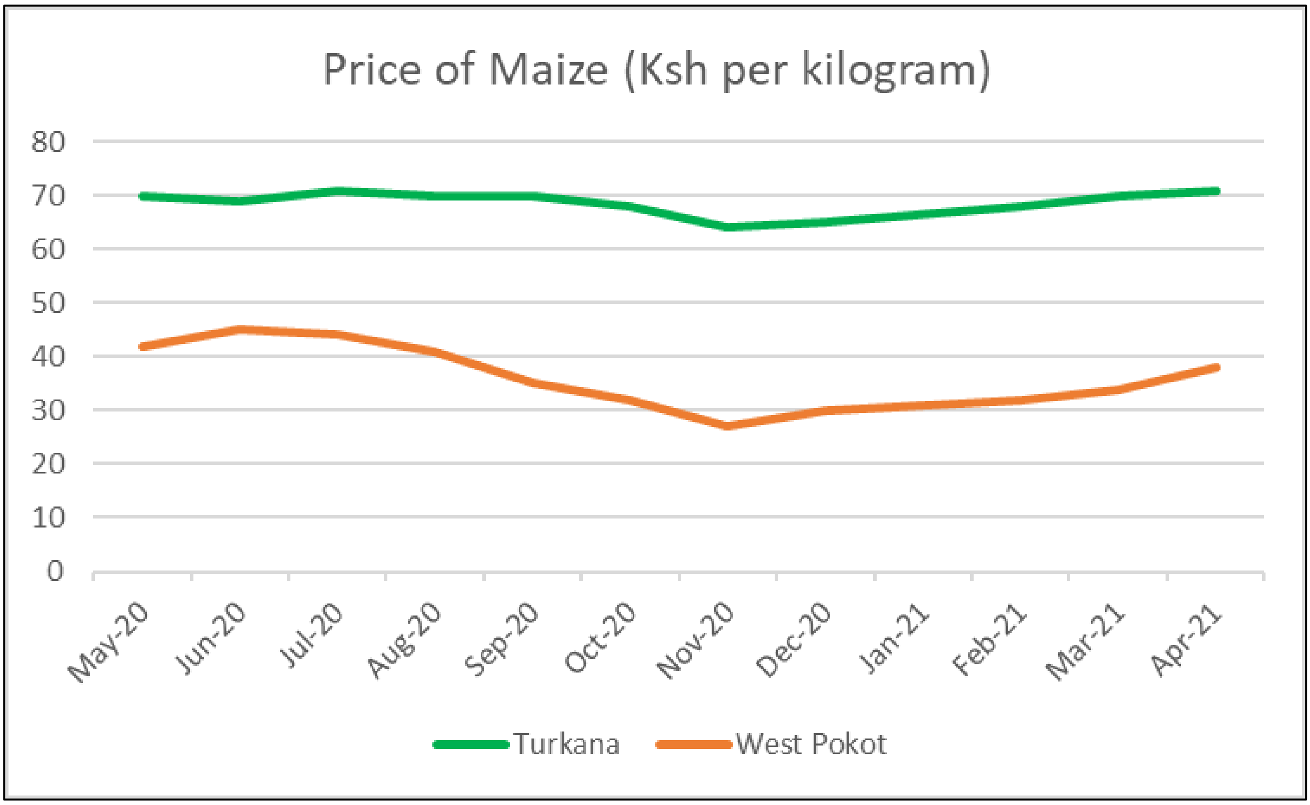


Figure 6.12-9: Maize Prices May 2020 to April 2021.

Source: NDMA Drought reports May 2020 – April 2021

The less favourable ToT in Turkana is also likely driven in part by the disparity in cattle value reported between May 2020 and April 2021. Whilst both counties saw relative stability in the price of small ruminants (goats) throughout the reporting period, with a decline in prices from January 2021 onwards, there is a notable difference in the average value of a 2-year-old, medium sized goat between the two counties. The average price for a goat in Turkana between May 2020 and April 2021 was 2912 Ksh, whilst in West Pokot it was 4225 Ksh (NDMA Drought reports May 2020 – April 2021).

Other indicators of stress on pastoralists are low levels of milk production and consumption. Milk production and consumption have remained relatively stable between May 2020 and April 2021, around the 1.5 litres per household per day level. There has been a decline in both production and consumption in 2021, particularly in Turkana (Figure 6.12-10). This has been linked to low calving rates and large-scale migration in search of forage. In West Pokot the downward trend in milk production and consumption in 20211 has been attributed to inadequate access to, and regeneration of, forage in traditional grazing area (NDMA Drought reports May 2020 – April 2021).

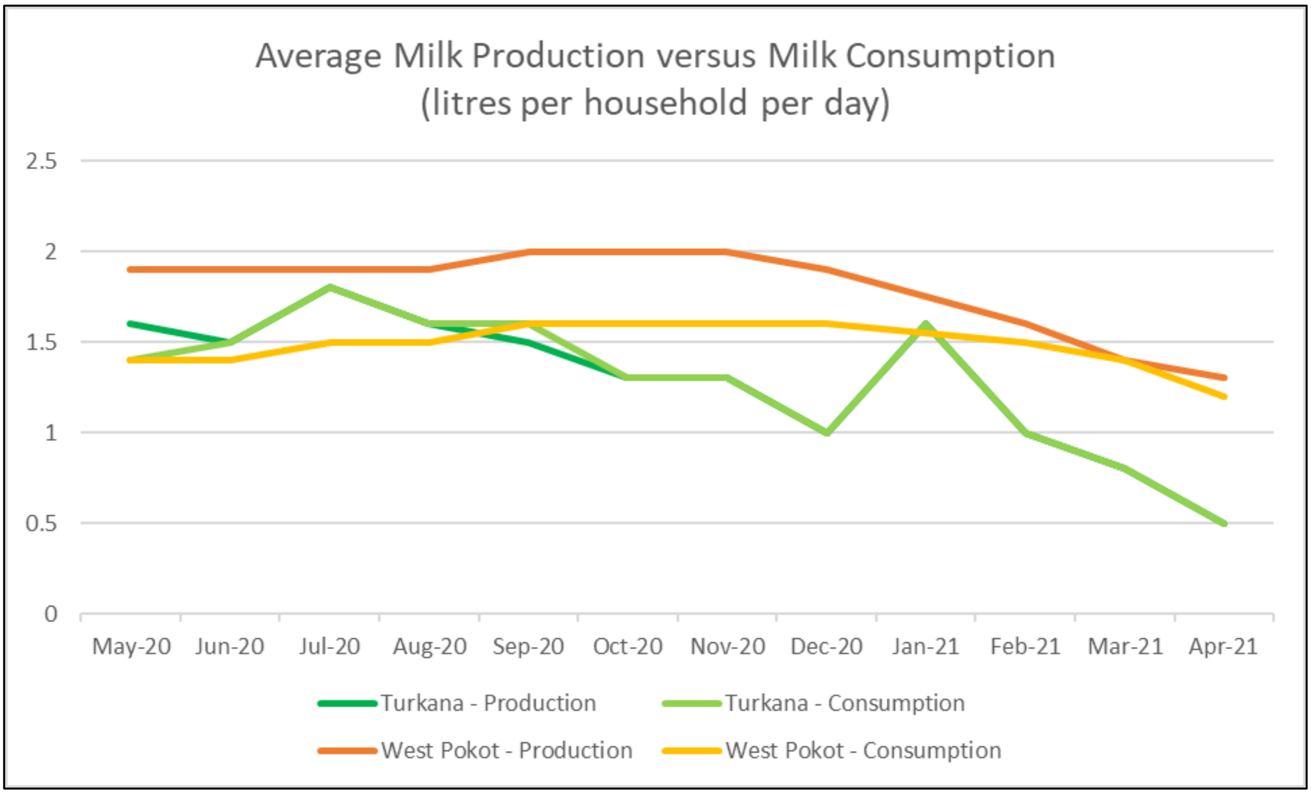


Figure 6.12-10: Milk Production vs Consumption May 2020 to April 2021.

Source: NDMA Drought reports May 2020 to April 2021

From qualitative research, Golder sought to understand the dynamic and current trends of the main livelihoods in the Project area. In general, the majority of KIIs and focus groups describe a general downturn in economic opportunities. Commonly cited reasons are drought, but almost all described a downturn linked to the scaling back of operations starting in 2017. This is said to have reduced purchasing power and caused reductions in everything from the number of small traders seeking licenses, to the demand for charcoal.

Although pastoralism is still the main source of livelihood for people in the Project area, efforts are being made to encourage diversification, primarily through complementary livelihoods such as livestock trading, which requires the development of more financial skills (KII, UN Women, 23 June 2016). Some pastoralists have diversified their livelihoods by opening kiosks or getting involved in livestock trade (KII, 31 January 2019). However, barter trade is still being practiced by many pastoralists where there is no money (Focus Group Discussion, 03 July 2016).

The Turkana County Government has been implementing programmes to support pastoralists in diversification of their livelihoods and creating more permanent settlements and market opportunities. These efforts include encouraging pastoralists to register in order to obtain data related to household size, gender and identification numbers. This register is used at Final Distribution Points (FDPs) for food in cases of emergency, but also helps to inform government programmes in providing essential services like health and education to enable people to have some sort of permanent settlements (KII, 25 June 2016). In the Kochodin Location, livestock traders noted that one main challenge is the inadequate knowledge on how to conduct the livestock business (Focus Group Discussion, 04 July 2016), which was also echoed by traders in Lokichar who cite literacy as one of the key challenges with improving business (KII, 30 January 2019).

In Lochwaangi Kamatak, the Sub-location Assistant Chief estimates that roughly 60% of the youth in his area have left nomadic life and gone to towns and larger settlements in search of salaried employment, particularly with oil exploration. For those who did get hired for a brief period during the E&A phase, they do not want to return to traditional pastoralist livelihoods. They prefer to find work as a livestock merchant or other small trade. The disruption to households is that they are less able to move with livestock since youth had previously been the family member who travelled long distances with livestock (KII, 29 June 2016).

In Kalemngorok, pastoralists describe a similar change in pastoralism. Because of drought and raids people are trying to shift into alternative livelihoods, which might include charcoal production and petty cash trade. Overall, they see a reduction in livestock per household (KII, 01 February 2019). Charcoal production has been a means of livelihood for women in particular.

Livestock traders in Nakukulas explained that the market fluctuates based on seasons and requirements of buyers. They usually buy animals at a cheaper price in the dry season, especially in January. This is because some pastoralists need food, but also because it is harder to find pasture, so more are willing to give up their livestock. The risk of buying at such times is that the animals themselves can lose value, causing them to lose money if they lose weight, the basis of price. They also consider distance to pasture when they buy. Having to travel 20 km or more can cause goats and sheep to miscarry. Another factor is whether they can graze animals close to established settlements as migrating longer distances increases the risk of theft and raiding (Focus Group Discussion, 4 July 2016).

In the Kositei Location, West Pokot Sub-county, 70% to 80% of the community practice pastoralism. This is the keeping and breeding of animals (goats, cows, camels, sheep, and donkeys) for meat, milk, skin, transport and labour (donkeys). According to reports from the Kositei Location Chief and his Sub-location Assistant Chiefs, there are no reported agricultural activities upstream as the earlier construction of the dam consumed previous farmlands. Now there are small subsistence agricultural activities downstream of the dam (towards the Turkana boundary) and garden farms growing crops like cabbages, kale and green grams can be found. Under the leadership of the current county government, irrigation activities have been initiated in the villages of Karon (Kasitei Sub-location, West Pokot Sub-county), Kases and Takaywa (Korpu Location, North Pokot Sub-county) (KIIs, 30 January 2019 and 2 February 2019).

6.12.2.18 Small Business and Trade

Turkana County has three urban centres namely Lodwar, Kakuma and Lokichoggio. Lodwar is the most developed with more infrastructural and social amenities. There are nine market centres in the entire County (Turkana County Government, 2016). The main market in the AoI is in Lokichar town. In Kangakipur, for example, business traders explain that they travel approximately 60 km to Lokichar to buy and sell their items, they hire a vehicle (paid evenly) to transport their food stuffs to the area (KII, Pastoralist business lady, Kangakipur, 4 July 2016).

Principal markets are located and comprise traders from Kitale, Nairobi and Webuye, an industrial town in Western Kenya, Southwest of Kitale. Exhibitions and major county events also provide a platform for sales. Small businesses rely on these activities to increase their sales. Transport is a challenge as some markets are further without having access to vehicles (KII, 28 June 2016).

Traders in Lokichar describe an overall situation for businesses that changed substantially in 2012 after the Operator arrived in Turkana County. In the mid-90s, only businesses were local. In 1999 to 2005, there were some new wholesalers who changed the market, but it was 2012 when businesses grew with a population increase. Non-Turkanas came with a lot of business ideas that brought business competition thus the locals were stimulated to venture into a variety of business opportunities (KII, 30 January 2019).

The arrival of the Operator has had mixed affects. On the positive side, youth have been trained with practical skills and youth have been incentivised to take on education programmes as well as to seek employment. Local workers used new skills to open businesses like welding. Competition is good and encourages traders to explore more business networks, which has also had a positive impact for women. However, it has been noted that influx has made it hard for locals to compete, and which has also triggered inflation (KII, 30 January 2019). For instance, in terms of land prices, a parcel of land 50 x 100 m might have sold for 50,000 KES prior to the Operator's arrival but may now sell for up to 500,000 KES for the same plot (KII, 30 January 2019).

There are few lending institutions due to the unfavourable business environment, which has limited access to financial services and a lack of properly organised marketing. Where financial services are available, the cost of credit has been unfavourable resulting in the lack of capital to finance enterprise development. Limited access to financial services has greatly affected trade, livestock and agriculture sub-sectors (Turkana County Government, 2013). The County Government supports groups interviewed during baseline research although it is reported by some stakeholders that the support is not enough. (Focus Group Discussion, 01 July 2016). Other sources of funding are related to microcredits, these are promoted by NGOs looking to improve household welfare conditions.

6.12.2.19 Wages and Salaries

Wage earners constitute only 6% of the population in Turkana County. Unemployment levels are estimated at 70% in contrast to national figures of 42% (Turkana County Government, 2013). The devolved government structure has produced more employment opportunities at county government level (KII, 22 June 2016). The county department structure has created diverse job opportunities, which contributes to wages and salaries. However, the unemployment rate remains much higher compared to national levels. A large proportion of this labour force remains untapped due to inadequate skills/training for the locals, and also fewer employment opportunities (Turkana County Government, 2013).

Wage earners in West Pokot County constitute only 5% of the population. This is attributed to low education levels among the county residents, historical injustices, lack of technical skills and limited job opportunities. Informal sector employs a good proportion of the County population through farming and pastoralism (West Pokot Spatial Plan, 2019).

There is very limited data on salaries and the contribution of cash salaries to household incomes.

6.12.2.20 Industrial Sectors

While the predominant economic activity is related to pastoralism, other contributions to the Turkana County economy are the use of natural resources from trees (agro-forestry), mining and tourism (Turkana County Government, 2013).

Similarly, in West Pokot the main economic activities are agriculture and livestock enterprises. These main areas are complemented by transport, trade and small-scale gold mining (West Pokot Spatial Plan, 2019).

6.12.2.20.1 Agro-Forestry

The income generating activities derived from the local indigenous forests in Turkana include aloe vera processing for soaps and shampoo by two groups, one in Namoruputh in Loima Sub-county and Kalemngorok in Turkana South. This activity also includes charcoal production, a practice that is done through the collection of fallen trees and regulated by a license program managed by the Forest Department in the County Government (Turkana County Government, 2013).

In West Pokot, high potential agricultural land is found only in the southern part of the County. Rain fed crop production is only possible in parts of the Kapenguria and Chepareria Divisions while irrigation is used in the Sigor Division. Crops grown include maize, millet, sorghum and beans. The only cash crops are coffee, pyrethrum and cotton (West Pokot Spatial Plan, 2019). Field research confirms that the locations closest to the Project area are limited to pastoralism given that rainfall does not sustain agriculture (KII, 29 January 2019).

6.12.2.20.2 Mining

There are many on-going mining activities in Turkana County. These include mining of gold although on a small scale but in various locations within the county (Turkana County Government, 2013).

West Pokot too has mining activities with limited gold deposits along river beds and limestone (West Pokot Spatial Plan, 2019). The limited mining in the Project area is said to have been disrupted due to the construction of the Turkwel Reservoir Dam (KII, 30 January 2019).

6.12.2.20.3 Tourism

Tourism accounts for close to 10% of Kenya's GDP and the County government estimates that this has great potential to generate employment in the future (Turkana County Government, 2016). The main tourism attractions in Turkana County are Lake Turkana, which is protected by UNESCO as a World Heritage Site, Central Island Marine parks within the lake, and the South Turkana Nature Reserve (NR). The National Government, as part of the Vision 2030 Development Plan, has earmarked the construction of a resort city at Eliye Springs, one of the landing beaches along Lake Turkana (Turkana County Government, 2013).

Significant wildlife is found in the South Turkana NR. There are also hippos and crocodiles in Lake Turkana in addition to the various fish species. There exists various bird species, key among them the flamingos in Lake Turkana (Turkana County Government, 2013).

Tourism in West Pokot is unexploited with the main site being the Nasolot NR. This reserve has elephant, buffalo, hyena, impalas, leopard and lions but this and other scenic sites are undeveloped (West Pokot Spatial Plan, 2019).

6.12.2.20.4 Other Industries

Fieldwork highlighted other small trade and industry that are practiced in both Counties.

In Turkana, another of the main activities in Kamuge is salt harvesting, said to engage 3,000 people in harvesting, packaging and retailing of this salt. At the beginning, the salt was sold in Lokori. However, the entrepreneurs have grown their market to cover Lokichar, Katilia, Lodwar, Katilu, Kalemngorok and Kainuk. The salt is mainly used for treating camels and for chewing with tobacco. One kg of salt sells at Ksh. 150. There are four types of salt harvested in Kamuge. Tobacco salt, Livestock salt (salt lick), Vegetable salt and "Prias" which is mostly preferred by camels (KII, 1 July 2016).

In Kangakipur Sub-location, mats are woven by women and girls and sold in local shops and in Lokichar. Woven mats are also used to settle bills in local shops. Shop keepers receive mats of equivalent value to food rations bought and later sell the mats in Lokichar. (KII, 4 July 2016).

In West Pokot, other industries include bee-keeping and fishing at the Turkwel Gorge Reservoir. This is said to be an industry that involves 10 to 20% of the population (KII, 30 January 2019).

6.12.2.21 Poverty

Turkana has some of the highest levels of poverty in the country. Kenyan National Bureau of Statistics (KNBS) reports poverty at 94%. However, such figures need to be considered in context described in Section 6.12.2.9. As discussed in that Section, many consider wealth through the context of herd size and a household ability to maintain their animals. Livestock traders in Nakukulas said they would characterise a wealthy person as someone who has 20 camels, 500 small stock, 30 heads of cattle and 50 donkeys (Focus Group Discussion, 04 July 2016). By contrast, poverty is considered to be when someone has no animals. Such distinctions are relevant when understanding the relatively high poverty rates.

The poverty rate in West Pokot County currently stands at 68.7%, represented by approximately 433,656 people. West Pokot County contributes approximately 2.1% to national poverty. There has been increase in poverty levels within the county triggered by higher living standards, increase in population and unstable sources of income (West Pokot Spatial Plan, 2019).

6.12.2.22 Land Use and Ownership

The following describes the baseline land use across the areas affected by the Project footprint, covering:

- Gazetted (Ngamia, amosing and Twiga and indicative gazetted (Ekales, Agete, Etom) field areas; and
- Interconnection routes between the fields

As explained in the baseline methodology section (Section 6.12.1.4), during the lands baseline surveys features such as homesteads, animal shelters, graves and community assets were recorded as GPS coordinates, photographed and details recorded. A similar classification of homesteads was used in all the lands baseline surveys from 2015 to 2021, as shown in Table 6.12-27, with example photographs of homesteads shown in Figure 6.12-12 and Figure 6.12-13.

Table 6.12-27: Categories of Homesteads

Category	Description
Long term homesteads ('permanent')	Either currently occupied or unoccupied. Long term homesteads are occupied in an area over an extended period covering both wet and dry seasons (see Figure 6.12-11) and typically for a period of a year or more. The elderly and young members of the household often remain at this homestead all year round. The location of these long-term homesteads is sometimes within an ere linked to the family, and the precise location within an area may periodically change every few months to avoid issues such as livestock dung build up in animal shelters, ticks and animal disease. If a long-term homestead is vacated for a short period (a few weeks) and is in a good state of repair, a household may sometimes re-use the homestead structure on their return. Otherwise it will not be re-used and the household will construct a new homestead structure. Only the household who constructed a homestead is able to use it and it is considered 'taboo' amongst the community to use someone else's homestead structure.
Short-term homesteads (seasonal)	Typically used for 2 to 3 months, e.g. during wet season grazing (see figure Figure 6.12-11), either currently occupied or unoccupied. Short-term seasonal homesteads are not re-used once vacated.
Very short-term homesteads (migratory)	Used for a few nights en route to other areas, either currently occupied or unoccupied. Very short-term migratory homesteads are not re-used once vacated.

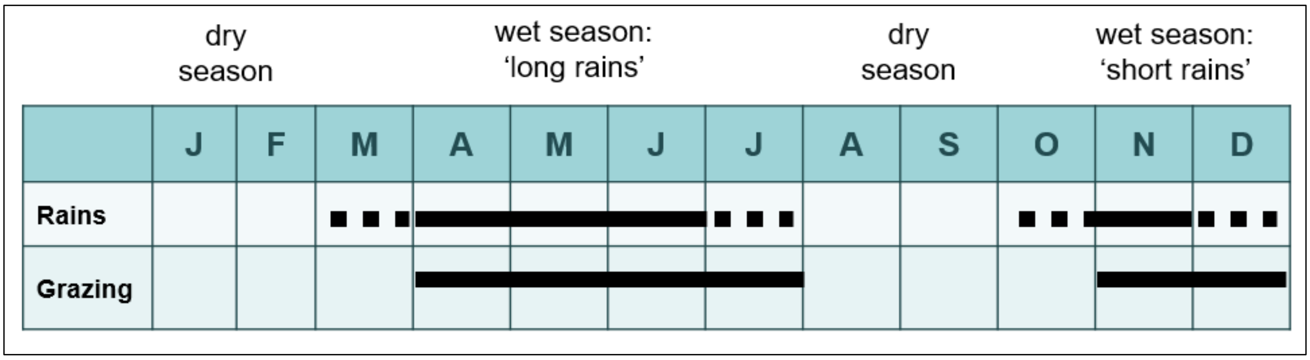


Figure 6.12-11: Typical Seasonal Rains and Grazing in the AoI

6.12.2.23 Twiga Field Area

The gazetted Twiga field area covers approximately 546 ha and is located in Turkana South Sub-county, Kapese Sub-location, 4.6 km north-east of Lokichar town and 1.9 km east of the Lomokamar settlement. The field measures approximately 2 km north to south and 3 km east to west – see Figure 6.12-17. All land in the Twiga field is classified as unregistered community land.

There are currently three existing wellpads in the Twiga field area (Twiga 1, Twiga 2 and Twiga 3) constructed during the E&A phase between 2013 and 2015. Twiga 2 and Twiga 3 will not be used for the Project and are therefore not included in this ESIA. There are existing murram access roads running to the three wellpads, which branch off a road that runs north to south through the middle of the Twiga field.

Land Character: The Twiga field area is a flat, largely open area of livestock grazing land vegetated with grass, small shrubs and occasional *eregai* trees (*Acacia reficiens*), and large *ewoi* trees (*Acacia tortilis/ewoi*) alongside a large lugga in the north-west corner of the field. The lugga is dry throughout the year apart from occasional short periods during the seasonal rains (Figure 6.12-11).

Livestock Grazing: Vegetation in the Twiga field provides grazing for the livestock of local households and occasional migratory households, mainly camels and goats, throughout the year, though during drier periods livestock is taken towards the hills and Turkwel River approximately 30 km to the west. The vegetation is also used by households to construct their traditional homesteads as illustrated in Figure 6.12-12 and Figure 6.12-13, typically made from Ewoi, Ekalale or Elim branches, bark from Ewoi and sometimes plastic sheets or tarpaulins, and animal shelters (Figure 6.12-14) made from acacia/Eregai branches. Goats also feed off seed pods shaken from Ewoi trees along the luggas (Figure 6.12-15).

Figure 6.12-12: Homesteads in the Twiga Field (Nov 2018) photo 1

**Occupied Long-term Homestead in north-west part of Twiga Field (Nov 2018)*

Figure 6.12-13: Homesteads in the Twiga Field (Nov 2018) photo 2

**Long-term Homestead under construction in north-west part of Twiga Field (Nov 2018)*

Figure 6.12-14: Animal Shelter for Goats or Camels

Figure 6.12-15: Goats and Camels Grazing in the Twiga Field Area (Nov 2018)

Figure 6.12-16: Open area in centre of Twiga Field Area

Community infrastructure: The only community infrastructure within the field area are two community water tanks, provided by the Operator. The only other community infrastructure in the vicinity of the field is the new Lomokamar Primary School classroom, constructed in 2018 and which came into use in 2019, located 120 m north outside the Twiga field area. The community uses large trees along the lugga to the north-west of the field as community meeting points.

Homesteads: The patterns, types and numbers of homesteads within Twiga field area recorded in baseline surveys from 2015 to 2021 have been generally consistent. As summarised in Table 6.12-28 and shown Figure 6.12-17 the baseline surveys identified the following patterns of homesteads:

- The November 2015 baseline survey identified four occupied homesteads in the Twiga field area, all of which were classified as long-term homesteads inhabited by families linked to the Lomokamar settlement and who stated during the surveys that they had lived in the area for many years. Three of these homesteads were located near the large lugga to the north-west of the field and one homestead was located 320 m to the east of the Twiga 1 wellpad.
- The November 2018 baseline survey identified six occupied long-term homesteads in the Twiga field area and one under construction soon to be occupied. These homesteads were at locations close to the occupied homesteads identified in November 2015, near the large lugga to the north-west and one just east of Twiga 1. The homestead families reported that they had been living in the area over several years and since before Tullow commenced activities in the area in 2012.

- The July 2019 baseline survey identified only one occupied homestead within the Twiga field area, close to the location of occupied homesteads identified in November 2015 and November 2018 towards the large lugga in the north-west part of the Twiga field.
- The April/May 2021 KJV survey identified an area containing up to 10 households within the Twiga field area, to the south-west of the Twiga 1 wellpad.

All the homesteads identified in the baseline surveys were traditional Turkana homestead structures as illustrated in Figure 6.12-13. No occupied or unoccupied short-term (seasonal) or very short (migratory) homesteads were identified within the Twiga field area during the first three baseline surveys. However, one vacated seasonal homestead was identified in the November 2018 baseline, used around May 2018, which was located 680 m south-east of Twiga 1, just outside the field area. The households identified in April/May 2021 were recorded as short-term.

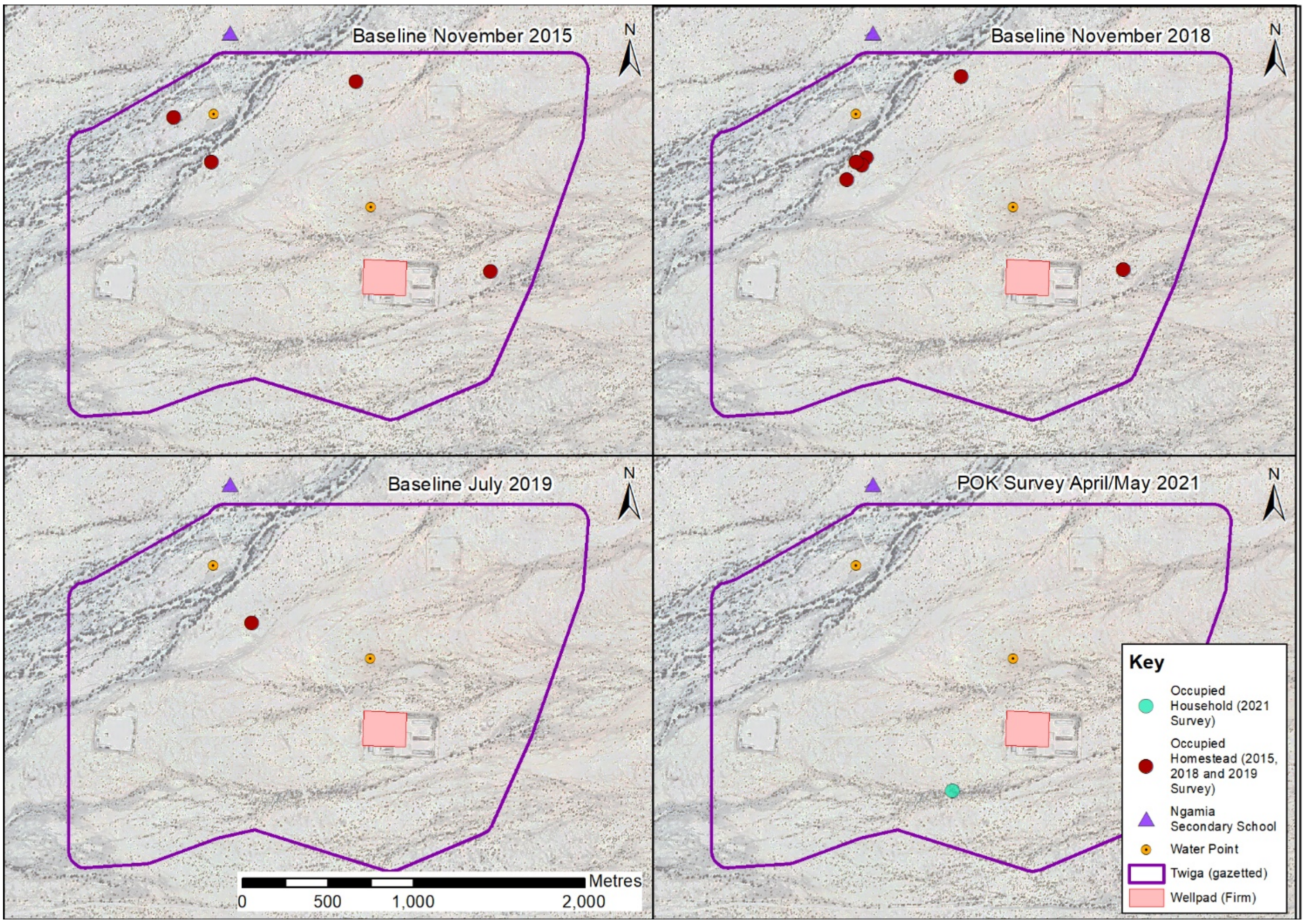


Figure 6.12-17: Locations of Occupied Homesteads (and Households – 2021 only) in the Twiga Field from surveys completed 2015 - 2021

Information gathered on the households living in the occupied households includes the following:

- Households: A relatively small number of households have lived in or near the Twiga field area in recent years (see Table 6.12-28). During the November 2018 survey, interviewed residents stated that these households had been living in the area for many years and before the Operator’s arrival in 2012.
- All the homesteads identified in the Twiga field area have been long-term homesteads used by households all year round. They graze their livestock in the local vicinity and occasionally, during drought periods, take their livestock towards the hills and Turkwel River approximately 30 km to the west, though elderly and

young children remain in the homesteads. Short-term (seasonal) or very short-term (migratory) homesteads have only been observed within the Twiga field area in 2021.

- Settlement Links: All the long-term households who live in or close to the Twiga field area are part of Lomokamar settlement. Children from the households attend school in Lokichar or the new Lomokamar Primary School classroom that was constructed in 2018 and came into use in 2019.
- Security: The year-round occupation of homesteads reflects the fact that the Twiga area is considered to be safe and is not subject to livestock raiding that affects residents further south in the Ngamia and Amosing areas.
- Other land users: Households reported during the November 2018 survey that they do not see many people from outside the area using the land, only the occasional migratory herders passing through or some households living there temporarily during wet season grazing periods. This is supported by the fact that apart from animal shelters constructed near to long term homesteads, there have been few other animal shelters identified in the Twiga field during the three baseline surveys.
- Water sources: Households obtain water from the community water tanks provided by the Operator located in the Twiga Field area. Prior to the water tank, households obtained water from dug water holes in the large lugga towards Lokichar to the west of the field.

Table 6.12-28: Occupied Homesteads (households only in 2021) in the Twiga Field during Baseline Surveys 2015 to 2021

Survey	Coverage of the Project Field Area	Occupied Long-Term Homesteads /households	Occupied Short-Term (Seasonal) Homesteads /households	Occupied Very Short-Term (Migratory) Homesteads/ households	Total Occupied Homesteads /households	Comments
Nov 2015	100%	4	0	0	4	3 homesteads near large lugga to north-west of Twiga field and one homestead 320 m to east of Twiga 1.
Nov 2018	100%	6	0	0	6	5 homesteads near large lugga to north-west of Twiga field and one homestead 320 m to east of Twiga 1.
July 2019	100%	1	0	0	1	1 homestead near large lugga to north-west of Twiga field
April/May 2021	<100% (survey not as detailed	0	Up to 10 households[(a)]	0	Up to 10 households[(a)]	Up to 10 households[(a)] near murram access road, 400 m south-west of Twiga 1

Survey	Coverage of the Project Field Area	Occupied Long-Term Homesteads /households	Occupied Short-Term (Seasonal) Homesteads /households	Occupied Very Short-Term (Migratory) Homesteads/ households	Total Occupied Homesteads /households	Comments
	as previous)					

a) *During KJV survey in 2021, only no. of households was collected, not homesteads (a number of households collectively comprise a homestead)*

6.12.2.24 Ngamia Field Area

The gazetted Ngamia field area (Figure 6.12-19) covers approximately 4,050 ha and is located in Turkana East Sub-county, Kochodin Sub-location, 19 km south-east of Lokichar town and 2.5 km north-west of Nakukulas settlement. All land in the Ngamia field is classified as unregistered community land.

There are currently eight existing wellpads in the Ngamia field (Ngamia 1, 2, 3, 4, 7, 8, 9 and 10) constructed during the E&A phase between 2012 and 2016. Ngamia 10 will not be used for the Project. There are existing murram access roads running to these wellpads, which branch off the main Lokichar to Lokwamosing road which runs through the centre of the field.

Land Character: The Ngamia field area is generally flat with a gentle slope west to east, comprising a combination of open areas with grass, small shrubs used for livestock grazing, large tree lined luggas and some areas of denser shrub/small tree vegetation. The luggas are dry throughout the year apart from occasional short periods during the seasonal rains.

Vegetation in the Ngamia field provides grazing for livestock, mainly camels and goats, especially during wet season grazing periods. During the dry season livestock is typically taken to graze towards the hills to the west. The vegetation is also used by households to construct their traditional homesteads, typically made from Ewoi, Ekalale or Elim branches, bark from Ewoi and sometimes plastic sheets or tarpaulins; and animal shelters (made from acacia/Eregai branches). Goats also feed off seed pods shaken from Ewoi trees along the luggas.

Community infrastructure: Community infrastructure within the Ngamia field area comprises two community water tanks, provided by the Operator, located near the main road 600 m inside the northern boundary of the Ngamia field and 600 m north of the Ngamia 1 wellpad. All people engaged during the baseline surveys stated that they use these water tanks as their source of water. In 2018 the Opertor installed a piped water system for supplying the community water tanks, including a new raised water tank (see Figure 6.12-18) located just north of Ngamia 1. In addition, the Ngamia Secondary School, which is in use and comprises classrooms and dormitories (constructed in 2016-2017) is located just within the Ngamia field area, 2.4 km south-east of Ngamia 1.

Figure 6.12-18: New Water Tank Linked to the Operator Piped Community Water System, Just North of Ngamia 1, Constructed 2018-19.

Homesteads: The numbers of homesteads within the Ngamia field at the baseline surveys from 2015 to 2021 are summarised in Table 6.12-29 and Figure 6.12-19. The baseline surveys identified the following in terms of homesteads:

- The November 2015 to March 2016 baseline survey which covered 90% of the Ngamia field area, identified 20 occupied homesteads within the area, 11 of these homesteads were located to the west of main road and nine to east. Eleven of the homesteads were classified as long-term homesteads, seven were short-term seasonal homesteads and two were very short-term migratory homesteads. The majority of homesteads were located to the north of the Ngamia field and clustered around the northern community water tank provided by the Operator. A smaller number, three homesteads, were clustered around the community water tank, provided by the Operator, just north of Ngamia 1 wellpad.
- The September 2016 EOPS Phase II ESIA baseline survey covered a central portion of the Ngamia field, representing 20% of the Ngamia field area. It identified 11 occupied homesteads within or in the close vicinity of the survey area, including several households that had also been present in November 2015. Seven of the homesteads were located to the west of the main road and four to east.
- The May 2017 EOPS Phase II baseline survey covered the same central portion of the Ngamia field as in September 2016, representing 20% of the Ngamia field area. It identified 15 occupied homesteads, all of which were located to the east of the main road, including a cluster of homesteads between Ngamia 1 and Ngamia 8. The higher number of homesteads in this survey compared with the previous November 2015 and September 2016 surveys may have been because of two factors: firstly, the survey took place in the wet season when households access wet season livestock grazing in the Ngamia field area; and because insecurity concerns relating to livestock raiding were high in May 2017 which would have discouraged households from occupying homesteads to the west of the main road.

The April/May 2021 KJV survey identified up to 580 occupied households within Ngamia. The number of homesteads were not recorded during the KJV survey (a small number of households comprise a homestead). Nevertheless, this represents a significant increase relative to previous surveys. Households are largely concentrated in two clusters, around the Lotiman and Kode Kode adakars (and associated community water points). Greater security against cattle raiding is a possible driver for in-migration.

Table 6.12-29: Occupied Homesteads (households only in 2021) in the Ngamia Field During Baseline Surveys 2015 to 2021

Survey	Coverage of the Project Field Area	Occupied Long-Term Homesteads /households	Occupied Short-Term (Seasonal) Homesteads /households	Occupied Very Short-Term (Migratory) Homesteads/ households	Total Occupied Homesteads /households	Comments
November/ December 2015 & March 2016	90%	11	7	2	20	11 homesteads to west of main road and 9 to east of road.
September 2016 (EOPS)	20%. Central part of Ngamia field.	11	0	0	11	7 homesteads to west of main road and 4 to east of road. 17 unoccupied homesteads were identified, which were understood to have been occupied sometime between December 2015 and September 2016.
May 2017 (EOPS)	20%. Central part of Ngamia field.	8	7	0	15	All 15 homesteads were located east of road and none to the west. 13 unoccupied homesteads were identified, which were understood to have been occupied sometime between September 2016 and May 2017
Nov 2018	100%	30 to 40 homesteads at Lotiman adakar; plus	11 located at scattered locations to	0	66 to 86	Two recently established adakar in the Ngamia field area.

Survey	Coverage of the Project Field Area	Occupied Long-Term Homesteads /households	Occupied Short-Term (Seasonal) Homesteads /households	Occupied Very Short-Term (Migratory) Homesteads/ households	Total Occupied Homesteads /households	Comments
		20 to 30 at Kode Kode adakar; plus 5 homesteads elsewhere in the field. Total: 55 to 75.	the east of the main road.			
July 2019	100%	Over 40 homesteads at Lotiman adakar; 6 homesteads near Lotiman adakar; over 20 homesteads at Kode Kode adakar. Total 66	9 (1 of which just west of road and 8 east of road)	0	75	The Lotiman and Kode Kode adakar were still occupied at the same locations observed in the November 2018 baseline.
April/May 2021	<100% (survey not as detailed as previous)	Up to 50 households[(a)] at Lotiman adakar and up to 70 homesteads at Kode Kode adakar. Total 120.	Up to 460 households[(a)], including large concentrations around the Lotiman and Kode Kode adakars, as well as large groups of households[(a)] along the C46. A small group of up to 5 households[(a)] was recorded towards the south-west of the Ngamia area, with a larger group of up to 35 households[(a)] recorded to the south-east, towards Nakukulas.	0	Up to 580	A significantly greater number of households[(a)] were identified during the 2021 survey

a) *During KJV survey in 2021, only no. of households was collected, not homesteads (a number of households collectively comprise a homestead)*

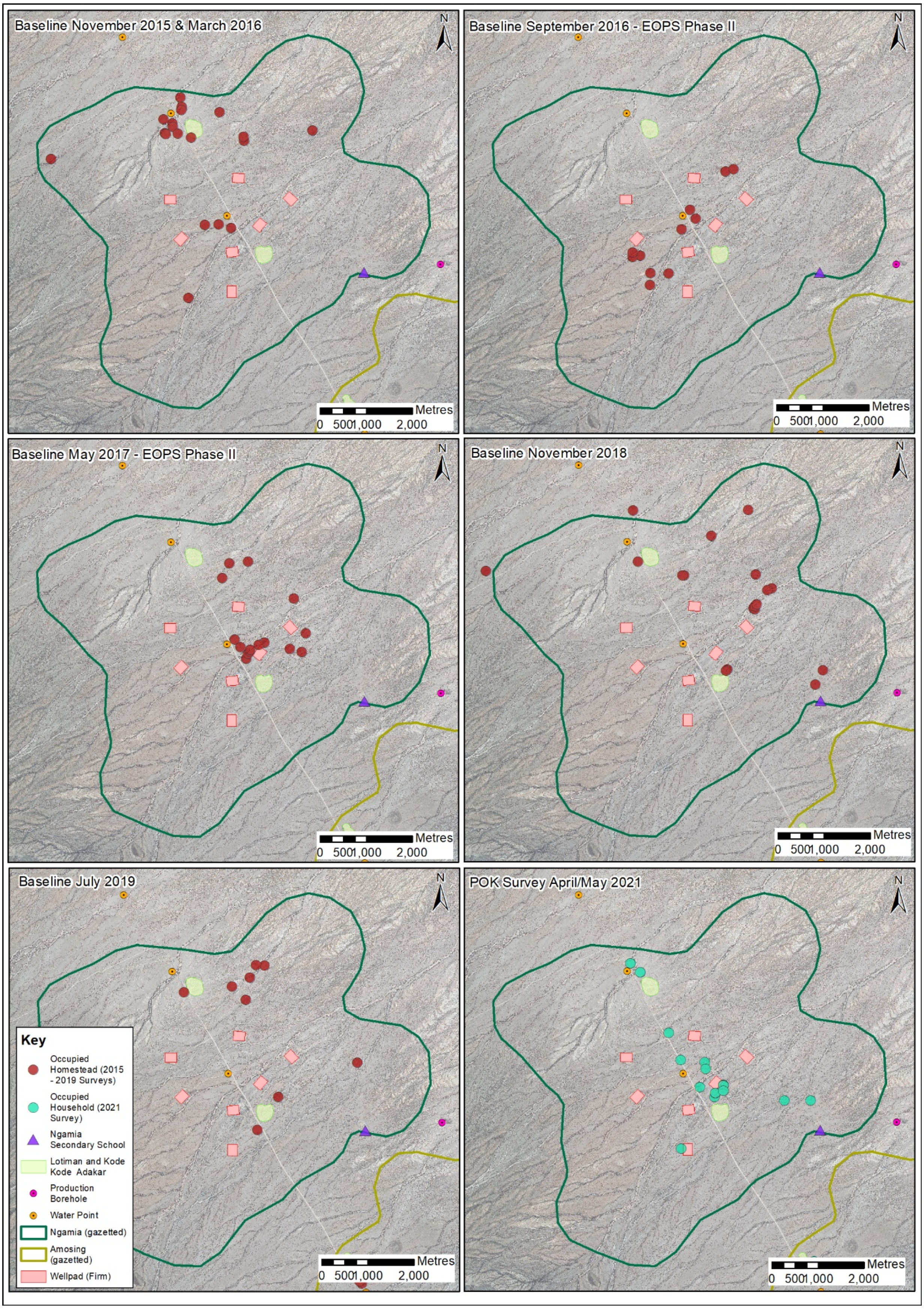


Figure 6.12-19: Locations of Occupied Homesteads (and Households – 2021 only) in the Ngamia Field in Baselines 2015 to 2021

- The November 2018 baseline covered the whole of the Ngamia field area. The survey found several significant new patterns in the numbers and distribution of homesteads:
  - Some 60 to 80 occupied homesteads were present in the Ngamia field area in November 2018, a significant increase on the numbers recorded from 2015 to 2017.
  - Two large Adakar clusters of occupied homesteads were observed for the first time, the Lotiman Adakar and Kode Kode Adakar, as described below. See Figure 6.12-22 and Figure 6.12-23.
  - Some modern style homesteads with corrugated sheet metal (CSM) roofs had been constructed near or inside these Adakar, as well as traditional conical shaped permanent homestead structures with palm tree roofs which had not previously been observed in the Ngamia field area and which are characteristic of traditional homesteads in the Lokicheda and Nakukulas settlements – see Figure 6.12-22.
  - The Ngamia Secondary School had been constructed during 2017 and was in use. This lies just within the Ngamia field area, 2.4 km south-east of Ngamia 1, this will remain and will not be impacted by the Project.
- The Lotiman Adakar was located 600 m inside the northern boundary of the Ngamia field, close to the northern Operator supplied community water tank, 1.1 km north-west of the Ngamia 3 wellpad. It covered an area of approximately 11.5 ha, see Figure 6.12-20.
- There were an estimated 30 to 40 households living in the Lotiman Adakar in November 2018. The Adakar was established around mid-2017 (it was not present during the May 2017 lands baseline survey). Based on discussions with elders in November 2018, households from the local area congregated in the Adakar for safety from livestock raiding, with its location selected because of proximity to the main road and Operator supplied community water points. Being near the main road was said to make it easier to access government support, which is considered especially beneficial in times of drought when communities become more reliant on drought assistance. The elders stated that the community intended to make this location a permanent settlement and had apparently requested Turkana County Government to construct a Lotiman Primary School nearby. At the time of the November 2018 survey the Lotiman Adakar was mainly occupied by older and young members of households, whilst youth and young men and women were away with their livestock accessing dry season grazing towards the hills to the west. Only a relatively small number of livestock were staying in or around the Adakar. Elders stated that almost all the people living at the Adakar were from the local area, with few people from outside the area; and that prior to congregating in the Adakar, households used to live in homesteads scattered around the area on the west and east of the road depending on the season and security situation. Before the establishment of the Adakar, households would generally move to Lokicheda or Nakukulas in times of insecurity.

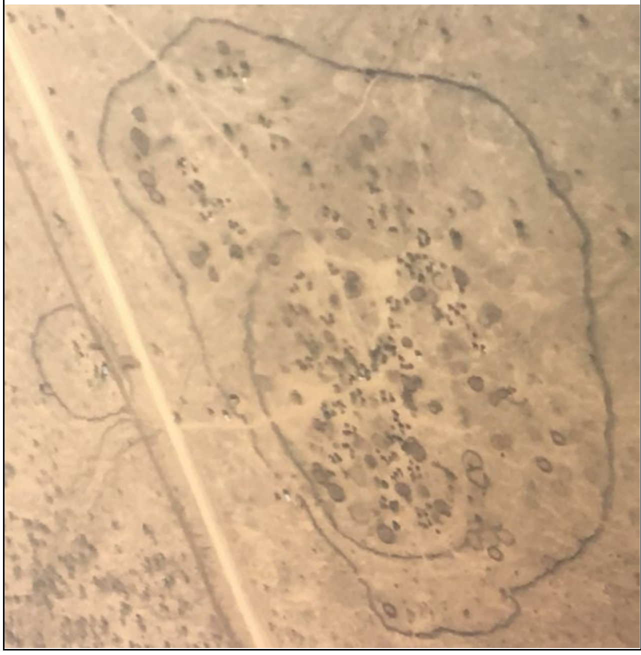
NOVEMBER 2018	JULY 2019
	

Figure 6.12-20: Aerial View of Lotiman Adakar Ngamia Field, November 2018 and July 2019

Figure 6.12-21: View from Inside the Lotiman Adakar, November 2018

Traditional conical shaped permanent homestead structure being built in the Lotiman Adakar	Modern Homestead with CSM Roof and traditional conical shaped permanent homestead just outside the Lotiman Adakar

Figure 6.12-22: Traditional & Modern Permanent Homestead Structures at the Lotiman Adakar, Nov 2018

- In November 2018 the Kode Kode Adakar was located around 200 m south-east of Ngamia 1 on the eastern side of the road and was occupied by 30 to 40 households (see Figure 6.12-23).

  In discussions with local elders in November 2018, the survey team was informed that people came to the Adakar for safety in the face of Pokot livestock raiding concerns. The location was selected due to proximity to the main road and to community water points provided by the Operator. Being near the main road was also said to make it easier to access government support. The elders reported that they intend to make this location a permanent settlement and said that they had requested Turkana County Government to construct a Primary School and dispensary there.

  The Kode Kode Adakar was established at the November 2018 location around March 2018, having moved from two previous sites which were 180 m south of Ngamia 3 (occupied June 2017 to October 2017) and 180 m east of Ngania-3 (occupied October 2017 to March 2018). Elders reported that both these former locations were abandoned due to problems with poor drainage and tick infestation.

  Elders stated that the Kode Kode Adakar is mainly occupied by older and young members of households, whilst young men and women are away with their livestock. Only a relatively small number of livestock were staying at the Adakar. The elders reported that almost all people living at the Kode Kode adakar were from the local area, with few people from outside the area.

  Prior to moving to the Adakar, households used to live in homesteads scattered around the area on the west and east of the road depending on the season. During the wet season they often located east of the road and to the west of the road during the dry season. This was also dependent on the security situation in terms of livestock raiding. Elders advised that households who in previous baseline studies lived in long-term homesteads in the Ngamia 1, Ngami 3 and Ngamia 7 area were now living in the Adakar. Before the establishment of the Adakar, households would generally move to Lokicheda or Nakukulas in times of insecurity, though a small number of around five households continued to stay in the Ngamia area.

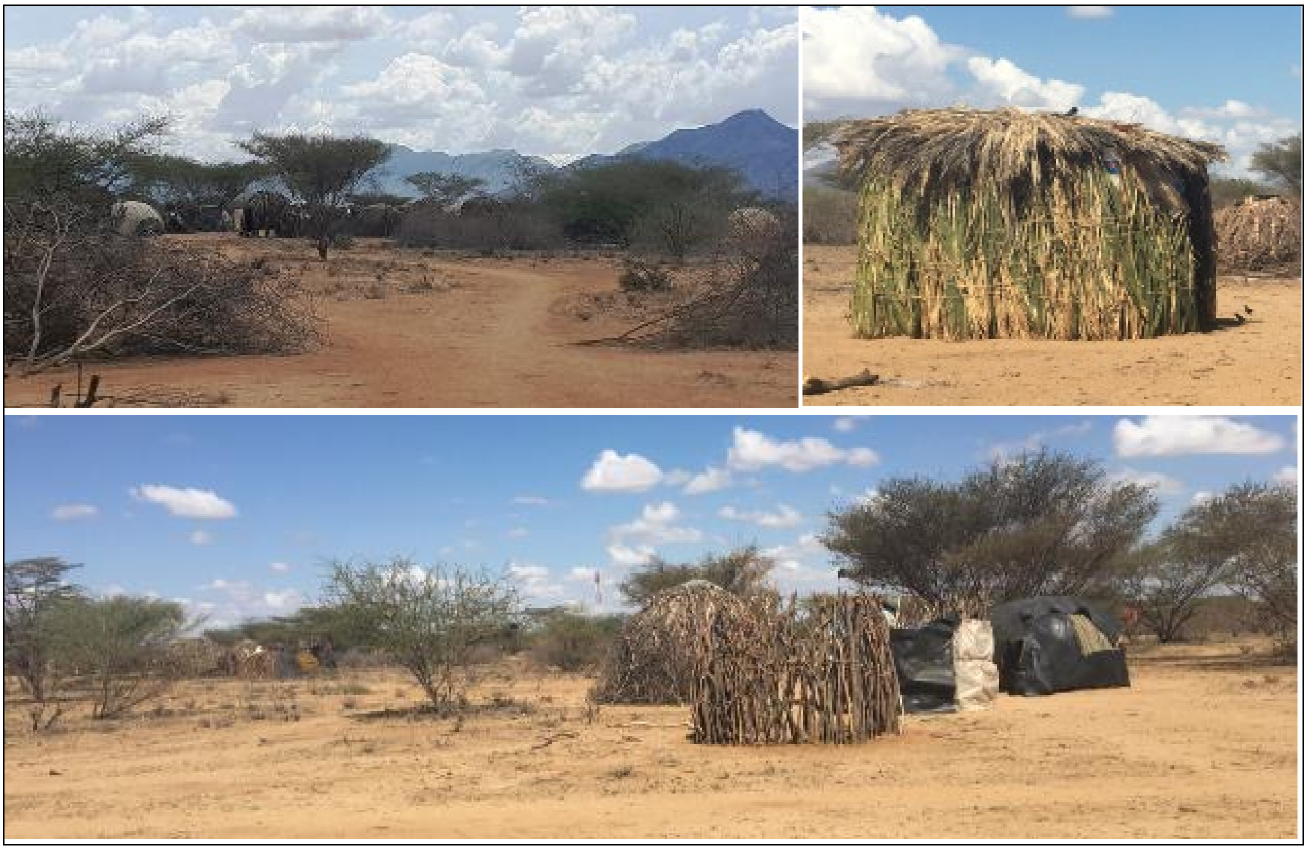


Figure 6.12-23: Views from Outside and Inside the Kode Kode Adakar (Nov 2018)

- Other occupied homesteads in the Ngamia field away from the Adakars: As well as the households living in the two Adakars above, 16 other occupied homesteads were identified in the Ngamia field area in November 2018. All of them were located east of the main road apart from one long-term/modern corrugated metal roof homestead on the western side of the road just opposite the entrance to the Lotiman Adakar. Of these 16, five were classified as long-term homesteads, 11 were short term seasonal homesteads and there are no very short term / migratory homesteads. In previous years when the risk of livestock raiding was low, dry season homesteads tended to be located to the west of the main road, but due to insecurity concerns in November 2018, households were located to the east of the main road. Several households also said that they had recently moved north from the Amosing area which had higher insecurity concerns than the Ngamia area.
- Other Socio-Economic features: The new Ngamia Secondary School, comprising classrooms and dormitories was constructed in 2017 to 18 and is located 2.4 km south-east of Ngamia 1. The two Operator supplied water tanks in the Ngamia field, one 650 m north of Ngamia 1 wellpad (the Kode Kode water tank) and one just north of the Lotiman adakar (the Lotiman water tank), provide the year-round source of water for all households present in the Ngamia field. In November 2018 the tanks were being connected by the Operator to a new piped water system, including the construction of a new raised water tank just north of Ngamia 1 (see Figure 6.12-18). Proximity to the water tanks is clearly one of the factors that has influenced the community's locational decisions for the Lotiman and Kode Kode adakars.
- Vacated Homesteads: The November 2018 survey recorded the locations of 47 vacated homesteads which have been used in recent years, including those identified as occupied in previous surveys (see Figure 6.12-24). These included:

- Fifteen vacated homesteads to the west of the road which were classified as seasonal homesteads and likely to have been occupied during July to October to access dry season grazing areas to the west;
- Thirty-two vacated seasonal homesteads located to the east of the main road most of which were thought to have been used for accessing wet season grazing areas April to July and November to December; and
- Two abandoned previous sites of the Kode Kode Adakar located within 150 m east and south of the Ngamia 3 wellpad.

- The April/May 2021 KJV survey identified up to 45 unoccupied households at the Kode Kode Adakar (see Figure 6.12-24).

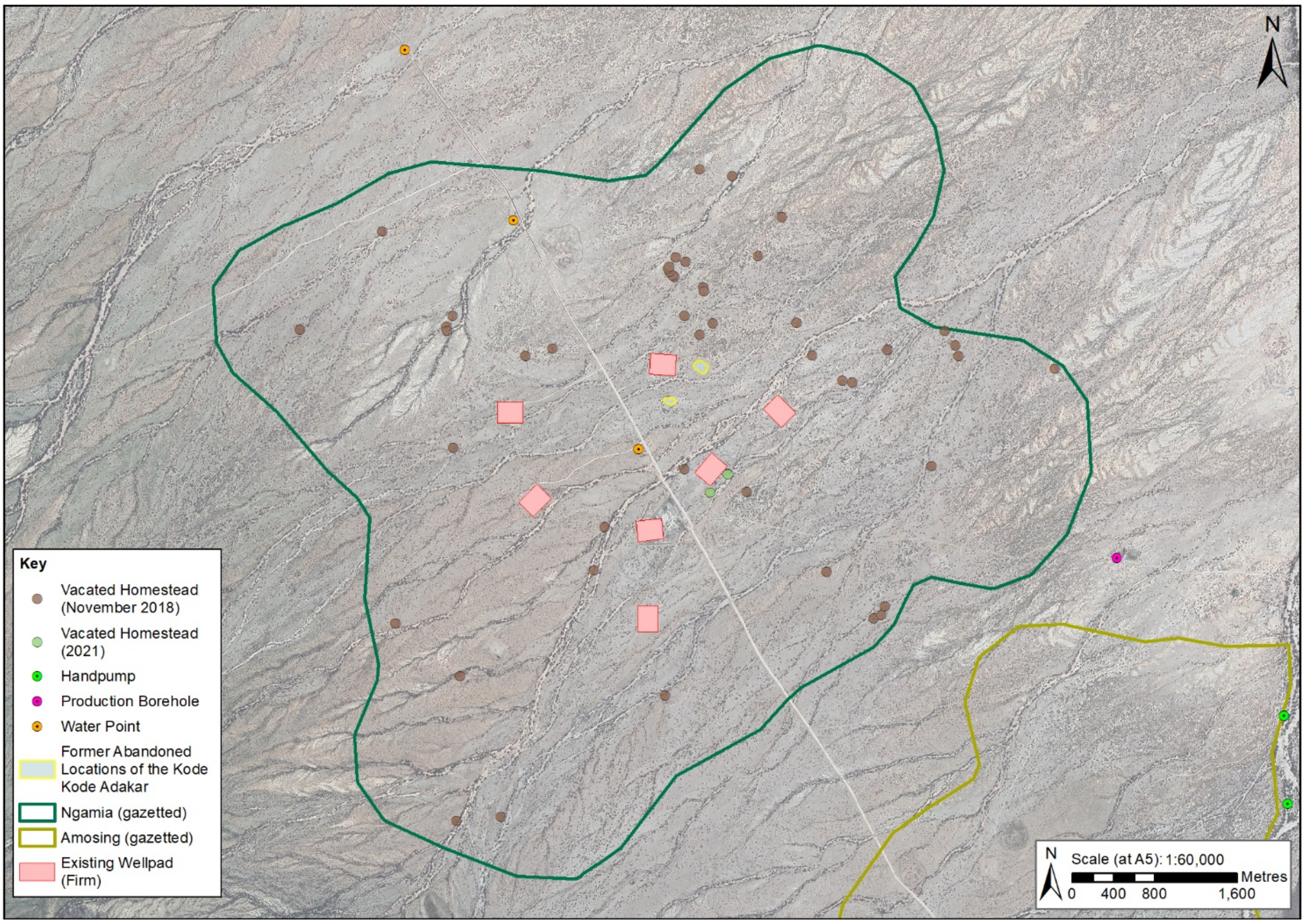


Figure 6.12-24: Vacated Homesteads in the Ngamia Field Identified in November 2018 and April/May 2021

The July 2019 baseline survey found a similar pattern of occupied homesteads in the Ngamia field to that observed in November 2018, with a total of approximately 75 households occupying homesteads, a broadly similar number to that observed in November 2018. The Lotiman Adakar and the Kode Kode Adakar were still occupied in the same locations as in November 2018, and in July 2019 contained over 40 and over 20 occupied homesteads respectively.

In addition, nine occupied short term seasonal homesteads were identified in the Ngamia field, including two near the Kode Kode Adakar and a cluster of five along a lugga to the east of the Lotiman Adakar. Households were using these homesteads for their livestock to access wet season grazing in the Ngamia area.

No additional community assets had been constructed in the Ngamia field compared with November 2018. The Operator's piped water system for supplying community water tanks had been completed, including the new raised water tank just north of Ngamia 1.

6.12.2.25 Amosing Field Area

The gazetted Amosing field area covers approximately 2228 ha and is located in Turkana East Sub-county, Kochodin Sub-location, 26 km south-east of Lokichar town, 1.5 km south of the Ngamia field area and less than 0.5 km south-west of Nakukulas settlement. The field measures approximately 6 km north to south and 4 km east to west at the widest points (Figure 6.12-25). All land in the Amosing field is classified as unregistered community land.

There are currently five existing wellpads in the Amosing field (Amosing 1, 3, 4, 5 and 7) constructed during the E&A phase between 2014 and 2016. Amosing 5 and Amosing 7 will not be used for the Project. There are existing murram access roads running to these wellpads, which branch off the main Lokichar to Lokwamosing road.

Land Character: The Amosing field area is generally flat with a gentle slope west to east, comprising a combination of open areas with grass, small shrubs used for livestock grazing, large tree lined luggas and some denser vegetated areas. The largest lugga runs west to east between Amosing 1 and Amosing 3. Luggas in the area are dry throughout the year apart from occasional short periods during the seasonal rains.

Livestock Grazing: Vegetation in the Amosing field provides grazing for livestock, mainly camels and goats, especially during wet season grazing periods. During the dry season livestock is taken towards the hills to the west. The vegetation is also used by households to construct their traditional homesteads, typically made from Ewoi, Ekalale or Elim branches, bark from Ewoi and sometimes plastic sheets or tarpaulins; and animal shelters (made from acacia/Eregai branches). Goats also feed off seed pods shaken from Ewoi trees along the luggas.

Community infrastructure: As shown in Figure 6.12-25**,** according to the KJV hydrocensus**,** community infrastructure within the Amosing field area comprises three Operator supplied community water tanks, located along the C46, and a hand pump, located towards the eastern boundary along the Kalabata. Two other handpumps are located just outside the eastern boundary of the gazetted area, along the Kalabata. All people met during the baseline surveys stated that they use these water tanks as their sources of water. Prior to the Operator supplied water tanks, local households used to obtain water from dug water pits in the Kalabata lugga to the east or the borehole at Nakukulas.

The new Operator -built Lokosimekori Primary School classrooms (Figure 6.12-25) are located within the Amosing field 775 m west of the Amosing 3 wellpad. These were constructed in 2018 by the local community using funding from the Operator but were not yet used in November 2019. These will remain and will not be impacted by the Project.

Homesteads: The numbers of occupied homesteads in the Amosing field identified at the baseline surveys from 2015 to 2021 are summarised in Table 6.12-30 and shown in Figure 6.12-25.

Table 6.12-30: Occupied Homesteads (households only in 2021) in the Amosing Field during Baseline Surveys 2015 to 2021

Survey	Coverage of the Project Field Area	Occupied Long-Term Homesteads /households	Occupied Short-Term (Seasonal) Homesteads /households	Occupied Very Short-Term (Migratory) Homesteads/ households	Total Occupied Homesteads /households	Comments
Nov 2015	90%	12	15	0	27	
September 2016 (EOPS)	16%, 1 km around Amosing 1	17 (plus 1 under construction)	0	0	17	13 of the 17 occupied homesteads were just outside EOPS area within the Project Field.
May 2017 (EOPS)	16%, 1 km around Amosing 1	0	0	0	0	Homesteads were unoccupied due to security concerns in April/May 2017.
Nov 2018	100%	Estimated 30 to 40 at the Lokosimekori adakar; plus 10 elsewhere in the field. Total: 40 to 50 homesteads.	2 (in the northern part of Amosing field).	0	42 to 52	30 to 40 homesteads in the Lokosimekori adakar, all classified as long term.
July 2019	100%	Estimated 30 to 40 at the Lokosimekori adakar, 2 nearby, and estimated 20 in the Katamanak adakar. Total: 52 to 62 homesteads.	0	0	52 to 62	30 to 40 homesteads at the Lokosimekori adakar and the 20 homesteads in the Katamanak adakar are all classified as long term.
April/May 2021	<100% (survey not as detailed as previous)	Up to 20 households [(a)]	Up to 150 households [(a)]		Up to 170 households [(a)]	A significantly greater number of households[(a)] were identified during the 2021 survey.

a) *During KJV survey in 2021, only no. of households was collected, not homesteads (a number of households collectively comprise a homestead*

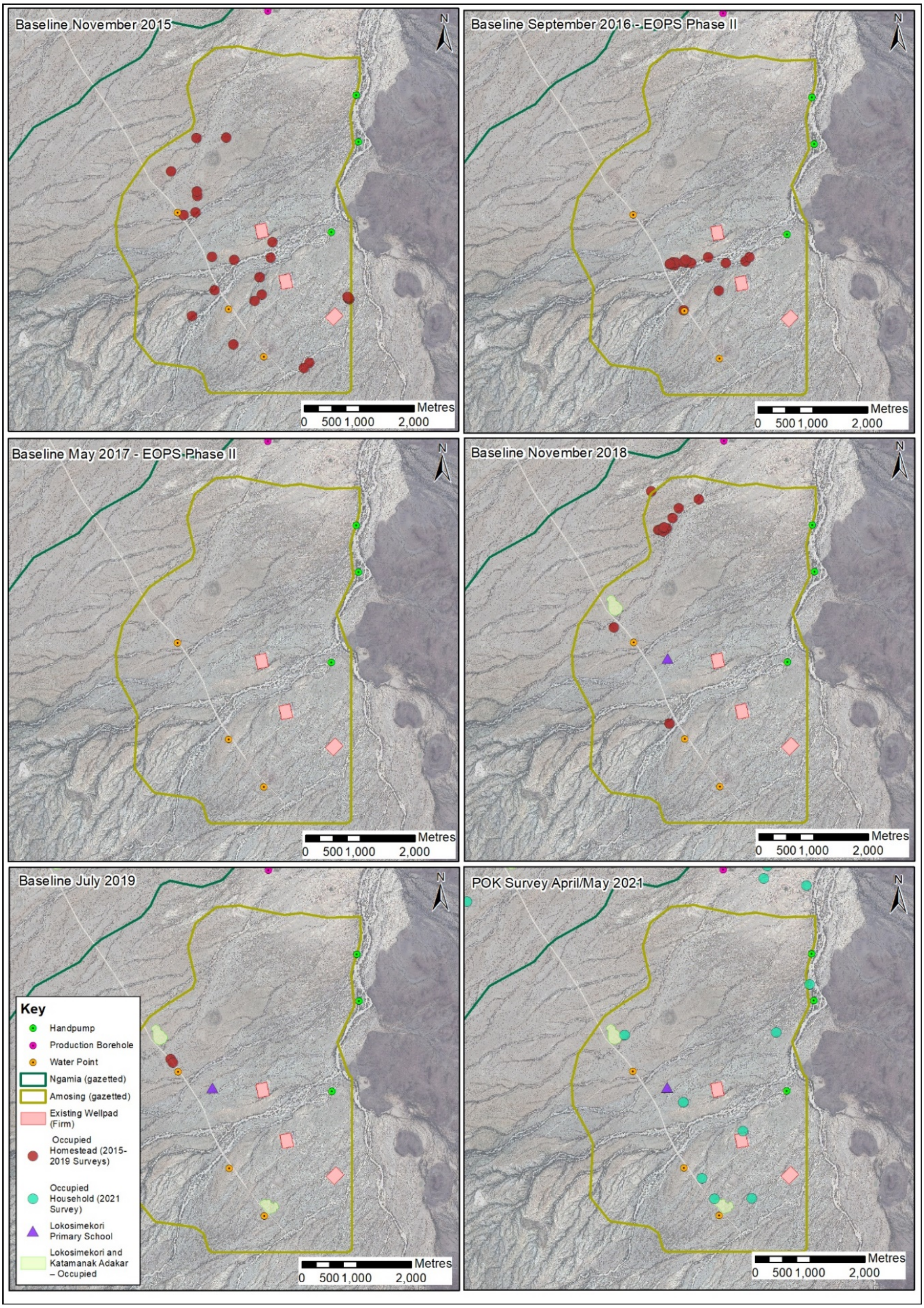


Figure 6.12-25: Locations of Occupied Homesteads (and Households – 2021 only) in the Amosing Field at Baseline Surveys 2015 to 2021

The baseline surveys identified the following in terms of homesteads:

- The November 2015 baseline survey covered 90% of the Amosing field area and identified 27 occupied homesteads, 12 of which were classified as long-term homesteads and 15 were classified as short-term seasonal homesteads. The occupied seasonal homesteads in the Amosing area are typically used during wet season grazing periods (usually April to July and November to December). During the dry seasons, livestock is moved towards the hills to the west where dry season homesteads are established, with the elderly members of households and children remaining at the long-term homesteads. All but three of the 27 occupied homesteads were located to the east of the main road. Nine of the homesteads (all classified as long-term homesteads) were located along the large lugga just north of the Amosing 1 wellpad. The 15 occupied short-term homesteads were located in various places including to the north and south of the Amosing field in areas of wet season grazing land.

- The September 2016 EOPS Phase II baseline covered a circle of approximately 1 km radius around the Amosing 1 wellpad (representing 16% of the Amosing field area). Within this 1 km circle, there were four occupied long-term homesteads in September 2016, located near the large lugga just north of Amosing 1. In addition, 13 occupied homesteads were located just outside the EOPS Phase II area (but within the larger Amosing field area) in an Adakar type cluster towards the main road approximately 1 km north-west of Amosing 1.

- The May 2017 EOPS Phase II baseline covered the same circle of approximately 1 km radius around Amosing 1 (representing 16% of the Amosing field area). During the May 2017 baseline there were no occupied homesteads within the EOPS Phase II area or its vicinity. However, there were five long-term homesteads along the lugga north of Amosing 1 which had only recently been vacated in late April or early May 2017 due to insecurity concerns regarding livestock raiding. The households occupying these homesteads were the same families which occupied the homesteads at similar locations in the 2015 and 2016 baselines. These households were understood to have moved to Nakukulas for safety and were expected to return once the security situation improved.

- The November 2018 baseline covered the whole Amosing field area. The survey found some significant changes to the number and distribution of homesteads involving the development of Adakar clusters of occupied homesteads and three modern homestead structures with CSM roofs. In total, there were approximately 40 to 50 occupied homesteads in the Amosing field area. In addition, classrooms had been constructed by the community using funding provided by the Operator earlier in 2018 at the site of the new Lokosimekori Primary School located within the Amosing field area 775 m west of the Amosing 3 wellpad, though these classrooms were not yet in use. The key observations relating to homesteads are as follows:
  - There was one occupied adakar cluster of homesteads, the Lokosimekori Adakar, with an estimated 30 to 40 households living there in November 2018. This was located just east of the main road some 200 m inside the north-western boundary of the Amosing field area and 750 m west of the existing Amosing 5 wellpad.
  - Local elders stated that this Adakar moved to its current location in late October 2018 and replaced a previous Lokosimekori Adakar location 250 m north-east of Amosing 5 (see Figure 6.12-29). This previous site was apparently abandoned earlier in October 2018 because moving closer to the main road was seen by the community as being better in terms of security and accessing government support, especially during drought periods, and closer to the Operator supplied community water tank.
  - Local elders met in November 2018 said that local people plan to make the Lokosimekori Adakar a permanent settlement and to make use of the new Lokosimekori Primary School 1.2 km to the south-east.

- A cluster of ten recently built unoccupied long term homesteads, including two modern homestead structures with CSM roofs (see Figure 6.12-27) were identified 250 m south of the occupied Lokosimekori Adakar, which indicates that households plan longer-term occupation in this Adakar location.
- Elders said that all of the households staying at the Lokosimekori Adakar were from the local area. In previous times, these households had been distributed across the area, and during times of insecurity many households from the Amosing area moved to Nakukulas for safety.
- Another site, which elders said had previously been the location of the Katamanak Adakar, lay further south just east of the main road 600 m inside the southern boundary of the Amosing field area. This had been vacated in October 2018 due to insecurity concerns over Pokot livestock raiding, and households were reported to have moved to the new Lokosimekori Adakar or to Nakukulas, Lokicheda or Kalapata for safety.
- As well as the 30 to 40 households currently living in the Lokosimekori Adakar, a further 12 occupied homesteads were identified elsewhere in the Amosing field area in November 2018. Ten of these homesteads were classified as long-term and two classified as short-term seasonal homesteads. Reflecting concerns over livestock raiding from the west, 10 of these 12 occupied homesteads were located east of the main road and in the northern portion of the Amosing field towards Nakukulas settlement which lies approximately 1 km north-east of the field.
- The November 2018 survey recorded the locations of 55 vacated homesteads which have been used in recent years, including those identified as occupied homesteads in previous surveys – see Figure 6.12-29. These included:
  - Vacated homesteads to the west of the road which were classified as seasonal homesteads and likely to have been occupied during the months of July to October to access dry season grazing areas to the west;
  - Vacated seasonal homesteads located to the north and north-east of the Amosing field area for accessing wet season grazing areas to the east of the main road; and
  - Vacated homesteads along the large lugga north of Amosing 1 where occupied long-term homesteads were previously observed during the 2015 and 2016 baselines.

Figure 6.12-26: View of the Former Lokosimekori Adakar – Vacated in October 2018 (Photo November 2018)

Figure 6.12-27: Newly Constructed, Unoccupied Permanent Homestead/Shop Structures Just South of the Occupied Lokosimekori Adakar (November 2018)

Figure 6.12-28: New Primary School Classrooms Constructed in the Amosing Field Area in 2018

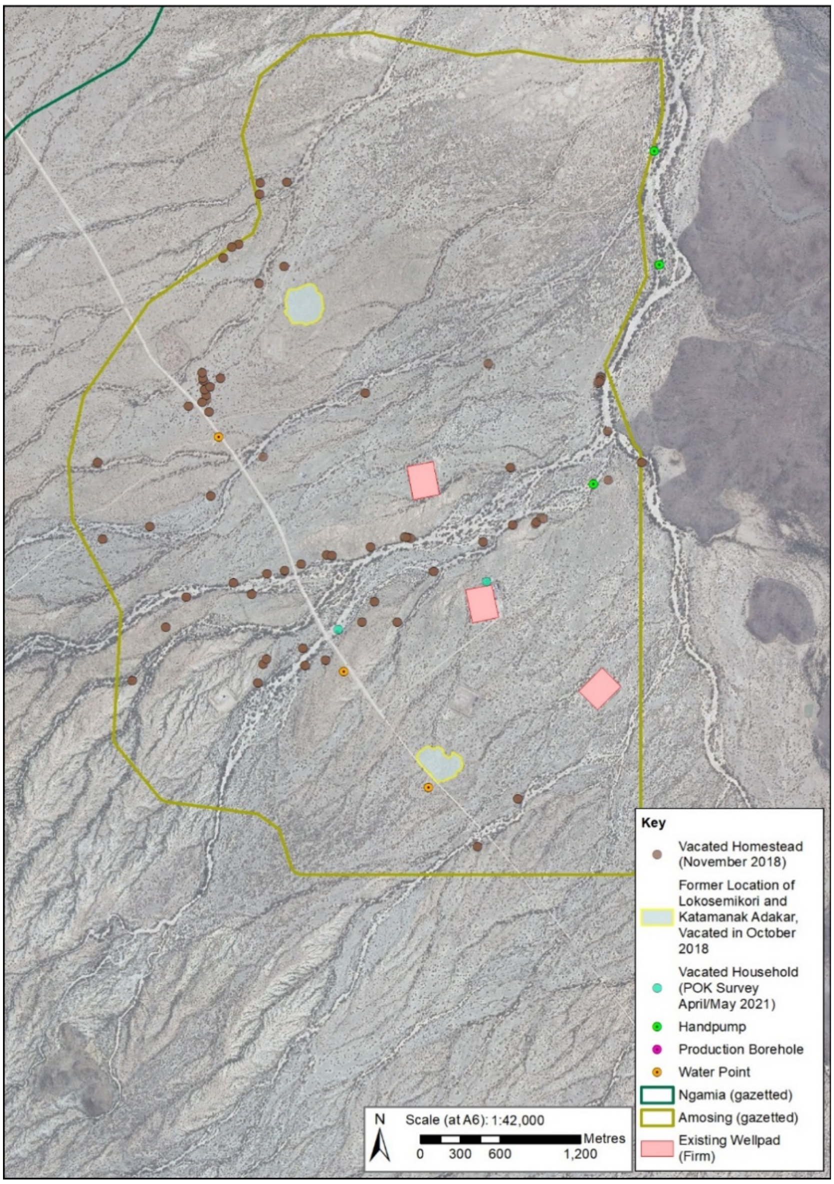


Figure 6.12-29: Vacated Homesteads in the Amosing Field identified in November 2018 and April/May 2021 (households only)

- The July 2019 baseline survey observed that the Lokosimekori Adakar (Figure 6.12-25) in the north-west part of the Amosing field contained an estimated 30 to 40 occupied homesteads in the same location as in November 2015. In addition, the Katamanak Adakar (Figure 6.12-31) towards the south of the Amosing field was occupied in July 2019 with approximately 20 homesteads. This Adakar had been unoccupied in November 2018 due to security concerns over livestock raiding. Apart from two modern CSM roofed homestead structures just south of the Lokosimekori Adakar (which were under construction in November 2018) no other occupied homesteads were identified in the Amosing field area. In total, there were approximately 50 to 60 occupied homesteads in the Amosing field area, an estimated increase of 10 since November 2018.
- The April/May 2021 KJV survey identified up to 170 occupied households within Amosing, as well as up to 10 unoccupied households. The majority of occupied households were recorded as short-term and were located near the former location of the Katamanak Adakar. Up to 20 long term households were identified at the former location of the Lokosimekori Adakar. This survey identified significantly more households

within the gazetted area than previous surveys. Greater security against cattle raising is also a possible driver for in-migration,

Figure 6.12-30: Aerial Image of Lokosimekori Adakar in Amosing Field, July 2019

Figure 6.12-31: Aerial Image of Katamanak Adakar in Amosing Field, July 2019

6.12.2.26 Ekales Field Area

The indicative gazetted area for the Ekales field is approximately 1,250 ha and is located at the border of Turkana South and Turkana East Sub-counties. It extends across the Lokichar and Kapese Sub-locations in Turkana South, and across the Kochodin and Lopii Sub-locations in Turkana East. It is located approximately 6 km south-east of Lokichar town. It is currently understood that all land in the Ekales field is classified as unregistered community land.

There are currently one existing wellpad, which will be used in the future and which was constructed during the E&A phase.

Land Character: the Ekales field area is largely flat open land that is used for livestock grazing, vegetated with a combination of grass, small shrubs and occasional larger trees, particularly along luggas. There is one large lugga that runs east to west through the southern section of the gazetted area, with a smaller lugga also running east-west through the central section of the gazetted area. The luggas are dry throughout the year apart from occasional short periods during the seasonal rains: the "long rains" of April to June and the "short rains" around November (see Figure 6.12-11).

Livestock Grazing: Vegetation in the Ekales field provides grazing for the livestock of local households and occasional migratory households, mainly camels and goats. The vegetation is also used by households to construct their traditional homesteads, typically made from Ewoi, Ekalale or Elim branches, bark from Ewoi and sometimes plastic sheets or tarpaulins; and animal shelters (made from acacia/Eregai branches). Goats also feed off seed pods shaken from Ewoi trees along the luggas.

Community Infrastructure: The April/May 2021 KJV survey identified one community water point, provided by the Operator, located along the C46. No other community infrastructure was identified.

Households: The April/May 2021 KJV survey identified up to 30 occupied short-term households at Ekales, located at the western end of the indicative gazetted area, along the C46. These are summarised in Table 6.12-31 and Figure 6.12-32.

Table 6.12-31: Occupied Households in the Ekales Field during KJV Surveys (2021)

Survey	Coverage of the Project Field Area	Occupied Long-Term Homesteads /households	Occupied Short-Term (Seasonal) Homesteads /households	Occupied Very Short-Term (Migratory) Homesteads / households	Total Occupied Homesteads /households	Comments
April/May 2021	<100% (survey not as detailed as previous)	0	Up to 30 households[(a)]	0	Up to 30 households[(a)]	Up to 30 households[(a)] along C46 at western end of the gazetted area

a) During KJV survey in 2021, only no. of households was collected, not homesteads (a number of households collectively comprise a homestead)

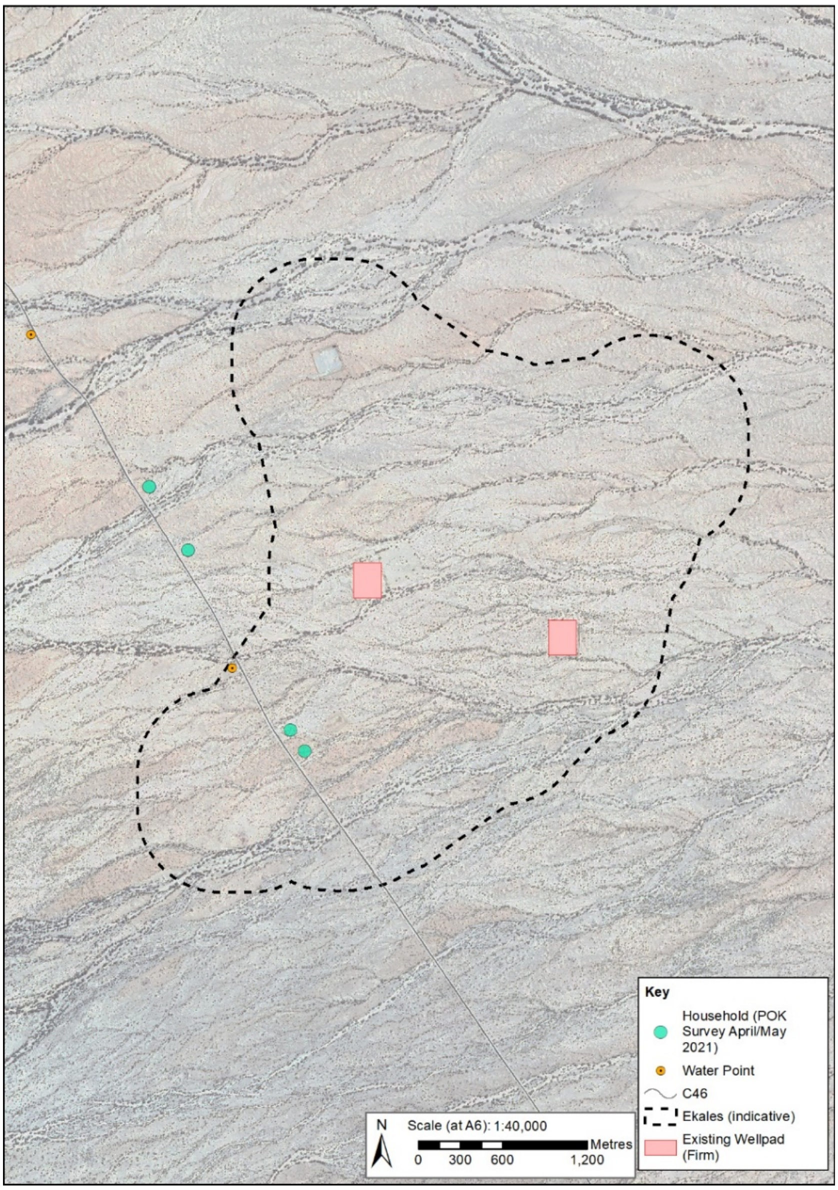


Figure 6.12-32: Locations of Households identified in the Ekales Field during KJV Surveys 2021

6.12.2.27 Agete Field Area

The indicative gazetted area for the Agete field is approximately 993 ha and is located in Turkana South Sub-county, Kapese Sub-location, 9 km north-east of Lokichar town. It is currently understood that all land in the Agete field is classified as unregistered community land.

There are currently two existing wellpads, which will be used in the future, and which were constructed during the E&A phase.

Land Character: the Agete field area is largely flat open land that is used for livestock grazing, vegetated with a combination of grass, small shrubs and occasional larger trees, particularly along luggas. There are no large luggas, but a number of smaller luggas run east-west through the gazetted area. The luggas are dry throughout the year apart from occasional short periods during the seasonal rains (Figure 6.12-11).

Livestock Grazing: Vegetation in the Agete field provides grazing for the livestock of local households and occasional migratory households, mainly camels and goats. The vegetation is also used by households to construct their traditional homesteads, typically made from Ewoi, Ekalale or Elim branches, bark from Ewoi and sometimes plastic sheets or tarpaulins; and animal shelters (made from acacia/Eregai branches). Goats also feed off seed pods shaken from Ewoi trees along the luggas.

Community Infrastructure: The April/May 2021 KJV survey identified no community infrastructure.

Households: The April/May 2021 KJV survey identified up to 5 occupied short-term households at Agete, located at towards the south-west of the indicative gazetted area, along the C46. These are summarised in Table 6.12-32 and shown in Figure 6.12-33.

Table 6.12-32: Occupied Households in the Agete Field during KJV Surveys (2021)

Survey	Coverage of the Project Field Area	Occupied Long-Term Homesteads /households	Occupied Short-Term (Seasonal) Homesteads /households	Occupied Very Short-Term (Migratory) Homesteads/ households	Total Occupied Homesteads /households	Comments
April/May 2021	<100% (survey not as detailed as previous)	0	Up to 5 households [(a)]	0	Up to 5 households[(a)]	Up to 5 households[(a)]along C46

a) During KJV survey in 2021, only no. of households was collected, not homesteads (a number of households collectively comprise a homestead)

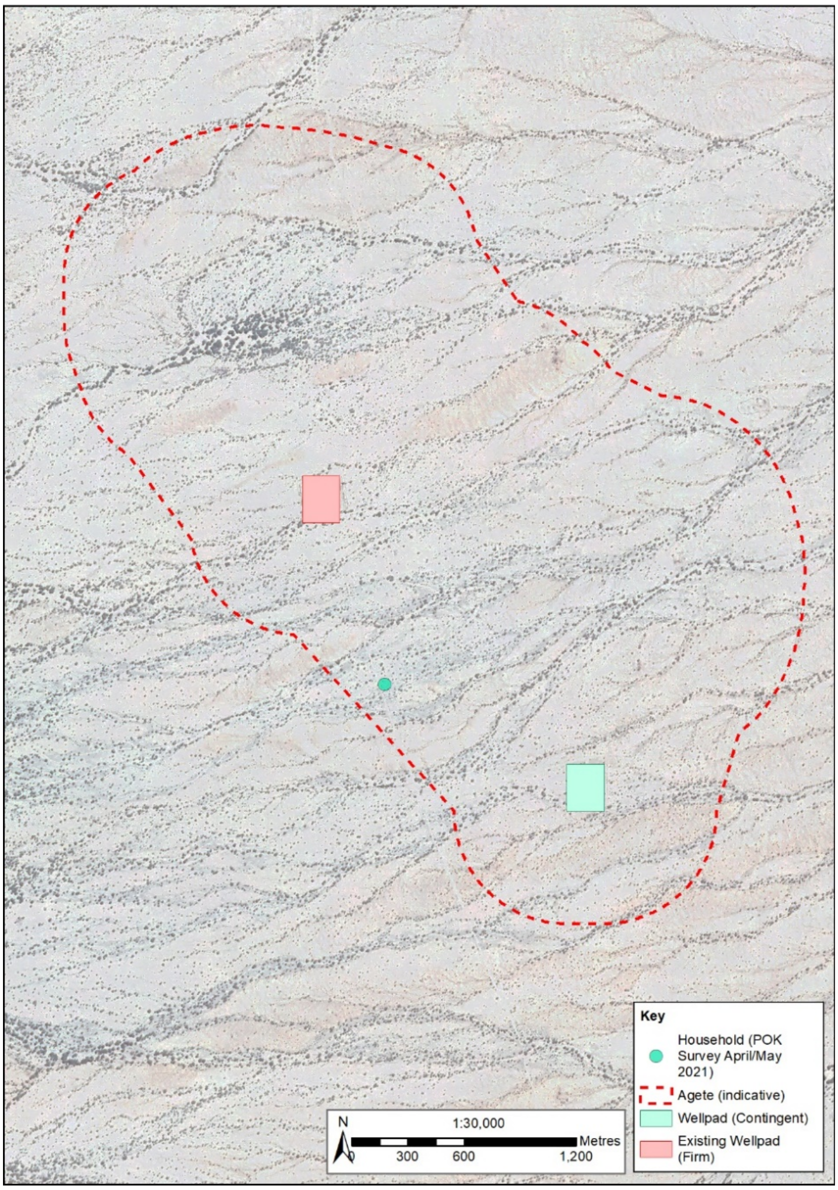


Figure 6.12-33: Locations of Households identified in the Agete Field during KJV Surveys 2021

6.12.2.28 Etom Field Area

The indicative gazetted area for the Etom field is approximately 2,150 ha and is located in Turkana South Sub-county, across the boundary of the Kapese and Lochwangi Kamatak Sub-locations. Etom is located 13.9 km north-east of Lokichar town. All land in the Etom field is classified as unregistered community land.

There are currently two existing wellpads, which will be used in the future, and which were constructed during the E&A phase.

Land Character: the Etom field area is largely flat open land that is used for livestock grazing, vegetated with a combination of grass, small shrubs and occasional larger trees, particularly along luggas. There are two large luggas that runs east to west through gazetted area, on to the north and one to the south, with a number of smaller lugga also running east-west through the central section of the gazetted area. The luggas are dry throughout the year apart from occasional short periods during the seasonal rains (see Figure 6.12-11).

Livestock Grazing: Vegetation in the Agete field provides grazing for the livestock of local households and occasional migratory households, mainly camels and goats. The vegetation is also used by households to construct their traditional homesteads, typically made from Ewoi, Ekalale or Elim branches, bark from Ewoi and sometimes plastic sheets or tarpaulins; and animal shelters (made from acacia/Eregai branches). Goats also feed off seed pods shaken from Ewoi trees along the luggas.

Community Infrastructure: The April/May 2021 KJV survey identified no community infrastructure.

Households: The April/May 2021 KJV survey identified up to 10 occupied short-term households at Etom, located at the western end of the gazetted area, along the C46. These are summarised in Table 6.12-33 and shown in Figure 6.12-34.

Table 6.12-33: Occupied Households in the Etom Field during KJV Surveys (2021)

Survey	Coverage of the Project Field Area	Occupied Long-Term Homesteads /households	Occupied Short-Term (Seasonal) Homesteads /households	Occupied Very Short-Term (Migratory) Homesteads / households	Total Occupied Homesteads /households	Comments
April/May 2021	<100% (survey not as detailed as previous)	0	Up to 10 households[(a)]	0	Up to 10 households[(a)]	Up to 10 households[(a)] along C46 at western end of the gazetted area

a) During KJV survey in 2021, only no. of households was collected, not homesteads (a number of households collectively comprise a homestead)

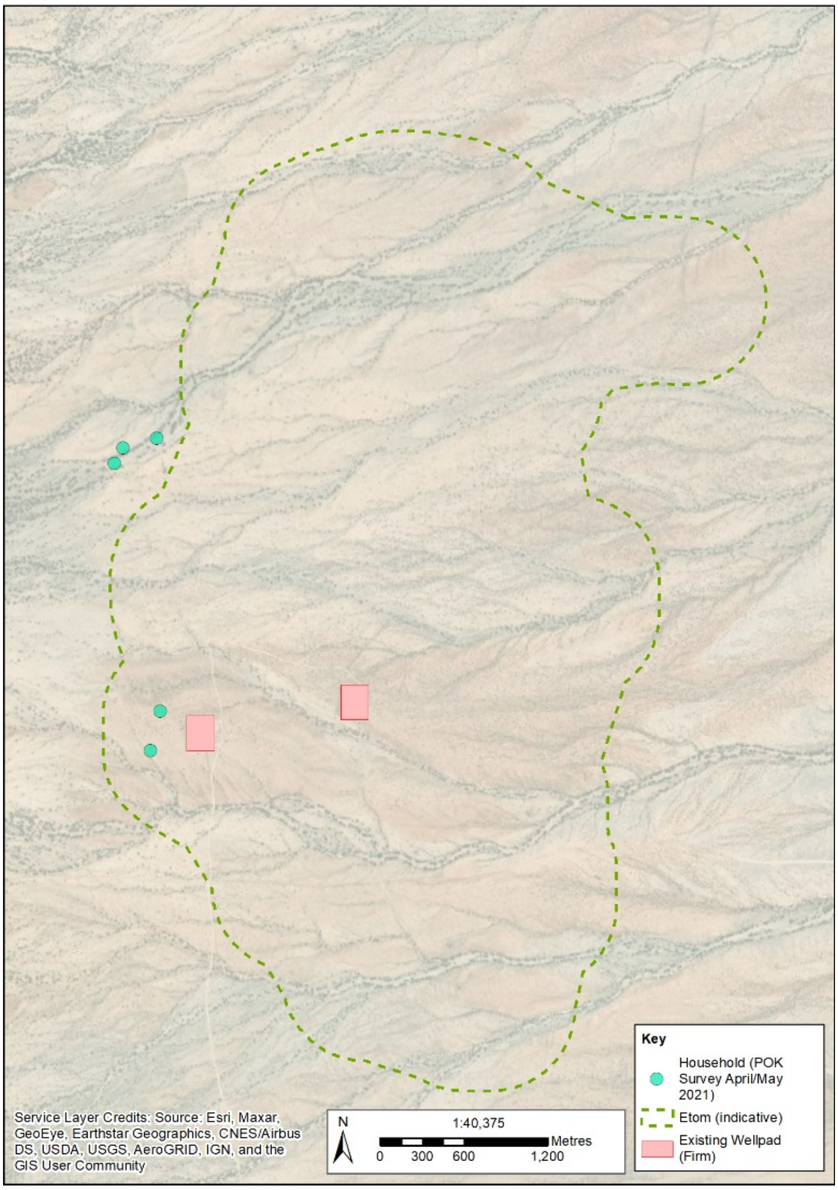


Figure 6.12-34: Locations of Households identified in the Etom Field during KJV Surveys 2021

6.12.2.29 Interconnection Routes Between Fields

The routes of interconnecting buried flowlines and OHTL run between the field areas and the CFA. These are shown in Figure 6.12-35. A 30 m RoW will be established for temporary land access during installation of the flow lines and an additional 10 m RoW established for the OHTL (40 m in total).

Baseline data analysis on land use along the RoW for the interconnection routes involved a baseline survey undertaken on the ground by the Operator in July 2019 and review by Golder of aerial imagery taken in early 2018 and July 2019. Both the 2019 baseline survey and analysis of imagery were focused on areas identified as proposed interconnections between Twiga, Ngamia, Amosing and the CFA to identify homesteads and any other community land use or assets along the route. The findings from the 2018 and 2019 baseline survey work are as follows:

- All land along the interconnection routes is classified as unregistered community land;
- The land is used for seasonal livestock grazing, to varying degrees depending on the nature of vegetation at different points along the routes;

- The routes pass through sparsely populated areas;
- On the Twiga to Ngamia route, only one occupied homestead area is within the 30 m flowline construction RoW, shown as H-04 in Figure 6.12-35 below. This is a long-term homestead located 1 km south-east of the Kapese airstrip facility and 4.6 km south of the Twiga field;
- There are 4 other occupied homesteads near to but outside the 30 m RoW at distances ranging from 66 m to 300 m from the interconnection route, as follows and as shown in Figure 6.12-35:
  - An occupied homestead 200 m west of the interconnection route, outside of RoW, located 1.4 km south of the Twiga field.
  - An occupied homestead 300 m east of the interconnection route, outside of RoW, located 3 km south of the Twiga field.
  - An occupied homestead 66 m west of the interconnection route, outside of RoW, located 3.4 km south of the Twiga field.
  - An occupied homestead 95 m west of the interconnection route, outside of RoW, located 8.4 km south of the Twiga field.
- No occupied homesteads were identified within the RoW for the 800 m section of interconnection route between the Ngamia and Amosing fields.

During the KJV survey completed in April/May 2021 focussed on areas proposed for interconnections between all infrastructure, no households were identified along interconnecting routes.

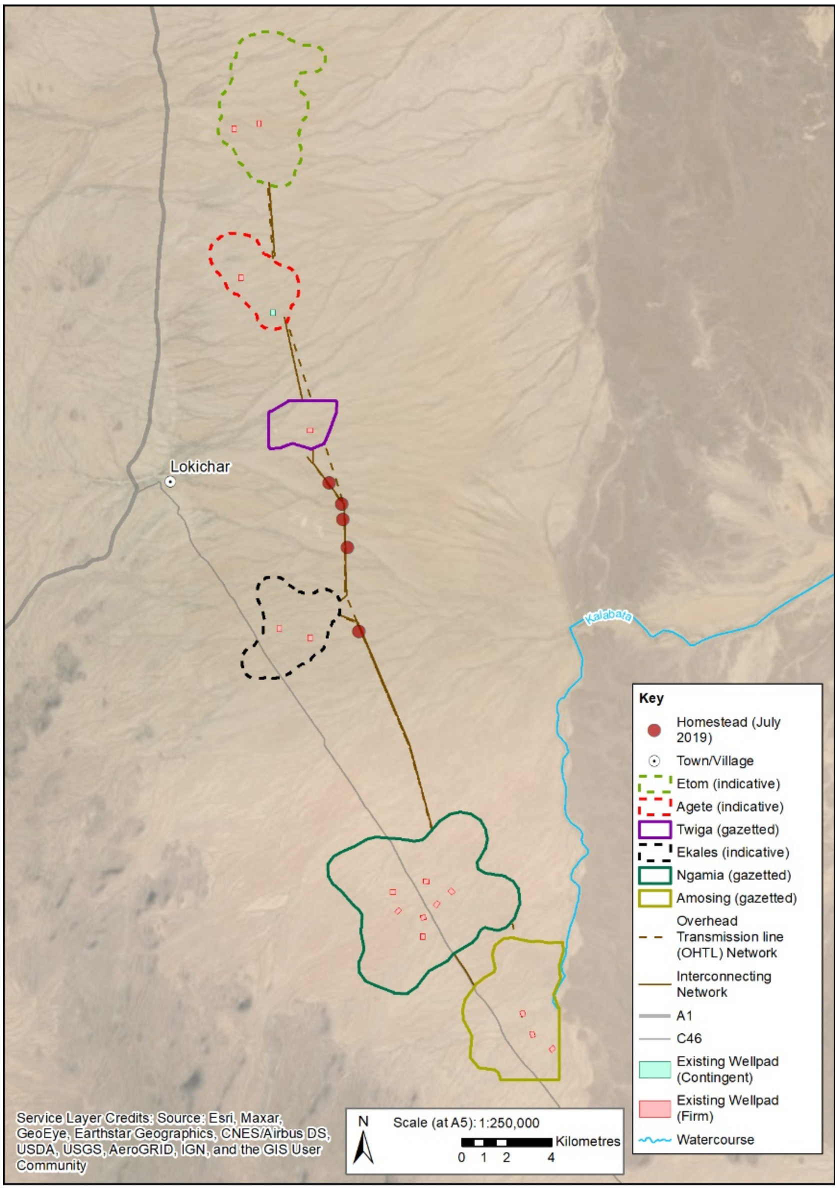


Figure 6.12-35: Interconnection Routes between Fields and Occupied Homesteads

6.12.2.30 Community Health and Safety

6.12.2.31 General Health Profile of Turkana County and West Pokot County

Table 6.12-34 shows the leading causes of morbidity in the two Counties. This is based on secondary data obtained from the HMIS for both Turkana and West Pokot, and primary data from KIIs and health facility assessments in Turkana County. Data is disaggregated into children under 5 years of age and children above 5 years of age and adults. There is no specific disaggregation for children and adolescents aged 5 to 15 years.

The leading causes of morbidity in the area are predominantly communicable and infectious diseases particularly upper respiratory tract infections, malaria, diarrhoeal diseases, skin diseases, and pneumonia. Malnutrition and anaemia also featured among child morbidities, but the burden could be underestimated given that most of the cases (mild-moderate) remain undetected at the community level. Eye and ear infections were also common as were intestinal worms, animal bites and injuries. HIV/AIDS and tuberculosis also cause significant morbidity and mortality, especially among adults. Non-communicable diseases are emerging, particularly hypertension, but these are still overshadowed by the high burden of communicable diseases.

Predisposing factors to disease burden in the area include favourable environments for mosquitoes to proliferate, dust that contribute to respiratory ailments, poor access to safe drinking water and sanitation, high levels of poverty and food insecurity, as well as cultural practices that affect health seeking behaviour and practices.

A detailed description of the morbidities is provided under specific EHAs (Section 6.12.2.33). Notably, the health indicators in the AoI are generally worse than the national average. This is reflected in the poor access to health services, poor access to safe drinking water and sanitation, limited health knowledge and awareness, poor maternal health and child health indicators, etc.

Table 6.12-34: Leading Causes of Morbidity in the Turkana and West Pokot Counties, 2018

Project area	Morbidity (children <5 years)	Morbidity (children >5 years and adults)
Turkana South Sub-county	■ Upper respiratory infections (43.1%); ■ Malaria, confirmed (25.2%); ■ Diarrhoeal diseases (15.7%); ■ Pneumonia (5.2%); ■ Skin diseases (4.1%); and ■ Other diseases (other diseases of respiratory system, unspecified fevers, eye and ear infections, urinary tract infections, malnutrition, anaemia etc.).	■ Upper respiratory infections (30.1%); ■ Malaria, confirmed (27.4%); ■ Diarrhoea diseases (6.6%); ■ Other respiratory diseases (6.4%); ■ Skin diseases (5.1%); ■ Pneumonia (4.4%); and ■ Other diseases (unspecified fevers, urinary tract infections, arthritis, injuries, typhoid fevered).
Turkana East Sub-county	■ Upper respiratory infections (42.1%); ■ Diarrhoeal diseases (15.1%); ■ Malaria, confirmed (12.1%); ■ Pneumonia (5.3%); ■ Skin diseases (3.8%); and ■ Other diseases (other respiratory diseases, ear and eye infections, unspecified fevers, anaemia, bites/injuries, malnutrition, intestinal worms, etc.).	■ Upper respiratory infections (30.3%); ■ Malaria, confirmed (19.4%); ■ Other respiratory diseases (6.4%); ■ Diarrhoea diseases (5.8%); ■ Skin diseases (4.2%); ■ Pneumonia (3.3%); and ■ Other diseases (injuries, urinary tract infections, typhoid fever, eye infections, animal bites, arthritis, etc.).
West Pokot County	■ Upper respiratory infections (51.1%); ■ Diarrhoeal diseases (15.2%); ■ Malaria, all cases (14.1%); ■ Eye infections (10.2%); ■ Pneumonia (6.0%); ■ Skin diseases (4.9%); and ■ Other diseases (unspecified fevers, malnutrition, intestinal worms, other respiratory diseases, ear infections, etc.).	■ Upper respiratory infections (32.0%); ■ Malaria, all cases (12.5%); ■ Pneumonia (5.9%); ■ Skin diseases (5.9%); ■ Diarrhoea diseases (4.7%); ■ Typhoid fever (4.5%); and ■ Other diseases (urinary tract infections, eye and ear infections, injuries, unspecified fevers etc.).

Source: HMIS 2018 and primary baseline data

6.12.2.32 Health Infrastructure and System Challenges

Health service provision in the Counties is centred around the tenets described by both the KEPH and Schedule IV of the Kenya Constitution (2010). These define mandates, roles and responsibilities for interventions and service delivery at Level 1 (community), Level 2 (dispensary), Level 3 (health centre), Level 4 (Sub-county hospital) and Level 5 (County referral hospital) of the health system. At national level, the MoH directs the overall policy direction and the overarching goals for which the County governments align their strategies and plans.

Table 6.12-35 provides a summary of the health infrastructure. An estimated half of the facilities are public (government owned), 38% private-for-profit, 10% FBOs and 3% owned by NGOs, Ministry of Health (2018). According to official County documents, the average distance to a heath facility is 35 km in Turkana County, and 25 km in West Pokot.

Table 6.12-35: Health Infrastructure in the AoI, 2018

Health facility	Turkana	West Pokot	Kenya (for reference)
By type			
Tertiary Hospital (Level 6)	0	0	4
Secondary Hospital (Level 5)	1	1	28
Primary Hospital (Level 4)	5	4	712
Health Centre (Level 3)	27	11	1715
Dispensary (Level 2)	169	104	4,507
Medical Clinic (Level 2)	22	15	3,351
Other	1	0	217
By ownership			
Government	166	101	5,167
FBO	36	17	1,110
NGO	4	1	321
Private for profit	19	16	4,036
Total	**225**	**135**	**10,534**

Source: Kenya Health Facility Master List (Webpage as of December 2018). Findings corroborated by findings from official County documents and primary baseline data from KIIs

In June 2021, the World Bank approved $750 million of development policy financing to support Kenya's recovery efforts and improve public investment spending, with priorities on supporting the healthcare sector. It is not clear if health infrastructure in Turkana or West Pokot will benefit from this investment.

Table 6.12-36 provides a summary of the health system challenges and contributing factors in the Project AoI, according to findings from primary participatory data collected in the field. Key challenges include inadequate health infrastructure, inadequate human resources for health, chronic food insecurity, poor health seeking behaviour, poor access to water and sanitation, and high burden of communicable and infectious diseases.

Table 6.12-36: Health System Challenges in the AoI

County	Challenges	Contributing factors
Turkana	■ Inadequate health infrastructure (35 km average distance to a health facility); ■ Inadequate human resources for health coupled with low capacity/skills of healthcare workers; ■ Food insecurity and high rates of malnutrition; ■ High demand for health services; ■ High burden of communicable and infectious diseases (HIV, TB, respiratory infections, etc.); and ■ Frequent outbreaks of epidemic diseases (cholera, typhoid fever, malaria). ■ Poor health seeking behaviour and health practices in the community; ■ Poor access to safe drinking water and sanitation; ■ Insecurity in certain areas; ■ Population mobility/nomadic lifestyle; ■ Emerging burden of non-communicable diseases; and ■ Referral system challenges .	■ Arid and semi-arid climate predisposes to risks of food insecurity; ■ Historical marginalisation of local population; ■ Vast and remote geographical area coupled with sparse population makes health service delivery challenging; ■ Population influx in urban and peri-urban areas; ■ Vulnerabilities associated with the borders of South Sudan/Ugandan and Ethiopia; ■ Large refugee population; and ■ Low literacy levels. ■ Negative cultural practices (such as use of traditional medicines); ■ Ethnic conflicts; and ■ Changing lifestyles and urbanisation are contributing to the emergence of non-communicable diseases.
West Pokot	■ No primary data.	■ No primary data.

6.12.2.33 Environmental Health Areas

The following section describes the baseline health status in relation to the proposed Project with reference to the EHA framework. This is based on secondary data that was identified during desktop review and primary data that was gathered during field work. The list below summarises the EHA as a reference (WBG, 2009).

- **EHA#1: Communicable diseases linked to the living environment** – Transmission of communicable disease (e.g. acute respiratory infections (ARI), pneumonia, tuberculosis (TB), meningitis, plague, leprosy, etc.) that can be linked to inadequate housing design, overcrowding and housing inflation. It also considers indoor air pollution related to use of biomass fuels.
- **EHA#2: Vector-related diseases** – Mosquito, fly, tick and lice-related disease (e.g. malaria, dengue, yellow fever, lymphatic filariasis, rift valley fever, human African trypanosomiasis, onchocerciasis)
- **EHA#3: Soil-, water- and waste-related diseases** – Diseases that are transmitted directly or indirectly through contaminated water, soil or non-hazardous waste (e.g. diarrheal diseases, schistosomiasis, hepatitis A and E, poliomyelitis, soil-transmitted helminthiases)
- **EHA#4: Sexually-transmitted infections, including HIV/AIDS** – Sexually-transmitted infections such as syphilis, gonorrhoea, chlamydia, hepatitis B and, most importantly, HIV/AIDS. TB will be discussed where relevant under HIV, but often linked to EHA#1.

- **EHA#5: Food-and nutrition-related issues** – Adverse health effects such as malnutrition, anaemia or micronutrient deficiencies due to e.g. changes in agricultural and subsistence practices, or food inflation, gastroenteritis, food-borne trematodiases, etc. This will also consider feeding behaviours and practices. Access to land plays a major role in developing subsistence farming contexts.
- **EHA#6: Non-communicable diseases** – e.g. Cardiovascular diseases, cancer, diabetes, obesity.
- **EHA#7: Accidents/injuries** – Road traffic or work-related accidents and injuries (home and project related); drowning.
- **EHA#8: Veterinary medicine and zoonotic disease** – Disease affecting animals (e.g. bovine tuberculosis, swinepox, avian influenza) or that can be transmitted from animal to human (e.g. rabies, brucellosis, Rift Valley fever, Lassa fever, leptospirosis).
- **EHA#9: Exposure to potentially hazardous material, noise and malodours** – This considers the environmental health determinant linked to the Project and related activities. Noise, water and air pollution (indoor and outdoor) as well as visual impact will be considered in this biophysical category. It can also include exposure to heavy metals and hazardous chemical substances and other compounds, solvent or spills and releases from road traffic and exposure to mal-odours. There is a significant overlap in the environmental impact assessment in this section. Ionizing radiation also falls into this category.
- **EHA#10: Social determinants of health** – including psychosocial stress (due to e.g. resettlement, overcrowding, political or economic crisis), mental health, depression, gender issues, gender base domestic violence, suicide, ethnic conflicts, security concerns, substance misuse (drug, alcohol, smoking), family planning. There is a significant overlap in the social impact assessment in this section.
- **EHA#11: Health seeking behaviours and cultural health practices** – Role of traditional medical providers, indigenous medicines, and unique cultural health practices.
- **EHA#12: Health system issues** – Physical health infrastructure (e.g. capacity, equipment staffing level and competencies, future development plans); program management delivery systems (e.g. malaria, TB, HIV/AIDS-initiatives, maternal and child health).

6.12.2.33.1 EHA#1: Communicable Diseases Linked to Housing Design

Communicable diseases (e.g. ARI, pneumonia, tuberculosis, meningitis, plague and leprosy) are spread from one infected person to another, from animal to human, or from some inanimate objects to an individual. Therefore, they are directly linked to housing design, overcrowding and the general living circumstances in a community.

6.12.2.33.1.1 Secondary Data

Rural housing in both Turkana and West Pokot is predominantly made of traditional material, with temporary or makeshift structures evident in areas linked to the nomadic lifestyle of some inhabitants. Households in Turkana (6.9 persons per household) and West Pokot (5.5 persons per household) are generally larger than the national average of 3.9 (KNBS, 2012; Turkana County Government, 2013; County Government of West Pokot, 2013). Most of these households (>90%) use solid fuels (wood, charcoal, dung, etc.) for cooking. The use of solid fuels for cooking is a major source of indoor air pollution and an important contributory factor for ARI and chronic airways disease. Access to electricity remains very low.

Tuberculosis is endemic nationally, with a prevalence of 558 cases per 100,000 people, according to a national survey conducted in 2016 (Ministry of Health, 2018). The National TB, Leprosy and Lung Disease (NTLD) Programme provides annual statistics on TB with reporting at national and County level based on programmatic data. The disease is also a burden in the AoI, with Table 6.12-37 summarising TB indicators in Turkana and

West Pokot Counties compared to national level, based on latest findings from the 2017 NTLD annual report. The number of bacteriologically confirmed cases of TB shows an upward trend in both Counties (Figure 6.12-36) (NLTD, 2018).

Table 6.12-37: Tuberculosis Indicators in the AoI, 2017

Indicator	Turkana	West Pokot	Kenya
Bacteriologically confirmed (no.)	1,182	834	44,365
TB case notification rate (per 100,000 population)	200	235	172
GeneXpert sites (no.)	2	3	32
GeneXpert utilisation rate (%)	36	31	49
Diagnostic sites, smear microscopy (no.)	27	28	537
TB treatment sites (no.)	49	46	3,618
Drug resistance (no. all forms)	21	15	577
Treatment success rate (% confirmed cases)	79	82	81
Death rate (% new confirmed cases)	2	4	6
TB-HIV co-infection rate (%)	22	10	28
TB cases that are children (<15 years) (%)	19	17	9

Source: NTLD Programme Annual Report 2017

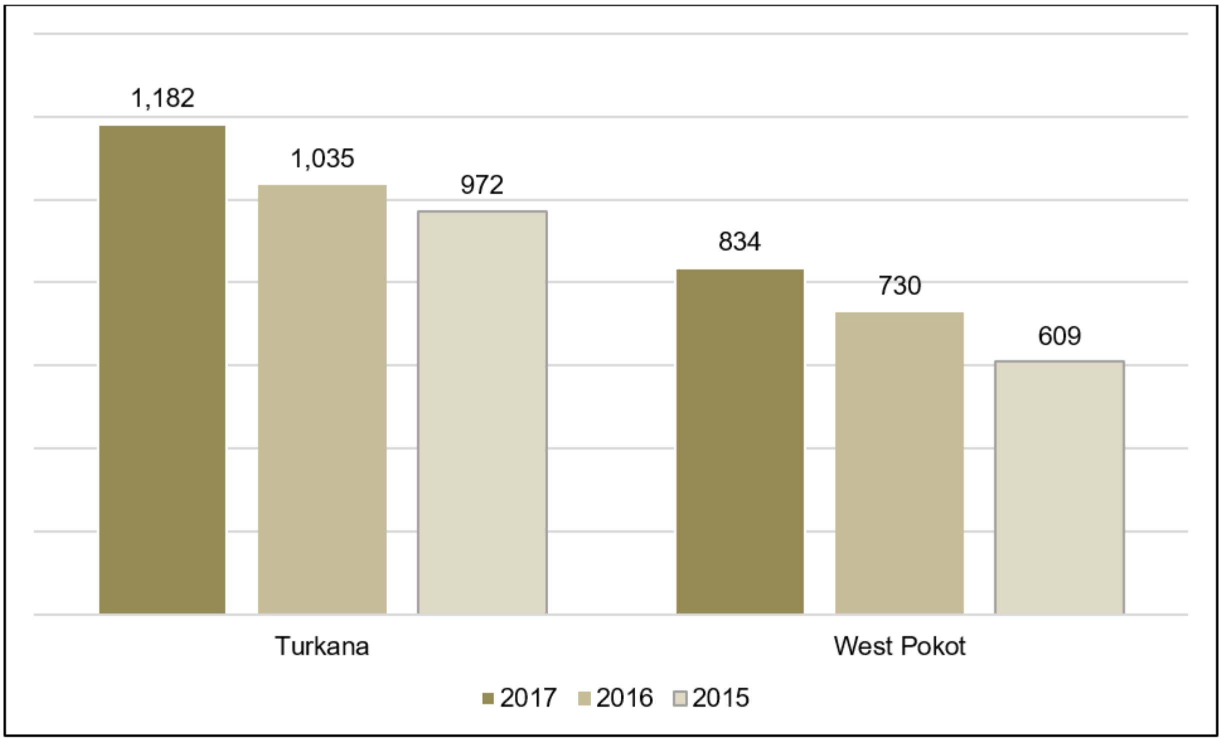


Figure 6.12-36: Trend in Tuberculosis Cases (Bacteriologically Confirmed) in the AoI, 2015-2017

Source: NTLD Programme Annual Report 2017

ARIs such as pneumonia, upper and lower respiratory tract infections are a leading cause of disease burden in Kenya (UNDP, 2018; Ministry of Health 2018). According to facility-based data, ARIs account for at least one-third of health consultations in public facilities (34% in 2017, 39% in 2016 and 40% in 2015). The burden of ARI is particularly high among children under-five years of age, where it accounts for 18% of deaths. ARIs are prevalent in the entire AoI, with 2018 routine HMIS data showing that the incidence of pneumonia is above national average (8.5%) in both Counties, with a high of 13.6% in Turkana South Sub-county (Figure 6.12-37) (Ministry of Health, 2019).

Measles remains an important disease of public health concern in Kenya with sporadic outbreaks that are often immediately contained (Obare 2012). Both Turkana and West Pokot Counties are prone to measles outbreaks owing to prevailing sub-optimal vaccine coverage occasioned by nomadic lifestyle and the significant movement of people. The risk in Turkana County is further compounded by its border location and the presence of a large refugee population. A 2017 measles outbreak resulted in 232 cases in Turkana County with the South Sub-County most affected (175 cases), and with West Pokot recording 17 cases. The Project AoI recorded a significant decrease in measles cases in 2018 (Turkana 35 cases, and 15 cases in West Pokot).

Meningococcal Meningitis is an outbreak risk as the north-western tip of Kenya lies within the African meningitis belt (WHO, 1998). Outbreaks of meningitis in the belt are generally associated with seasonality linked to semi-arid areas (dust a predisposing factor). Turkana County is vulnerable to meningitis outbreaks owing to its border location and presence of refugee populations. The risk is generally low in West Pokot. No outbreaks of the disease have been recorded or reported in the AoI in recent past.

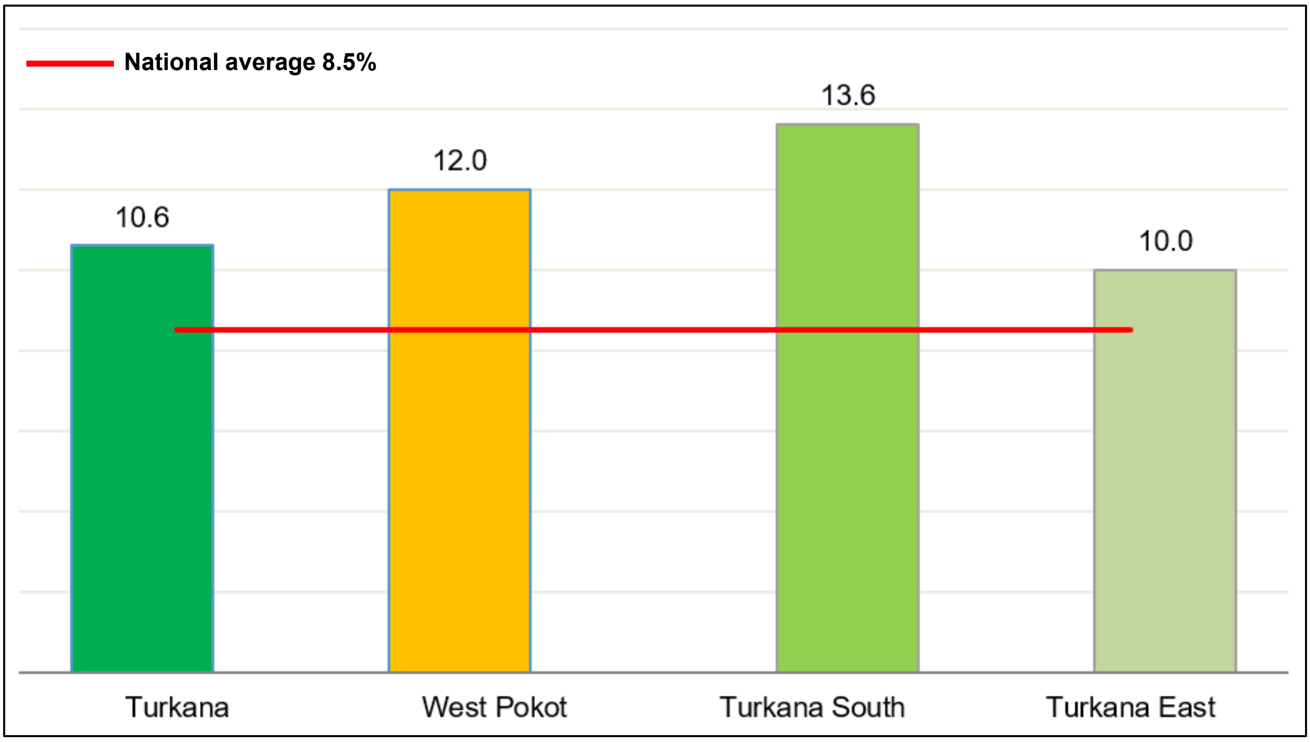


Figure 6.12-37: Incidence of Pneumonia (%) in the Project area, 2018

Source: HMIS 2018

COVID-19, which was first detected in Kenya on 14 March 2020 and has resulted in 3,428 deaths (as of 17 June 2021) (WHO, 2021), continues to be a global pandemic and a primary health concern in Kenya, even as increasing numbers of vaccines are administered around the globe. Vaccination rates vary from country to country, with global equitable access to vaccines through the COVAX programme a key priority for the WHO and its partners. As of 15 June 2021, a total of 1,116,021 vaccine doses had been administered in Kenya (WHO, 2021).

Based on a search of the Turkana County government website in June 2021, a number of key elements were noted on the situation in the County and response elements:

- In July 2020, a new intensive care (3 beds) and high dependency unit (4 beds) was opened at Lodwar County Referral Hospital, to support the potential need for critical COVID-19 patients. It was planned to have a total 13 bed total capacity in the County, including 2 beds for Lokichar hospital. Three new ambulances were also noted to be operational.
- In a statement in October 2020, it was noted that a number of healthcare workers had been infected and that additional healthcare workers were being recruited to support the hospital.
- Testing capacity was installed in the Lodwar County Referral Hospital and in Kakuma in the form of a GeneXpert testing units, with 400 test kits donated in February 2021 by the UNHCR. Previously tests were sent to Eldoret or Kisumu for analysis.
- UNHCR is also supporting the improvement in hospital infrastructure and increased ICU capability.
- In March 2021, the County Governor and the First Lady received their first doses of the vaccine to promote confidence in future vaccination drives. As part of the 9,000 doses that the County received, over 250 frontline and healthcare workers were also vaccinated, but the article noted some initial hesitancy in this group.
- The majority of infections in the County were recorded at the Kakuma refugee camp.

6.12.2.33.1.2 Primary Data

Housing is a major challenge in most parts of Turkana County. Most of the population in rural areas live in *manyattas,* which are makeshift structures, built of rudimentary materials. Poor housing was linked to widespread poverty and the migratory lifestyle of people. Housing inflation was reported in major urban centres particularly Lodwar town and in Lokichar centre. Influx of people has been witnessed in Lodwar and Lokichar and this was partly linked to devolution of resources to County level and the oil discovery in the area (Focus Group Meeting, 21 November 2018).

Focus group discussion participants characterised their housing as poor and cited lack of money to build adequate housing. Participants in Lokichar urban area reported that the demand for housing has increased leading to increasing rental prices. Mushrooming of guest houses and lodges was also evident in Lokichar urban centre, indicating an increasing demand for temporary accommodation. In the local urban settlements, it was reported that there is an increasing number of permanent and semi-permanent housing structures being erected, while the situation in rural areas remained unchanged.

Respiratory infections emerged among the top five causes of morbidity in Turkana County and the local Project area. Findings from field research show that ARIs constitute at least one third of health facility consultations in Turkana South and East Sub-counties. Facility-based data from Lokichar Health Centre (missionary facility), Lokichar Dispensary, Katilu Hospital and Elelea Hospital all showed ARIs among the top five diagnoses. Key informants identified dusty weather and poor housing as the main predisposing factors. This was consistent with findings from the focus group discussions where participants spontaneously listed cough and pneumonia amongst the commonest ailments affecting young children and adults in their communities.

TB was listed among the top ten health challenges in Turkana County (Focus Group Meeting, 21 November 2018). This was corroborated by findings from local health facilities and focus groups. The County TB programme manager reported an increasing trend of new TB cases and attributed this partly to increasing efforts to detect cases, through active screening and improved diagnostics using the GeneXpert analyser. As of 2018, the County had only three GeneXpert sites (at Kakuma Refugee Camp, Lodwar Hospital, and Katilu in Turkana South). Turkana County records 2,600 to 2,800 new TB cases every year. Informal settlements in Lodwar, Kakuma, Lokichar and Kalokol (around Lake Turkana) were cited as hotspots for new TB infections. Multi-drug resistant TB is an emerging threat especially in Lodwar, Kakuma (12 cases in 2017) and Lokichar (4 cases in 2017). TB-HIV co-infection remains a concern the County, at a rate of 22% in 2017. Diagnostic and treatment services for TB were available in all hospitals and some health centres. There is currently no TB treatment centre in Lokichar which relies on the nearest centre at Katilu Sub-County Hospital or the Lodwar County Referral Hospital (has a dedicated TB *manyatta*). Medications for TB including multi-drug resistant TB treatment were generally available at no cost, with occasional stock outs linked to supply chain inefficiencies.

Measles remains a concern in the entire AoI owing to the prevailing poor immunisation coverage and its outbreak potential. According to KIIds, cases are recorded almost every year. Turkana South and West (Kakuma Refugee Camp) were reported as hotspots for measles outbreaks. Meningococcal meningitis did not emerge as a concern, but the threat of an outbreak was acknowledged.

COVID-19 cases are recorded within the AoI, with the Turkana CDSC questionnaire response (completed 5 June 2021) indicating 1,478 recorded cases in Turkana. These cases were reported as unevenly distributed across the county, with 372 cases reported in Turkana Central (SCDSC questionnaire, completed 10 June), 17 in Turkana South (SCDSC questionnaire, completed 16 June) and no cases in Turkana East (SCDSC questionnaire, completed 11 June).

Questionnaire responses received from the CDSC and three SCDSCs are generally aligned and corroborate the information summarised by the NDMA in their long and short rain assessments. The responses received confirm that curfews and restrictions on the movement of pastoralists across county boundaries were enforced to curb the spread of COVID-19, which resulted in economic and social disruption.

The responses to questionnaires also confirm that health budgets, other budgets and staff were diverted to assist in tackling the pandemic. Questionnaire responses also highlight a lack of trained medical staff, and insufficient PPE and other live-saving facilities, equipment and resources (e.g. intensive care beds, ventilators and oxygen). All responses indicated that health facilities in the area would struggle if a surge in cases of COVID-19 were to occur, although they are slightly better equipped or prepared now to respond to disease outbreak or pandemic situations than prior to COVID-19.

The ability to meet County health targets was generally acknowledged to have initially been significantly impacted, with other health programmes suffering as a result of diverted funds and resources towards tackling COVID-19, as well as reluctance to attend health centres for fear of contracting COVID-19. The consensus in the responses received, however, was that over time the delivery of other health care programmes has begun to return to ‘normal’. Services that were affected included low childhood immunization and growth monitoring in this especially vulnerable group. Antenatal care was also disrupted when services were curtailed due to cases of COVID-19 in the facilities. Chronic disease management programmes (such as TB care) have also been disrupted. Health services were also disrupted as facilities were repurposed to isolation facilities, health care staff were allocated solely to COVID-19 response and human resources were subject to burnout due to heavy workloads. Turkana Central appeared to be the worst affected in the questionnaire responses, with 10 deaths including healthcare workers.

6.12.2.33.2 EHA#2: Vector-Related Disease

The most important disease vectors in the Project area are mosquitoes that may transmit malaria and certain filarial disease; and flies, especially sand-flies that may transmit leishmaniasis.

6.12.2.33.2.1 Secondary Data

Malaria: Turkana falls in the seasonal transmission zone, while West Pokot lies in the highland epidemic-prone zone. Description for each zone are shown in Table 6.12-38.

Table 6.12-38: Malaria Epidemiological Zones in Kenya

Malaria zone	Description	Prevalence	AoI County
Endemic areas	Areas of stable and intense malaria transmission throughout the year with high annual entomological inoculation rates. Includes the Lake Endemic and Coastal Endemic areas which are home to 29% of the country's population.	>20%	None
Highland and epidemic-prone areas	Malaria transmission in the western highlands is seasonal with considerable year-to-year variation. The entire population is vulnerable and case-fatality rates during an epidemic can be greater than in endemic regions. Approximately 20% of Kenyans live in these areas.	3 to 20%	West Pokot
Seasonal transmission areas	This epidemiological zone includes the arid and semi-arid areas of northern and central parts of the country, which experience short periods of intense malaria transmission during the rainy seasons. Although geographically the largest zone, only 17% of the population lives in these areas.	1 to 5%.	Turkana
Low risk areas	This zone covers 10 Counties in the central highlands of Kenya including Nairobi. Approximately 34% of the population lives in this zone.	<1% to none	None

Source: NMCP, 2016

Data from official County documents shows that malaria contributes 41.8% of outpatient morbidity in Turkana County, and 15.2% of outpatient morbidity in West Pokot (Turkana County Government, 2013; County Government of West Pokot, 2018).

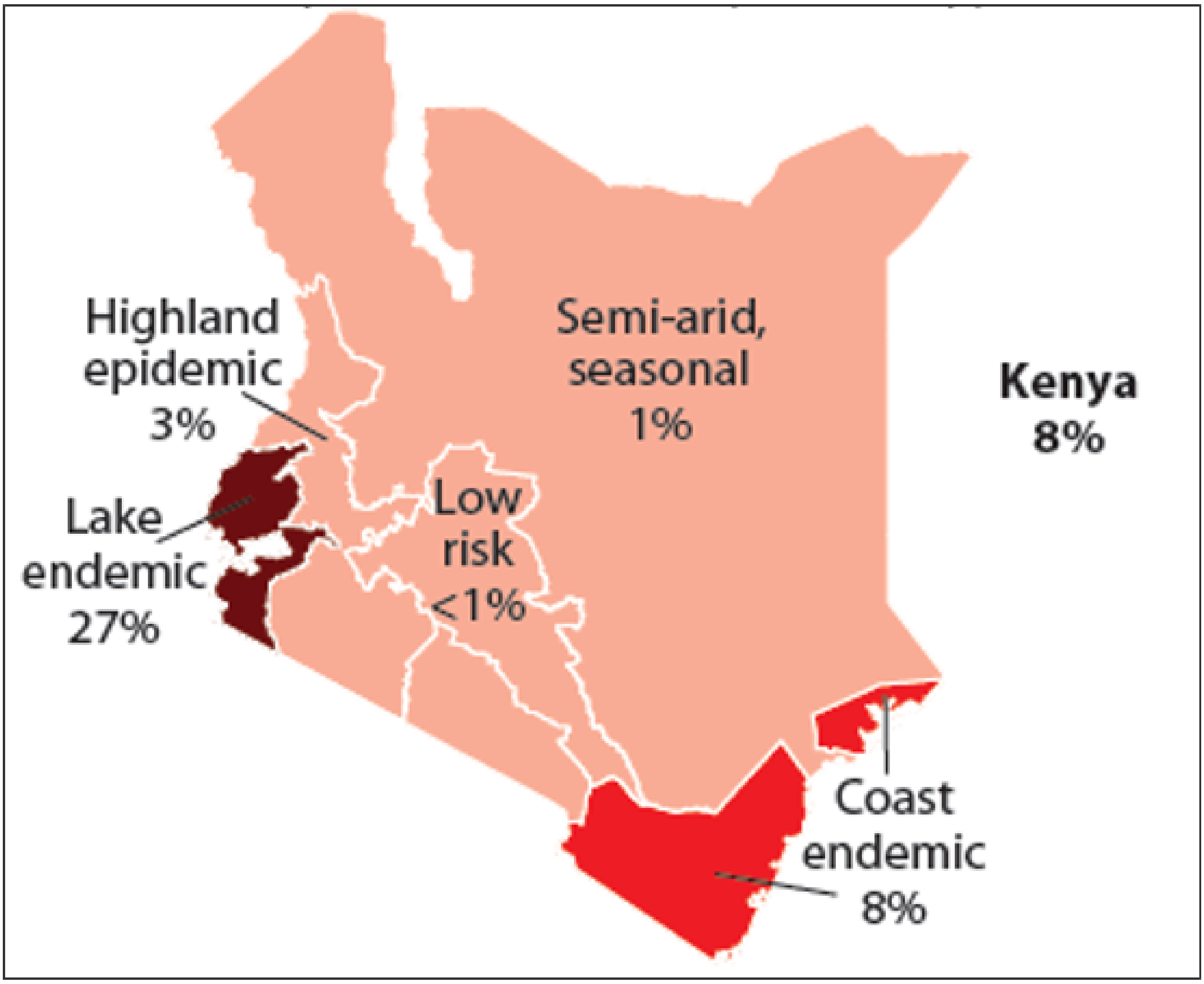


Figure 6.12-38: Prevalence of Malaria in Kenyan Children (Age 6 Months to 14 Years Old) Stratified by Epidemiological Zones, 2015

Source: KMIS 2015

HMIS data for 2018 shows a high malaria positivity rate (proportion of febrile patients that test positive for malaria) in Turkana County (37.4%), compared to 22.2% in West Pokot and 26.6% as the national average. Nearly half (45.2%) of febrile patients in Turkana South and at least a third (36%) in Turkana East tested positive for malaria during 2018 (Figure 6.12-39) (Ministry of Health, 2019). Between 2016 and 2018, the number of confirmed malaria cases in Turkana County increased from 107,977 to 117,003. During the same period confirmed malaria cases in Turkana South increased four-fold from 4,301 to 17,680, while cases in Turkana East increased five-fold from 682 to 3,100. However, West Pokot County registered a modest increase in confirmed malaria cases from 30,762 in 2016, to 34,621 in 2018 (Ministry of Health, 2019). Regarding malaria related deaths, Turkana County recorded 456 in 2018, increasing from 245 in 2017, and 323 in 2016. Nearly half of the malaria deaths in Turkana County in 2018 (231 out of 456) occurred in Turkana South, while Turkana East recorded a few deaths. West Pokot recorded 125 malaria deaths in 2018, representing a fatality rate of 3.6% (Ministry of Health, 2019). It is noted these statistics reflect the patients that were treated in a public health facility and given health seeking behaviour and access challenges, the results may not be consistently accurate.

According to a personal communication with a leading malaria researcher Professor Robert Snow from KEMRI, malaria risks vary tremendously across the vast area of Turkana (Snow, R., 2016). This was largely driven by the presence of *An. Arabiensis* mosquito and often associated with water courses, especially the Turkwel River

(Snow, R., 2016). Distribution of malaria cases were also associated with movement of people and weak malaria control programmes. A study completed in Lokichar in 2010 indicated a parasite prevalence of 30%. The risk in the Project area varies between a 5 and 40% (Snow, R., 2016).

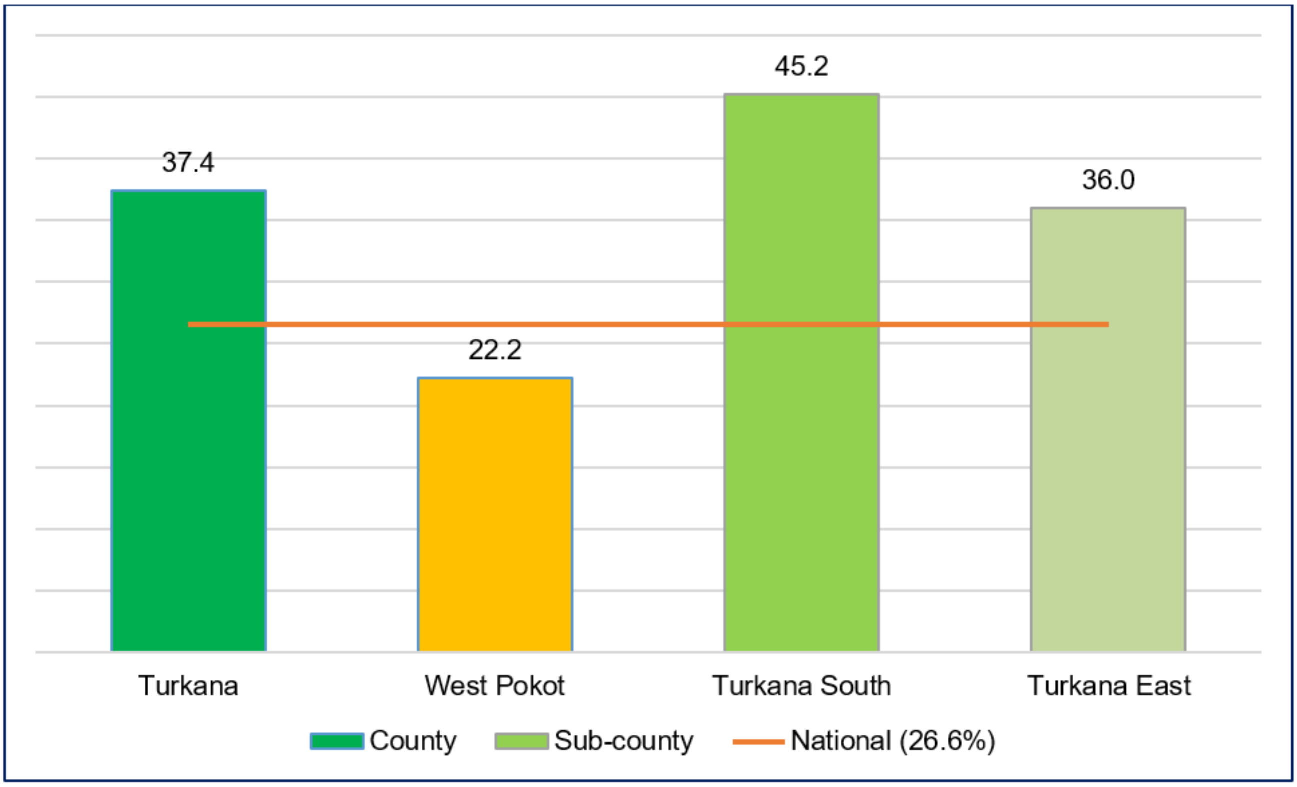


Figure 6.12-39: Malaria Positivity Rate (%) in the Project Area, 2018

Source: HMIS 2018

Arboviral diseases (arthropod borne viruses) are a risk in the Project area. These acute viral fevers (dengue, chikungunya, yellow fever, Rift valley fever) are transmitted by a day-biting mosquito from the *Aedes* genus, which breeds mainly in human-made containers. These diseases are often poorly documented due to limited awareness by health care providers and lack of diagnostic capability. Studies have documented a dengue antibody positivity rate of 12.5% nationally, with clustering around Coastal and North-Eastern regions of the country (Ochieng et al., 2015). Literature indicates a 14% sero-prevalence of yellow fever antibody in northern Kenya, but no confirmed cases or outbreaks have been documented for many years (Sanders et al., 2016).

Rift valley fever is a significant risk in pastoral communities. An outbreak of Rift valley fever was reported in July 2018 from North-Eastern Kenya (Wajir County), which resulted in four human deaths (Daily Nation, 2018). However, no cases were recorded in either Turkana or West Pokot.

Leishmaniasis, especially the visceral form (Kala-azar), is endemic in parts of Kenya, particularly the Rift Valley, eastern and north-eastern regions (Tonui, 2006). The disease is a risk in both Turkana and West Pokot Counties, which according to HMIS data recorded 272 and 335 cases in 2018, respectively. Turkana South recorded 38 cases Kala-azar in 2018 while Turkana East recorded only 2 cases (Ministry of Health, 2019).

6.12.2.33.2.2 Primary Data

Malaria is an important health concern in Turkana County, with the burden of disease, and therefore risk, considered to be higher than is generally reported on malaria spatial distribution models. According to the County malaria programme coordinator, the disease has localised hot-spots in the County. In Turkana South, the Turkwel and Kerio Rivers were noted as high-risk areas, as are areas in Loima and parts of Turkana East. The increased risk in Turkana South and part of Turkana East was linked to the bordering of endemic areas, especially West Pokot and Baringo, respectively. The risk in Loima was linked to irrigation schemes.

Malaria exhibits a seasonal pattern with an upsurge of cases during the rainy season. The programme officer reported an increase in malaria cases from 125,466 in 2015, to a high of 193,327 in 2017 (including clinically diagnosed and reported malaria cases[42]). Several deaths were also recorded.

According to the national malaria policy, the entire Turkana County is considered low risk for malaria and therefore does not benefit from any mass targeted malaria control programmes. Therefore, there is no mass distribution of LLINs at a community level and no facility-based issuance of LLINs to high-risk groups like children and pregnant women. Some indoor residual spray activity was conducted in the Loima area during November to December 2017, with this in response to an intense transmission period that resulted in a localised epidemic.

A government-led entomological study was conducted in Turkana County in March 2018. The results were not available at the time of writing the report.

Focus group participants consistently listed malaria among common ailments affecting young children, with the disease especially a big challenge during the rainy season. While the majority knew the mode for malaria transmission (through mosquito bites), there were some misconceptions of malaria transmission through drinking dirty water or consumption of dirty food. Ownership of LLINs was generally very low and participants cited lack of a government distribution programme and the lack of means to purchase their own net. Assessment of the local health facilities in Lokichar, Katilu and Lokori revealed that malaria is among the top-five reasons for outpatient consultation. Rapid diagnostic test kits for malaria and treatment were generally available in public health facilities, with these provided to the public at no cost.

Kala-azar was mentioned among neglected tropical diseases occurring in Turkana County and reported to have a focal distribution pattern along riverbanks. The vector (sand-fly) was associated with and breeds around anthills. Key informants at Lokichar Health Centre and Katilu Hospital reported that tens of cases of Kala-azar are recorded every year. Rapid serological test kits and treatment were generally available at the public facilities, but poor recognition of symptoms, confounding diagnosis, and late presentation of cases often led to poor patient outcomes.

No primary data was available on arboviral diseases.

6.12.2.33.3 EHA#3: Soil, Water and Waste-related Diseases

The prevalence of soil, water and waste-related diseases highly depend on sanitation facilities and access to safe drinking water, factors that often show strong variations at regional and local levels.

6.12.2.33.3.1 Secondary data

Seven in ten households in Kenya (69%) have access to an improved source of drinking water. This proportion is higher in urban (90%) than rural areas (59%) (KNBS, 2015). For more than a quarter of households, it takes 30 minutes or longer to obtain drinking water (KNBS, 2015). Nationally, only half (53%) of households have access to an improved sanitation facility, including 30% that are shared (KNBS, 2015). Data for 2013 shows that only 44% of households in Turkana County have access to safe drinking water, with a far lower proportion (18%) having access to improved sanitation services (KIRA, 2014).

[42] The clinical cases of malaria are generally made on a presumptive basis, either due to the lack of diagnostics or a high index of suspicion.

As of 2018, only 41% of West Pokot's population had access to safe drinking water with the average distance to nearest water point at 5 km. Sanitation also remains a big challenge in West Pokot with only 33% coverage for sanitation services. The majority in both West Pokot (67%) and Turkana (56%) Counties have no sanitation facility and therefore practice open defecation. Both these Counties are implementing a Community Led Total Sanitation (CLTS) strategy, an innovative community led drive for collective behaviour change towards greater ownership and sustainable sanitation in maintaining an open defecation free status. A CLTS monitoring system is in place, with January 2019 data showing that only 51 out of 1,956 villages in Turkana County (3%) and 32 out of 2,311 villages in West Pokot (1%) have been certified as open defecation free. CLTS data also shows that 96% of villages in both Turkana East and South still practice open defecation (CLTS, 2019). According to a 2018 survey, only 10% of Turkana population wash their hands at critical times (Ministry of Health, 2018)).

Diarrhoeal disease (caused by bacteria, virus and parasites), cholera and typhoid fever are some of the most common diseases in this context. Cases are largely attributable to three major environmental causes: poor sanitation, poor hygiene, and contaminated water and food (ACF, 2013). HMIS data for 2018 shows that a third (35%) of children seen in outpatient clinics in Turkana County and 30% in West Pokot presented with diarrhoea. This proportion was even greater in Turkana South at 40.8% Figure 6.12-40) (Ministry of Health, 2019).

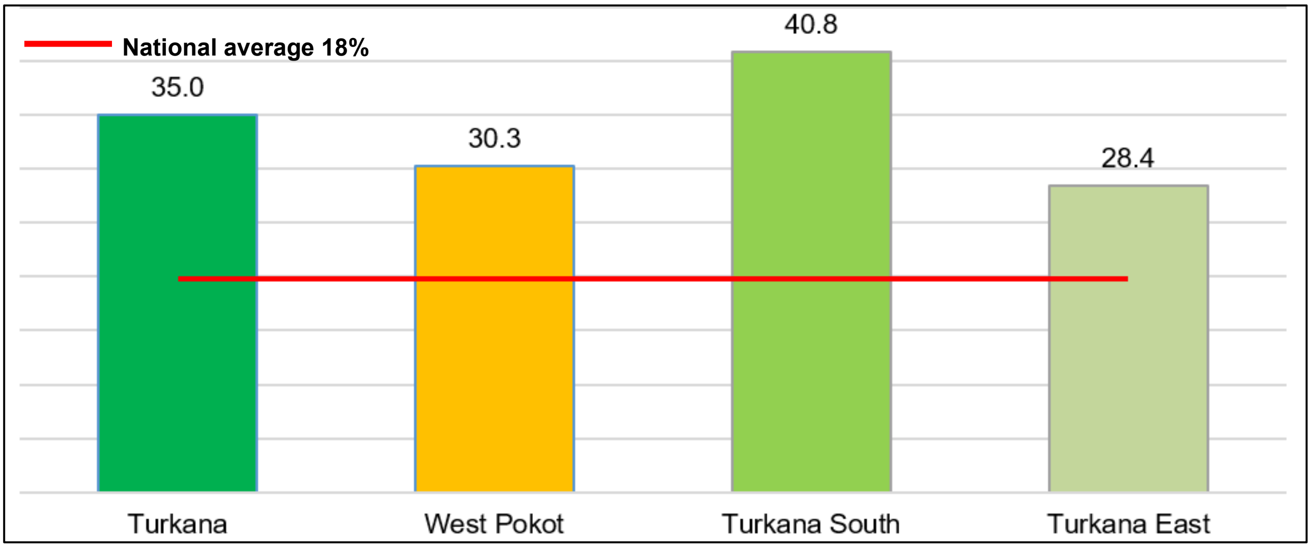


Figure 6.12-40: Proportion of Sick Children (Under 5) Presenting with Diarrhoea in the Outpatient Clinics, 2018

Source: HMIS 2018

Cholera outbreaks occur frequently and remain a significant risk in the Project area, with a 2018 outbreak in Turkana County resulting in a total of 1042 cases and 11 deaths (Turkana County Government, 2018). Turkana Central, North, South and West contributed most of the cases as shown in Table 6.12-39 (Turkana County Government, 2018). Turkana East did not record any cholera cases during the 2018 outbreak. The 2018 outbreak also extended to West Pokot which recorded 352 cases (Ministry of Health, 2019).

Table 6.12-39: Cholera Outbreak in Turkana County, 2018

Sub-county	Total cases (confirmed and suspected)	Deaths	Fatality rate (%)
Turkana Central	516	6	1.2
Turkana West	220	2	0.9
Turkana South	168	2	1.1

Sub-county	Total cases (confirmed and suspected)	Deaths	Fatality rate (%)
Turkana North	123	1	0.8
Loima	15	0	0.0
Turkana East	0	0	0.0
Kibish	0	0	0.0
Total	**1,042**	**11**	**1.1**

Source: Cholera situation report for Turkana County as at 27 July 2018

Helminthiases or intestinal worm infection, mostly roundworms and hookworms are prevalent countrywide. These infections can be caused by ingestion of eggs from contaminated soil (e.g., roundworm, whipworm and *Giardia*) or by active penetration of the skin by larvae in the soil (e.g., hookworm). The high rates of open defecation in the AoI coupled with poor hygiene practices are key predisposing factors to the high burden of intestinal worms reported locally.

Schistosomiasis (bilharzia) is endemic in parts of Kenya especially areas with large pools of fresh stagnant water. Both the uro-genital form (caused by *Schistosoma haematobium*) and the intestinal form (caused by *Schistosoma mansoni*) have been documented (ChartsBin, 2012). Different genus of freshwater snails act as intermediate hosts (Utzinger, 2009). However, survey data shows a low prevalence (<1%) of the disease in Turkana and West Pokot (Brooker, 2009). In 2018, Turkana County recorded 131 cases of bilharzia, of which 4 occurred in Turkana South, and none in Turkana East. West Pokot recorded 53 cases of bilharzia (Ministry of Health, 2019).

Poliomyelitis (polio) is an important consideration in this context. While Kenya achieved polio free status in 2003, recent imports of the virus from neighbouring countries have led to sporadic outbreaks, especially in the northern part. The outbreaks have been linked to ongoing wild poliovirus circulation in Somalia and Southern Sudan, with 14 cases reported in Kenya from the Dadaab (Garissa County) refugee camp in 2013 (WHO, 2016). Turkana, West Pokot and other north-eastern parts of the country are considered hotspots for potential polio outbreaks (IRIN, 2016). During 2016 to 2018, Turkana County notified 9 cases of acute flaccid paralysis while West Pokot recorded 5, but none was confirmed as polio.

Hepatitis A and Hepatitis E virus are endemic in Kenya owing to their transmission via the faecal-oral route through contaminated food or water (WHO, 2015). Even though data is limited, these conditions are a likely risk in the Project area given the underlying environmental and living conditions.

6.12.2.33.3.2 Primary Data

Poor access to safe drinking water and sanitation services were cited among key health challenges in Turkana County. According to the County WaSH coordinator, 46% of households have access to safe drinking water; with the average distance to a water point estimated at 15 to 20 km. Faecal contamination of water as a result of widespread open defecation was a noted challenge. High salinity of ground water was also reported as a concern. Based on results from a 2016 to 2017 nutritional and health survey in the Turkana County, only 16% of the population have toilet/latrine facilities, with a high degree of open defecation. The practice of open defecation was attributed to nomadic lifestyle, culture (not sharing toilets with in-laws), and poverty. The County is implementing the CLTS programme to increase sanitation coverage, but the progress remains very slow.

It emerged from an interview with a Turkana South medical officer that the entire Sub-county is water stressed and there is increasing demand for water in urbanising areas such as Lokichar. Focus group participants also reported that access to safe drinking water was a challenge and the supply was inadequate. Ground water (boreholes) was the most common source but increasing use of surface water was reported during the rainy season, with these sources often shared with animals. Participants in Kapese, Lokichar and Nakukulas settlements reported that the Operator has been active in the provision of safe water sources for the local communities, constructing boreholes and piping or trucking water to storage tanks placed at central locations. Long queues were evident at most of the public water points, and water vending using bowsers was observed in Lokichar, further indicating the high demand for water (Figure 6.12-41).

Figure 6.12-41: Examples of Water Sources in the AoI

Diarrhoeal diseases were reported as a major health concern, with an ongoing risk for cholera, typhoid fever, amoebiasis and dysentery outbreaks. According to the Turkana County WaSH coordinator, cyclical cholera outbreaks occur every 9 to 10 years, with the most recent outbreak reported in January to August 2018, resulting in 1042 cases and 11 deaths (case fatality rate of 1.1%). The outbreak occurred in five Sub-counties: Loima, Turkana Central, South (Lokichar and Katilu), North and West. Lokichar recorded 16 cases. The response to the cholera outbreak involved setting up temporary treatment centres in the affected areas. The outbreak occurred in two waves and lasted 8 months; this partly linked to inadequate and weak outbreak response mechanisms.

Focus group participants also reported diarrhoea among commonest ailments in their community and also cited frequent cholera outbreaks. This was further corroborated by findings from local health facilities where diarrhoea was consistently listed among top-five morbidities.

Intestinal worm infections also occur, with a primary school and child health clinic based deworming programme in place supporting mass drug administration biannually. Bilharzia was reported to be generally uncommon. Polio was not reported.

Waste disposal emerged as a huge challenge. Turkana County does not currently have a sewerage plant and no organised garbage collection system is in place. Most combustible wastes are burnt in the open. Some liquid wastes from septic tanks and slaughterhouses are transported for disposal in Kitale, but that was considered unsustainable given the distance. The entire County has only 4 incinerators (1 in Turkana South) for the management of biohazardous waste material.

Responses to the questionnaires in June 2021 indicate that the ability to meet County health targets was generally acknowledged to have initially been significantly impacted, with other health programmes suffering as a result of diverted funds and resources towards tackling COVID-19. Although over time the delivery of other health care programmes has begun to return to ‘normal’. The effect may have impacted health programmes and NGO programmes relating to the management of soil, water and waste related diseases, but it is unclear to what extent these have been impacted by COVID-19.

6.12.2.33.4 EHA #4: Sexually-Transmitted Infections, Including HIV/AIDS

Extractive sector and energy projects in developing countries have a legacy of increasing transmission of STIs through a complex network of social and economic determinants.

6.12.2.33.4.1 Secondary Data

HIV/AIDS: The AoI lies within a low to medium HIV prevalence (Figure 6.12-42) with an estimated prevalence of 3.2% in Turkana County and 1.6% in West Pokot (National AIDS Control Council, 2018; Ministry of Health, 2018).

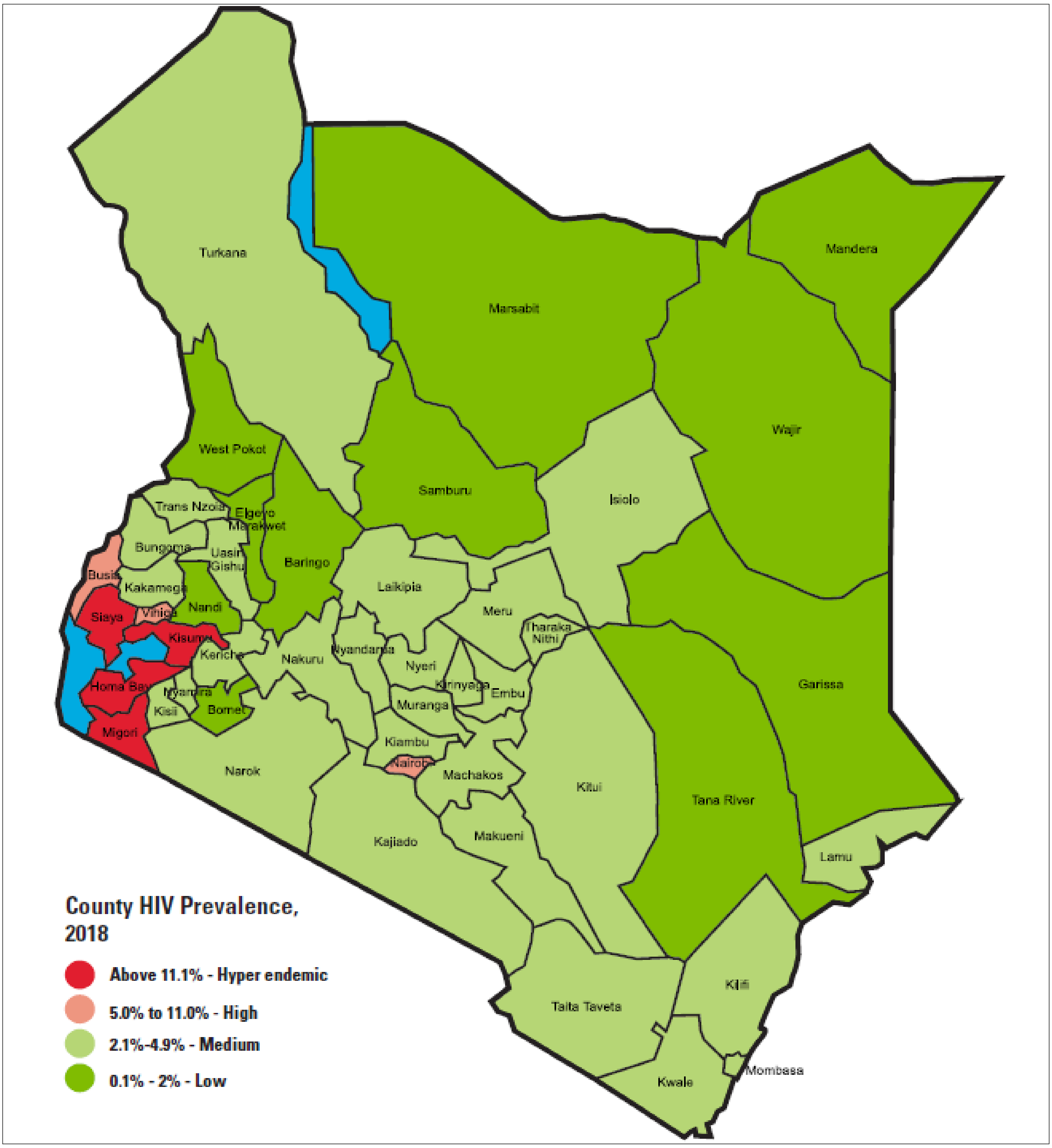


Figure 6.12-42: HIV Prevalence in Kenya by County, 2018

Source: Kenya National AIDS Control Council (NASCOP) AIDS Response Progress Report 2018

The HIV situation in Turkana County is summarised in Table 6.12-40 based on data from an official presentation by the County AIDS programme coordinator in October 2018. The County contributes to 1.6% of the national HIV burden. Together with associated opportunistic infections, the disease accounts for 30 to 40% of adult bed occupancy at Lodwar Hospital. Estimates from data models show that the HIV prevalence in Turkana County has significantly decreased from a high of 7.6% in 2013 to 3.2% in 2018 (NASCOP, 2014; Pulkol, 2018). Between 2013 and 2015, the number of people living with HIV in the County decreased by 50% but increased slightly (by 3%) during 2015 to 2018. HIV-related deaths in the County has declined 77% from 2,537 in 2013, to 588 in 2018 (Pulkol, 2018). Based on survey data presented in the 2014 Kenya Demographic and Health Survey (KDHS), knowledge on HIV was more or less universal in Turkana County, but when questioned on prevention methods knowledge was poor, with 49.2% of women and 2.4% of men reporting that using a condom and limiting sexual contact to one uninfected partner were effective prevention methods [5]. The survey also showed that only 23.9% of women and 1.7% of men (lowest nationally) in the County had comprehensive knowledge about HIV/AIDS. Payment for sex was questioned in the survey with only 0.6% of men in Turkana County reporting that they had ever paid for sex (KNBS, 2014).

Table 6.12-40: Turkana County HIV Estimates, 2018

Indicator	Value
HIV Prevalence	3.2%
Male HIV prevalence	2.7%
Female HIV prevalence	4.5%
HIV Incidence per 1000	0.7%
Adults LWHIV	21,343
Adult new infections	403
Adult HIV related deaths	506
Children LWHIV	1883
Children new HIV infections	152
Children HIV-related deaths	81
Total people living with HIV	23,230
Total new HIV infection	556
Total HIV-related deaths	588
PMTCT need	1117
Mother-to-child transmission rate	18.3%
Adolescents LWHIV (10-19 years)	1,743

Indicator	Value
Adolescents new HIV infections	84
HIV-related deaths among adolescents	42
Young adults LWHIV (15-24 years)	2,582
Young adults new HIV infections	175
HIV related deaths among young adults	51
Adult antiretroviral coverage	23%
Children antiretroviral coverage	38%
PMTCT coverage	48%

Source: Turkana County HIV Situation Presentation by County AIDS Programme Coordinator, October 2018. LWHIV=Living with HIV

The HIV situation in West Pokot shows a better outlook than the national average. The prevalence has decreased from 2.3% in 2014, to the current 1.5%. The County is traversed by the great northern transport corridor with several truck stoppage points which have been identified as hot spots for new HIV infections and commercial sex activity (County Government of West Pokot and NACC, 2016). Gaps and challenges to the HIV response in the County include inadequate funding, negative cultural practices such as female circumcision and wife inheritance, unmet support to orphans and vulnerable children, high stigma and discrimination of HIV affected persons (County Government of West Pokot and NACC, 2016).

Table 6.12-41 (NACC, 2018) shows the trend in new HIV infections in Kenya over the period 2013-2017. Turkana recorded a steady decrease in new HIV infections while West Pokot recorded some increase during 2017.

Table 6.12-41: Trend in New HIV infections, 2013-2017

Increase in HIV infections 2013 to 2017	Decrease in 2015 then increase in 2017	Increase in 2015 then decrease in 2017		Decrease in HIV infections 2013 to 2017	
1 county	8 counties	19 counties		19 counties	
Nairobi	Nakuru	Machakos	Bungoma	Migori	Muranga
	Narok	Makueni	Busia	Homabay	Baringo
	Uasin Gishu	Kiambu	Kwale	Siaya	Samburu
	Kajiado	Meru	Kilifi	Kisumu	Nyeri
	Nandi	Embu	Lamu	Kisii	E. Marakwet
	Lakipia	Tharaka Nithi	Taita Taveta	Turkana	Nyandarua
	West Pokot	Mombasa	Kitui	Bomet	Kirinyaga
	Vihiga	Isiolo	Marsabit	Nyamira	Mandera
		Kakamega	Tana River	Transzoia	Garissa

Increase in HIV infections 2013 to 2017	Decrease in 2015 then increase in 2017	Increase in 2015 then decrease in 2017		Decrease in HIV infections 2013 to 2017	
			Wajir	Kericho	

Source: NASCOP Kenya AIDS Response Progress Report 2018

Sexually transmitted infections such as gonorrhoea, syphilis and chlamydia are an important global health priority because of their devastating impact on women and infants. Moreover, STIs and HIV are linked by biological interactions and can occur in the same population cohorts. Infection with certain STIs can increase the risk of acquiring and transmitting HIV as well as altering the course of HIV progression. STIs are a major health concern in Kenya, with the country recording over 100,000 cases every year (Ministry of Public Health and Sanitation, 2009). HMIS data show that Turkana County and West Pokot recorded 2,224 cases and 2,923 cases of STIs in 2018, respectively. In 2018, Turkana South contributed 20% (452 STI cases) while Turkana East contributed 5% (112 STI cases) (Ministry of Health, 2019).

Hepatitis B virus (HBV) infection is endemic in Kenya and is an important consideration in this context. The virus is 50 to 100 times more infectious than HIV and is transmitted in a similar fashion. Co-infected persons have an increased rate of liver disease, higher HBV and HIV viral loads, and poor response to antiretroviral drugs. According to KEMRI researchers, northern Kenya including West Pokot and Turkana County have shown a high prevalence of HBV, but the actual rate is not known[43] .

6.12.2.33.4.2 Primary Data

HIV/AIDS is among the top health challenges and priorities for Turkana County. According to an interview with the County AIDS and STIs coordinator, HIV prevalence has decreased from 7.6% in 2013, to 4.0% in 2016 and to 3.2% in 2017/18 based on estimates from mathematical models. The most-at-risk populations in the County include female commercial sex workers, adolescent girls, fisher-folk (around Lake Turkana), and the emergence of gay men (Lodwar town). Hotspots for HIV infection in the County include the transport corridor from Kitale-Lodwar-Lokichogio and some urban settlements (including Lodwar and Lokichar). Programmatic data (2016) shows the highest prevalence in Turkana Central (6.7%) followed by Turkana West (3.7%) and Turkana South (3.6%).

Turkana County is currently implementing several interventions against the disease including behaviour change communication, prevention of mother-to-child transmission, free condom distribution, key at risk populations programme, voluntary medical male circumcision and up-scaling of HIV testing, care and treatment services. Challenges include stigma (which remains a problem), limited access to testing and treatment services (<40%), poor treatment adherence (viral suppression rate of 67%, with the target at 90%) and loss to follow-up due to the migratory lifestyle of many inhabitants.

STIs in general were considered a concern, with a prevalence of 2.4% among pregnant women attending antenatal care (ANC) (2017 data). Different causes of STIs are diagnosed including hepatitis B, gonorrhoea and syphilis, and this necessitates tracing and treatment of contacts.

Factors that influence HIV and STIs transmission in the County include trans-generational sex, commercial sex activity, culture of multiple sexual partnerships (polygamy), population mobility and influx in towns, limited awareness and poor uptake of HIV prevention services.

Findings from focus groups show that majority of participants were aware of HIV/AIDS, but the disease was associated with fear and stigma ("*put HIV positive people in an enclosure*" or "*deny them treatment so they all die*"). Many considered the disease a big challenge because of the lack of a cure. The primary modes of HIV

[43] Relief Web. *Hepatitis B cases on the rise in Kenya*. 2014 [cited 2016 April]; Available from: http://reliefweb.int/report/kenya/hepatitis-b-cases-rise-kenya

transmission were correctly identified by both male and female participants. Condom use was reported to be very low and seen as “*a man’s decision*”. In Lokichar, it emerged that commercial sex activity has increased and some of the sex workers come from outside the area. A bit of commercial sex activity was reported in Lokori urban settlement, but this was subtle and open transactions were not obvious. The rural settlements (Kapese, Nakukulas, Kasuroi and Lochwaangi Kamatak) did not report any evidence of commercial or transactional sex activity, however this contradicts primary research related to social maladies and discussed in Section 6.12.2.46.

Responses to the questionnaires in June 2021 indicate that the ability to meet County health targets was generally acknowledged to have initially been significantly impacted, with other health programmes suffering as a result of diverted funds and resources towards tackling COVID-19. Although over time the delivery of other health care programmes has begun to return to ‘normal’. The effect may have impacted health programmes and NGO programmes relating to sexually transmitted infections, but it is unclear to what extent these have been impacted by COVID-19.

6.12.2.33.5 EHA #5: Food and Nutrition-Related Issues

Nutritional status can provide valuable insights into the health of a community and is a useful indicator to track general well-being.

6.12.2.33.5.1 Secondary Data

More than 75% of Kenya’s population, especially living in rural areas, derive their livelihoods from agriculture. The arid and semi-arid areas of the country are extremely vulnerable to food insecurity. The MoH together with partners conduct a Standardised Monitoring Assessment on Relief and Transition (SMART) survey in food stressed areas every year. This includes the Counties of Turkana and West Pokot. Table 6.12-42 gives a summary of the food and nutrition situation in the Project area at the time of this baseline assessment (November 2018).

Table 6.12-42: Food and Nutrition Situation in the Project area

County	Food security and nutrition situation
Turkana	A SMART survey completed in January 2018 showed reduction in levels of acute malnutrition across the County compared to a similar period in 2017. The County was classified in a critical nutrition situation, but there was improvement with the global acute malnutrition score of 16.2% in January 2018, compared to 30.1% in January 2017. Severe acute malnutrition rates decreased to 2.2% in 2018, compared to 5.7% in a similar period in 2017. Global stunting was measured at 20.3% in January 2018 and was highest in Turkana South (23.9%) followed by Turkana Central (20.8%). Food consumption score and dietary diversification remained a challenge. Contributing factors to the chronic food insecurity include high levels of poverty, harsh climate with inadequate rainfall, frequent droughts, diminishing green pastures for livestock and poor road infrastructure that hamper delivery of foodstuffs (Ministry of Health, 2018).
West Pokot	According to a SMART survey conducted in June 2018, the global acute malnutrition rate declined to 11% compared to a similar period in 2017 (20.4%). This classified the County as a serious nutrition status, but this was an improvement from the critical nutrition status classification in 2017. The improvement was attributed to increased access to health and nutrition services/awareness, a cash-transfer programme, and improved household food security due to long rains from March to May of 2018. Stunting, an indicator for chronic food insecurity remains high, but has shown a modest decrease from 46% in 2014, to 40% in 2017 and the current 38% in 2018 (Ministry of

County	Food security and nutrition situation
	Health, 2019). Food consumption score and dietary diversification remains a challenge. Contributing factors to food insecurity include high poverty levels (69%), rampant insecurity, poor road infrastructure, inadequate rainfall worsened by shocks of drought.

Source: SMART Survey for Turkana County (January 2018) and West Pokot (June 2018) (Ministry of Health, 2018)

Malnutrition is a leading contributor to child deaths in less developed settings. Because of its multi-factorial causality (socio-economic, agricultural, climatic, etc.), malnutrition is one of the important indicators for monitoring a given population's health status and gives a reliable snapshot on the burden of disease within a community. Malnutrition is a major concern in both Turkana and West Pokot, owing to the underlying chronic food insecurity (as described above). Anaemia is also common particularly in pregnant women and children (Ministry of Health, 2019).

6.12.2.33.5.2 *Primary Data*

Food security is a huge challenge in Turkana County. According to the County Nutrition Coordinator, the situation worsens during dry spells and shocks occur throughout the year. This has led to endemic malnutrition in the entire County and over-reliance on food aid. The situation is particularly worse in informal settlements and remote rural areas. In 2017, at least 75,000 children in Turkana County suffered moderate to severe malnutrition, but this decreased to 30,000 in 2018. Nutritional surveillance is performed throughout the year, supported by community health volunteers. According to key informants, factors that contribute to food insecurity and malnutrition in the area include widespread poverty, poor coping mechanisms, changing livelihood patterns, and behaviour related practices. The County is working with the national government and partners such as the World Food Programme to address the situation. These include responding to nutrition emergencies by providing relief food and supporting cash transfers (a safety net) and school feeding programmes. Midterm goals include expanding irrigation (currently being done in Loima and parts of Lokori), women empowerment (voluntary loaning and saving schemes) and livelihood diversification. Health promotion of breastfeeding and proper feeding practices is a continuous and ongoing process.

Findings from focus groups show that households experience chronic food insufficiency which worsens during drought. Malnutrition is a big issue and the situation is dire throughout the year. Most households consume only one meal a day and dietary diversity is limited with meals generally consisting of starch-based foods (maize, millet, rice) and beans with occasional meat (livestock is rarely slaughtered for food), while milk is rarely consumed (available only during rainy season). Most local communities buy food and it was reported that food prices are increasing, and the availability was limited. Participants attributed the price inflation to high demand (reported in Lokichar and Lokori) and poor road infrastructure that hamper food delivery thereby increasing transport costs.

Responses to the questionnaires in June 2021 indicate that the ability to meet County health targets was generally acknowledged to have initially been significantly impacted, with other health programmes suffering as a result of diverted funds and resources towards tackling COVID-19. Although over time the delivery of other health care programmes has begun to return to 'normal'. The effect may have impacted food programmes and NGO programmes relating to food and nutrition-related issues, but it is unclear to what extent these have been impacted by COVID-19.

6.12.2.33.6 EHA #6: Non-Communicable Diseases

Non-communicable diseases (NCDs) have emerged as the highest cause of disease burden globally. Cardiovascular diseases, cancers, diabetes, and chronic respiratory diseases are responsible for most NCD-related morbidity and deaths. The four major risk factors are: unhealthy diet, physical inactivity, harmful alcohol consumption and tobacco smoking (WHO, 2011). Estimates indicate that NCDs account for 27% of total deaths in Kenya (2014 statistic) (WHO, 2014).

6.12.2.33.6.1 Secondary Data

Hypertension, the most frequent and important risk factor for cardio-vascular disease is a growing concern, with an estimated urban prevalence of 13% among women and 12% among men (van de Vijver et al., 2013). Awareness, treatment, and control are generally poor, and less than a quarter of those on treatment achieving blood pressure control (van de Vijver et al., 2013).

Diabetes is an emerging health concern countrywide. A higher prevalence of 14.7% has been recorded in urban areas compared to 2.7% in rural areas (Njenga, 2009; Maina, 2011).

Cancer burden continues to increase largely because of the aging and growth of the global population alongside behaviours that increase cancer risk, particularly smoking. The estimated proportion of preventable cancer is 40%, with nine leading modifiable risk factors shown in Figure 6.12-43 (Danaei et al., 2005). The burden of cancers in Kenya is increasing at a high rate with close to 37,000 new cancer cases and 28,000 cancer-rated deaths recorded every year (a high death rate of 76%) (Macharia et al., 2018). The leading cancers among Kenyan women are breast-, cervix- and oesophageal cancers. The most common among men are cancers of the oesophagus and prostate as well as Kaposi sarcoma (associated with HIV) (Macharia et al., 2018).

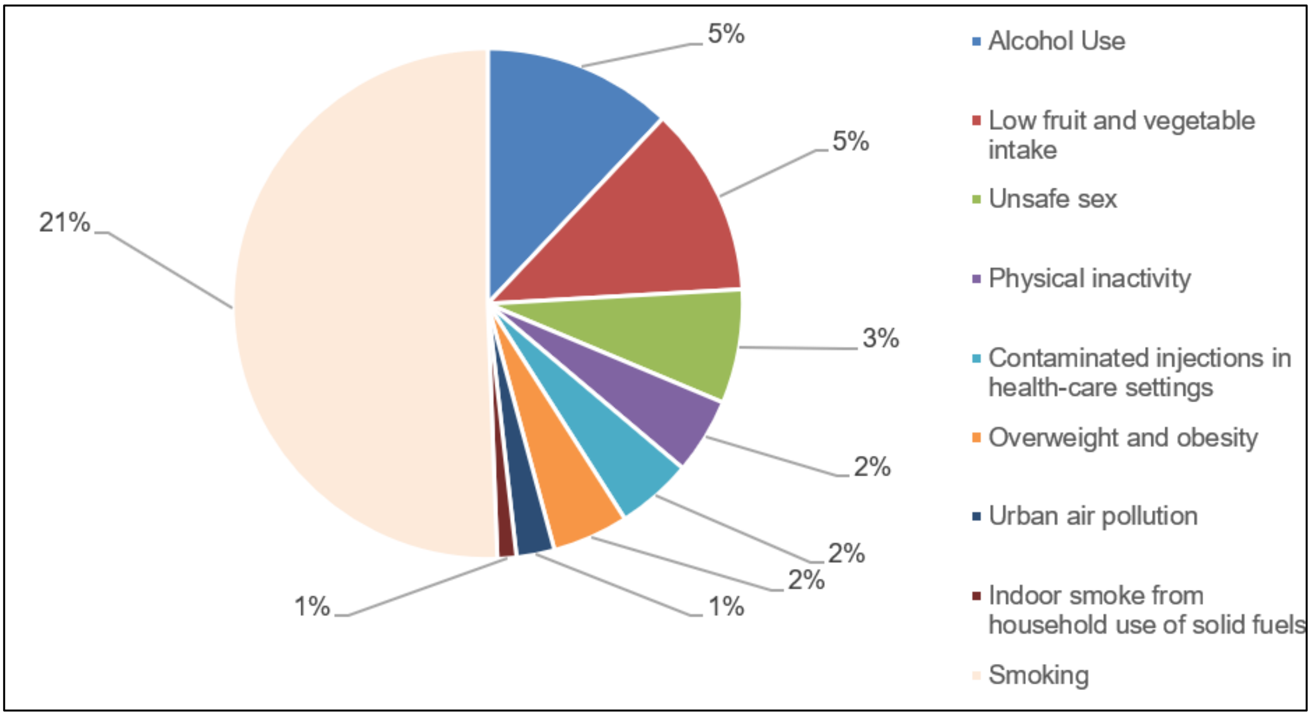


Figure 6.12-43: Modifiable Risk Factors for Cancer Prevention

Chronic respiratory diseases including chronic obstructive pulmonary disease and asthma are an important consideration with risk factors including tobacco smoking, indoor and outdoor air pollution, allergens and occupational exposure (asbestos, silica, certain gasses). The principal use of solid fuels for cooking and heating is a documented source of indoor air pollution, which increases the risk for both acute and chronic respiratory infections and disease. Tobacco smoking is more common in men, with an estimated prevalence of 17% who smoke nationally (KNBS, 2015).

6.12.2.33.6.2 Primary Data

According to the Turkana County public health officer, NCDs particularly hypertension, diabetes and cancers are an emerging health concern in the County. These were linked to changing lifestyles and urbanisation. Cancers of the breast, cervix, and prostate were listed as the most common in women and men, respectively. Sniffing of tobacco products is also common in Turkana, with this linked to throat cancer. It was also mentioned that chronic airways disease and asthma (linked to dusty and cold weather) occur but primary data on these conditions was lacking. To support this growing trend the County is implementing a strategy to address NCDs and the associated risks factors. These include preventive measures (awareness, advocacy, and education) and early diagnosis (screening programmes) and treatment.

Challenges in managing the conditions include; i) late presentation as many of these conditions are not symptomatic until complications are evident, with chronic and severe complications becoming more common; and ii) inadequate diagnostic and treatment services including lack of appropriate and adequate range of medication.

At Lodwar Hospital, at least 100 cases of hypertension and 60 cases of diabetes were being followed up as of November 2018. Findings from local health facilities (Lokichar, Katilu and Elelea) showed that cases of hypertension and diabetes were generally rare with these conditions not a major concern. However, poor health seeking behaviour and lack of skills in the facilities may aid in these low detection rates.

The local health facilities lacked capacity to diagnose or manage cancers and therefore referred all suspected cases to Lodwar Hospital. However, cases from Lodwar are generally referred to MTRH in Eldoret for specialised care. Between 2015 and 2017, Lodwar Hospital referred at total of 551 cancer patients with the numbers increasing as follows: 2015 (142 cases), 2016 (201 cases) and 2017 (208 cases).

Responses to the questionnaires in June 2021 indicate that the ability to meet County health targets was generally acknowledged to have initially been significantly impacted, with other health programmes suffering as a result of diverted funds and resources towards tackling COVID-19, as well as reluctance to attend health centres for fear of contracting COVID-19. The effect may have impacted health programmes relating to non-communicable diseases, but it is unclear to what extent these have been impacted by COVID-19.

6.12.2.33.7 EHA #7: Accidents and Injuries

Road traffic accidents contribute a significant portion of the burden of disease in Kenya and have enormous impact on the social and economic well-being of individuals, their families, and society.

6.12.2.33.7.1 Secondary Data

Road traffic accidents and domestic or other forms of violence are relevant with data from Kenya's National Transport and Safety Authority reporting that at least 3,000 people die on the country's roads every year and nearly a third of road accidents are directly fatal (Dossa, 2013). The upsurge of traffic accidents has been attributed to increased use of motorised transport, poorly regulated public transport, driving while intoxicated, over-speeding and poor utilisation of safety equipment such as seat belts and helmets (Bachani et al., 2012). HMIS data for 2018 shows that road traffic injuries contributed 7.6% of all injuries in Turkana County, with the disaggregated to 7.9% in Turkana South, 3.9% in Turkana East and 4.9% in West Pokot. The data is presented in Table 6.12-36 (Ministry of Health, 2019).

Violence of any kind has a serious impact on the economy of a country. Gender-based violence (GBV), usually defined as any physical, sexual, or psychological violence that occurs within the family or general community, is reported to occur commonly in Kenya. Statistics from the KDHS 2014 show that almost half (45%) of Kenyan women have ever experienced physical violence at some point in their lifetime, an increase from 39% in 2008 (KNBS, 2015). Inter-ethnic conflict has been an ongoing concern in the semi-arid north, especially between the Turkana, Samburu and Pokot communities. The main sources of conflicts are land, grazing areas for livestock, boundary disputes, and cattle rustling. The situation is worsened by the illegal availability of firearms in the communities (UNOCHA and Relief Web International, 2013). Table 6.12-43 shows records of injuries in the Project area in 2018 with violence-related injuries making up 8.8% of injuries in Turkana County and 8.0% in West Pokot, and when disaggregated to the sub-County level this is reported at 10.2% in Turkana South and 8.8% in Turkana East. Cases of sexual violence were also recorded (Ministry of Health, 2019).

Table 6.12-43: Records of Injuries in the Project area, 2018

Indicator	Turkana County	West Pokot County	Turkana South (Sub-county)	Turkana East (Sub-county)
Road traffic injuries	2,781	1,686	516	141
Other injuries	12,874	23,307	2,352	1,422
Sexual violence	439	477	96	30
Violence related injuries	3,193	2,763	666	313
Burns	3,553	3,269	636	334
Snake bites	1,661	369	236	83
Dog bites	1,685	1,034	369	141
Other bites	10,302	1,442	1,680	1,110
Total	**36,488**	**34,347**	**6,551**	**3,574**

Source: HMIS 2018

Baseline conditions related to security and conflict are considered in more detail in section 6.12.2.48.

6.12.2.33.7.2 Primary Data

Trauma related injuries remain a concern in the entire Turkana County. Gunshot wounds contribute significantly to trauma cases and the numbers are reportedly increasing. Lodwar Hospital registers several gunshot cases every month, the majority being referrals from rural and peripheral areas of the County as the hospital has a theatre and orthopaedic capability. Illegal gun ownership remains a concern and related incidents of violence are often associated with tribal factionalism and cattle theft.

Lodwar Hospital has improved its capability to deal with trauma cases but still lacks capacity to manage severe trauma given the lack of intensive care unit (under construction) and neurosurgical specialists.

Road traffic accidents are also becoming increasing common, especially accidents involving motorcycles as ownership of these vehicles has increased in the past few years. Head safety gear and seatbelts are not commonly worn, with attendant risk of severe injuries. During the period 2015 to 2018, Turkana County recorded 33 cases of severe head injuries and majority were referred to MTRH. Poor road conditions were regarded as a contributing factor, but this may limit severe injuries, as over-speeding was not possible on the poor roads. Emergency response has significantly improved, and the number of ambulances increased from 2 in 2013 to 13 in 2018, but these were still inadequate to serve the needs of the County. There was no effective pre-hospital ambulance system that responds to the scene of accidents.

Traffic counts were undertaken in April 2021 by KJV along the C46 and A1, the results of which are presented in Annex I. These counts indicate that the C46 is primarily frequented by motorcycles and light vehicles, with increased traffic on the A1, including more buses and commercial vehicles, as well as heavier vehicles (e.g. farm vehicles, articulated lorries and construction vehicles).

Physical and sexual assault of women and sometimes children was increasingly reported. This has prompted Lodwar Hospital to set up a dedicated unit (‘wellness centre’) to manage cases of GBV and child abuse, with support from an NGO, International Rescue Committee. Most victims come from Lodwar town, but there are also referrals from peripheral facilities. Substance abuse and influx of people (especially in Lodwar town) of different cultural norms and behaviours were seen as contributing factors.

Key informants in Lokichar, Katilu and Lokori reported increasing cases of road accidents, the majority associated with motorcycles. Ethnic conflict, premeditated by cattle theft contributed significantly to assault injuries in the area, which included gunshot wounds (actual statistics not available). Katilu Hospital reported at least one case of GBV (physical or sexual assault) per month. Domestic violence is largely tolerated, and many cases go unreported.

Animal bites particularly snake bites were reported as a concern, the majority are venomous and require immediate treatment. Polyvalent snake anti-venom was available in most hospitals but rarely at health centres or dispensaries.

6.12.2.33.8 EHA #8: Veterinary Medicine and Zoonotic Diseases

Zoonotic diseases are caused by infectious agents transmitted between animals and humans. Environmental changes, human and animal demography, pathogen changes and changes in farming practices as well as social and cultural factors such as food habits and religious beliefs may play a role in the emergence of these diseases. This group of diseases include influenza, rabies, and viral haemorrhagic fevers.

6.12.2.33.8.1 Secondary Data

Influenza virus infection is an important consideration as there has been global concern related to spread of highly pathogenic influenza viruses that have mutated to pose transmission risk to humans from animal hosts, with the potential to cause pandemics. These include SARS, H5N1 and H1N1 viruses. Kenya recorded cases of avian pandemic influenza (H5N1) in 2006 and over 600 cases of pandemic influenza A (H1N1) in 2009 (Matheka et al., 2013). Seasonal influenza outbreaks are common. The prevailing poor environmental health conditions and changing weather patterns promote influenza outbreaks. Pandemic influenza remains a general risk in this setting the risk emanating from increasing population mobility and mixing.

Brucellosis is common among pastoral communities. In 2018, West Pokot and Turkana Counties recorded 5,144 cases and 2,620 cases of brucellosis, respectively. Cases were also recorded in Turkana South and East (Figure 6.12-44). Rapid serological tests are the mainstay of diagnosis with good availability in most local health facilities at the time of this report.

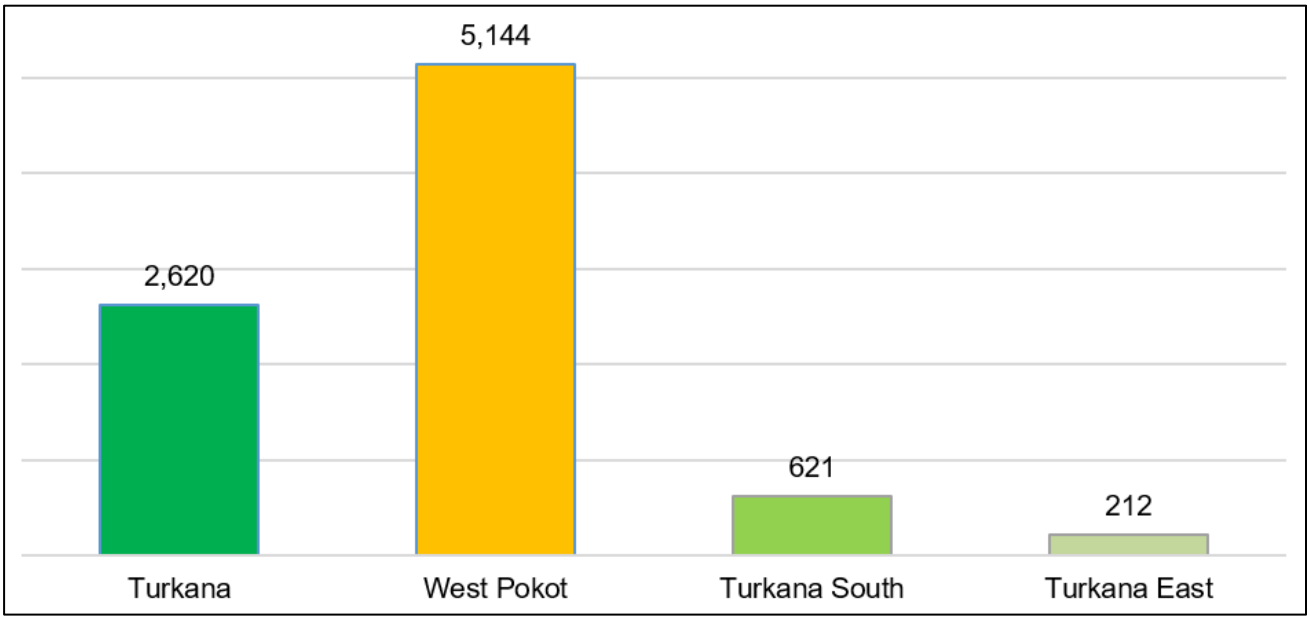


Figure 6.12-44: Brucellosis Cases in the Project area, 2018

Source: HMIS 2018

Rabies is endemic nationally, and the most common mode of transmission is through the bite or saliva of an infected animal. Unvaccinated domestic dogs are the most common source of infection in this setting (WHO, 2017). Despite being vaccine-preventable, rabies still poses a significant public health problem in the developing world and in the absence of timely post-exposure prophylaxis, the infection is always fatal. No cases of rabies were recorded in the Project area during 2016 to 2018, but the disease remains a considerable risk as evidence from secondary data shows many cases of dog bites (Ministry of Health, 2019).

Viral haemorrhagic fever is a general term for a severe illness, sometimes associated with bleeding and multi-organ failure, but with high mortality rates. These are caused by various viruses, including Ebola, Marburg and Crimean-Congo viruses. No case of viral haemorrhagic fever has been registered in Kenya. However, the risk remains linked to global movement of populations as witnessed with the recent (2014 to 2016) Ebola outbreak in West Africa and the current outbreak in the North-Eastern Democratic Republic of Congo.

6.12.2.33.8.2 Primary Data

According to the Turkana County epidemiologist, a suspected case of viral haemorrhagic fever was registered in the County in 2016, but this was not confirmed. Brucellosis and echinococcosis (dog tape worm infection) are the most common zoonotic diseases in the Project area. Rabies is also a significant risk. Several cases of bites by stray dogs are recorded but post-exposure prophylaxis is routinely administered to avert rabies disease. The vaccine was available in local health facilities but the minimum cost of US$100 for the complete course was considered prohibitive.

Rift Valley fever was also considered a risk given the pastoral nature of the communities, but no cases have been recorded in recent past.

Seasonal influenza is common, but these were broadly categorised as respiratory infections and not separately classified.

Collaboration between the County health and veterinary departments is done through what is referred to as "*one-health concept*". However, regulation of veterinary services has not been devolved to the County level as yet and still managed nationally.

Responses to the questionnaires in June 2021 indicate that the ability to meet County health targets was generally acknowledged to have initially been significantly impacted, with other health programmes suffering as a result of diverted funds and resources towards tackling COVID-19, as well as reluctance to attend health centres for fear of contracting COVID-19. The effect may have impacted health programmes, including immunisation programmes relating to veterinary medicine and zoonotic diseases, but it is unclear to what extent these have been impacted by COVID-19.

6.12.2.33.9 EHA #9: Potentially Hazardous Materials, Noise and Malodours

These may also be listed as environmental health determinants and include items such as pollution of air, soil and water as well as possible exposure to organic or inorganic pollutants, noise and malodours. The pathway to human exposure to pollutants can be complex and can occur from a variety of sources such as ambient air, drinking water, soil and food. The specific environmental health determinants will be discussed in the relevant specialist studies and the baseline conditions for water quality (ground and surface), air quality, visual intrusion, noise/vibration and hazardous chemical substances will be described under these reports, with health elements discussed as required in the impact assessment.

In separate meetings with County health managers and Sub-county health officers, participants voiced their concern on issues of environmental impacts that may be harmful to health of people and were particularly interested in how the Project will manage its waste and minimise environmental degradation.

6.12.2.33.10 EHA #10: Social Determinants of Health

Social determinants of health are the conditions in which people are born, grow, live, work and age, including the health system. These circumstances are shaped by the distribution of money, power and resources (see sections 6.12.2.7, 6.12.2.10, 6.12.2.16)

6.12.2.33.10.1 Secondary Data

Mental and behavioural disorders are an often-neglected public health problem. It is estimated that up to 25% of outpatients and 40% of in-patients in Kenya suffer from mental health conditions (Ministry of Health, 2015). The most frequent diagnosis is depression, substance abuse, stress and anxiety disorders. Suicide and homicide rates are generally low. The Mathare Psychiatric Hospital located in Nairobi (with a bed capacity of 700) is the only specialised psychiatric hospital in the country. Figure 6.12-45 shows the number of psychiatric disorders in the AoI in 2018. Neuropsychiatric conditions such epilepsy also occur (data not shown).

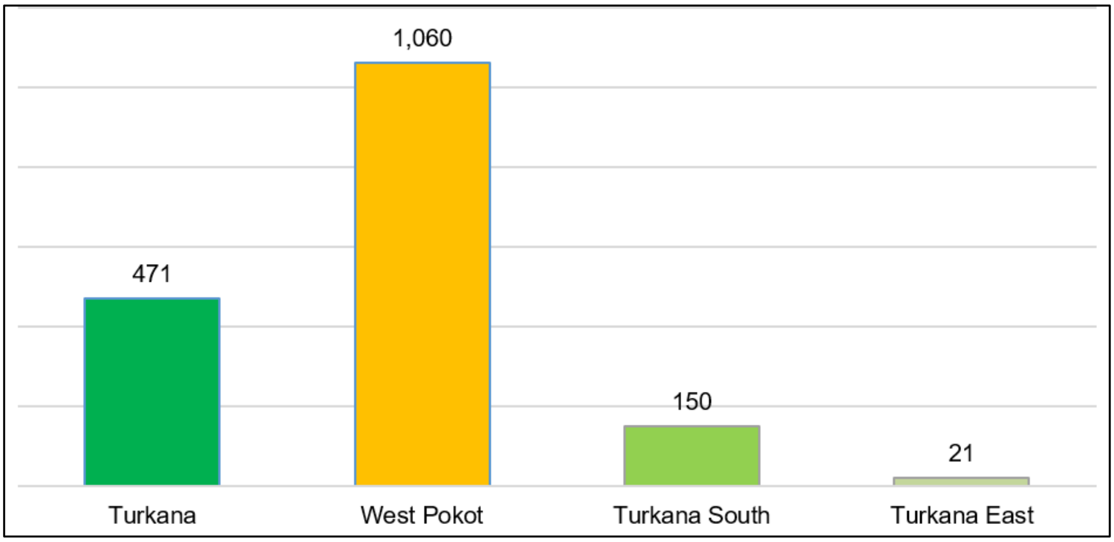


Figure 6.12-45: Psychiatric Disorder Cases in the Project area, 2018

Source: HMIS 2018

Substance abuse such as alcohol, tobacco or other drugs is a growing public health concern nationally. Abuse is often associated with crime, prostitution and domestic violence. A 2012 national survey found that 13% of Kenyan adults use alcohol, 9% use tobacco and 4% consume khat *(miraa),* 1% use cannabis and 0.1% use heroin. Overall, cannabis/marijuana is the most easily available illicit drug at 49% (NACADA, 2012). Secondary data on substance abuse in the AoI were not available.

Education is a key determinant to support and uplift the health status and wellbeing of an individual in a society, and indeed entire communities. Employment and earnings are more likely to empower women if they are in control of their own income. Wage earners constitute only 5% of the West Pokot and 6% of the Turkana population (Turkana County Government, 2013, County Government of West Pokot, 2018). Literacy levels in both Counties are amongst the lowest nationally, with nearly two-thirds of women (64%) and over a third of men (35%) in Turkana County having no formal education (KNBS, 2015). Free primary education and subsidised secondary education have had a positive impact on school enrolment and completion rate over the past 15 years, but this has also exerted pressure on existing education facilities. Baseline conditions related to education are considered in more detail in section 6.12.2.45.

It is generally recognised that women are primarily impacted by domestic GBV, which creates both a health and psychological burden. It also recognised that in many societies, women are socialised to accept, tolerate and even rationalise the practice.

Teenage pregnancies and early marriages are an important consideration. Children born to women aged 15 to 19 are more likely to die in infancy and early childhood. Women who start having children in this age group, often do not complete school, limiting their future economic possibilities and other life prospects. Survey data show that the prevalence of teenage pregnancies in West Pokot (29%) and Turkana (20%) Counties are above the national average of 18% (KNBS, 2015).

Polygamy is an acceptable cultural way of life in the region, with survey data (2018) reporting a high prevalence of polygamy among pastoralist communities in Kenya, with West Pokot (25%) and Turkana County (20%) reporting the second and third highest rates nationally (Kinuthia, 2018).

6.12.2.33.10.2 Primary Data

Mental health disorders have demonstrated an upward trend in the AoI. Psychosocial stressors (economic strife, poverty and other social challenges) and substance abuse were identified as contributing factors.

Substance abuse particularly alcoholism, teenage pregnancy and commercial sex activity were reported as emerging health challenges in Turkana County. The trend is increasing particularly in urban areas and peri-urban informal settlements. Findings from focus groups also show that traditional brews are commonly consumed because they are easily available and affordable. Snorting of tobacco is also common among men and women. Use of illicit drugs such as marijuana and other drugs was reported in Lodwar town and Lokichar urban settlement.

Commercial sex activity was reported in urban areas, particularly in Lodwar and Lokichar. This was linked to business boom that came with devolution process at the County level and the discovery of oil. The more rural communities in the Project area did not report any obvious commercial sex activity. Lokori urban settlement reported little commercial sex activity, with this not openly practiced.

Trans-generational sex is common in this setting, in the context of cultural polygamy, with old men marrying very young girls, with the only prerequisite the ability to afford the price for the bride (generally a few cattle). Teenage pregnancies were largely attributed to early marriages, with most girls in the area married at the age of 14 to 17 years. School drop-outs as result of early marriages and early pregnancies were seen as leading contributors to the poor state of women in the society, the majority of whom lacked formal education. Further, high level of illiteracy was seen as a challenge to health education and contributes to poor awareness of health issues. Additionally, women were perceived as marginalised in many aspects including education, employment opportunities and decision-making capabilities.

Violent behaviour was reported as common in general society, with this reflected in the high rates of violence-related injuries as well gender based domestic and sexual violence. Ethnic animosity and substance abuse were reported as contributing factors.

6.12.2.33.11 EHA #11: Health Seeking Behaviour and Cultural Health Practices

Health seeking behaviour is the manner in which people choose which health provider to consult, and when to consult them, depends on a variety of factors, often related to supply (availability of healthcare, cost, equipment, etc.) and demand (affordability, accessibility, prioritisation, etc.). It is essential to understand these factors and identify the community practices to support an understanding of entry into the healthcare system, and how to target any interventions.

6.12.2.33.11.1 Secondary Data

Survey findings (KDHS 2014) show that nearly half of Kenyan women (46%) face at least one-barrier in accessing health care for themselves or their child. These range from getting permission to go for treatment, getting money for treatment, distance to a health facility, and not wanting to go alone. At a national level, care seeking towards a formal health provider has increased from 49% in 2008, to 63% in 2014 (KNBS, 2015). The same survey showed that 62% and 77% of respondents sought medical care from a health facility or formal provider for Turkana and West Pokot Counties, respectively. Self-medication and use of traditional medicine, however, remain common (KNBS, 2015).

Traditional medicine plays an important role in health seeking behaviour, and for several reasons this is often the primary route of health consultation, especially where access and cost are a major determinant in the ability to utilise modern healthcare. Cultural practices in both rural and urban Kenya support the use of herbal medicine for treatment of certain ailments, even when access to modern medicine is available. This is especially common for chronic conditions including HIV/AIDS, hypertension, infertility, cancer and diabetes (Kigen et al., 2013). Use of traditional medicine is a common practice among the Turkana and most adults, especially women, have a wide knowledge of herbal plants that they use for medication (Harragin, 1994). Use of traditional medicine is also common among the Pokot and the County government there has set aside funds to support value addition to natural/medicinal plants for alternative medicine (County Government of West Pokot, 2018).

Female circumcision/ female genital mutilation (FGM) is prevalent among the Pokot (74%) (Ooko, 2019) but less so among the Turkana (1.7%) (KNBS, 2015). The practice is considered a violation of human rights and has been outlawed in Kenya. It is associated with negative health consequences, some of which can be serious. Health education, poverty alleviation and promotion of women's rights are key interventions to reducing this practice.

6.12.2.33.11.2 Primary Data

According to the key informant's health seeking behaviour and the use of traditional medicine is a challenge in Turkana County. However, it was noted that the utilisation of formal health services is increasing, with this likely to be associated with improved access as the number of health facilities in the County had increased with a reduction in the average distance to a health facility to 35 km in 2018, from compared to 50 km in 2013. Late presentation due to poor health seeking behaviour was reported as a key contributor to poor health outcomes. Other factors that influence health-seeking behaviour include poor awareness of health issues, use of traditional medicine, transport challenges, nomadic lifestyle and limited decision making by women. In addition, responses to the questionnaires in June 2021 indicate that there has been an increased reluctance to attend health centres for fear of contracting COVID-19.

Findings from focus groups showed that most respondents prefer formal health care but there were instances when they utilise (or prefer) alternative medicine. There are not many traditional healers in the local communities and the use of traditional medicine is decreasing. In general, the participants' reasons for visiting a traditional healer included: distance to a health facility ("if facility is far or closed"), mental disorders, lack of transport, or to seek second opinion if patient fails to improve with conventional treatment. Commonly used herbs are *"ekong"* (aloe vera), "*emus"* (herbal concoction for treatment of fractures and bone disease) and *mwarubaini* (a tree claimed to treat over 40 illnesses including malaria).

6.12.2.33.12 EHA #12: Health Systems Issues

A good health system delivers quality services to all people, when and where they need them. This requires a robust financing mechanism, a well-trained and adequate workforce, reliable information on which to base decisions and policies, well maintained facilities and logistics to deliver quality medicines and supplies. Reproductive health, maternal and child health are some of the key measures of a health system.

6.12.2.33.12.1 Secondary Data

Reproductive health statistics show high fertility rates in Turkana (6.9) and West Pokot (7.2) compared to the national average of 3.9. Use of contraceptives is generally very low in the Project area, estimated at 10% in Turkana County and 14% in West Pokot County (NBS, 2015). HMIS data for both Counties show increasing uptake of contraceptives, but at a very slow rate.

Table 6.12-44 gives a summary of reproductive, maternal and child health indicators stratified for Kenya and the two Counties in the Project area, based on survey data from the KDHS 2014 and Kenya Economic Survey 2018 (KNBS, 2015; KNBS 2018).

Table 6.12-44: Reproductive, Maternal and Child Health Indicators in the AoI

Indicator	Year	Turkana County	West Pokot County	Kenya (for reference)
Total fertility rate (number of children per woman)	2014	6.9	7.2	3.9
Current use of any method of family planning (% of currently married women age 15 to 49)	2014	10	14	58
Pregnant women who received antenatal care from a skilled provider (%)	2014	91	85	96
Pregnant women who made 4+ ANC visits (%)	2014	49	18	58
Births assisted by a skilled provider (%)	2014	23	27	62
Births delivered in a health facility (%)	2014	23	26	61
Fully immunised children (% in 2014)	2014	57	31	68
Fully immunised children (% in 2017)	2017	88	39	63

Source: KDHS 2014 and Kenya Economic Survey 2018

Maternal health encompasses the dimensions of health during pregnancy and delivery. Maternal health indicators in the Turkana and West Pokot Counties are much worse than national average (KNBS, 2015). While a majority of pregnant women receives antenatal care, the majority of delivery care (77% in Turkana and 74% in West Pokot) still occurs at home under the care of unskilled attendants. This contributes to high maternal mortality rates in these areas. Figure 6.12-46 shows the number of maternal deaths recorded at health facilities in the Project AoI, during the period 2016 to 2018. Deaths that occur at community level are poorly documented and not captured in the HMIS.

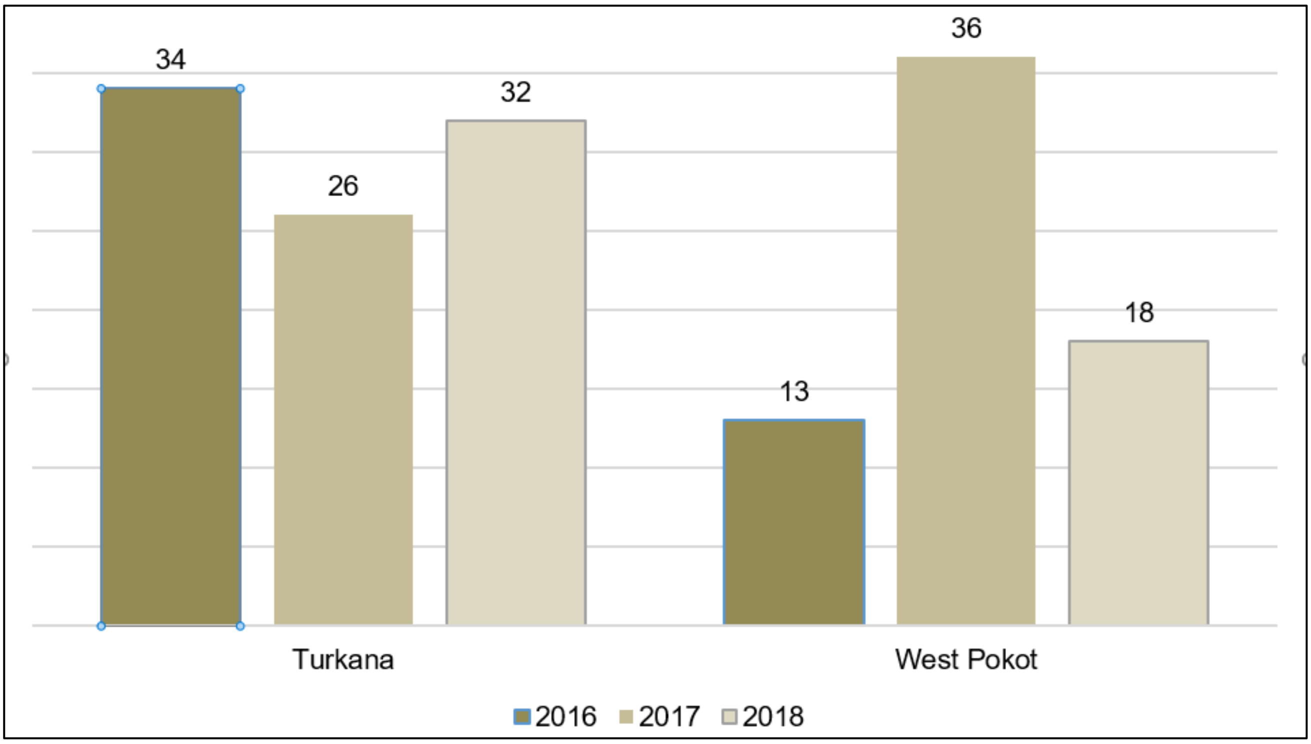


Figure 6.12-46: Maternal Deaths Occurring in Health Facilities in the Project AoI, 2016-2018

Source: HMIS 2018

Child health is a basic indicator of a country's socioeconomic situation and quality of life. Identifying children most at risk helps policymakers and programme planners to allocate resources and target programmes more effectively. HMIS data show that the leading causes of child morbidity in the Project area are ARIs, pneumonia, diarrhoeal diseases, intestinal worms, malnutrition and seasonal malaria (Ministry of Health, 2019). According to official County documents, child mortality rates in the Project area are higher than the national average, but the mortality data from HMIS remains inconclusive because deaths occurring at community level are not adequately documented.

Immunisation of children against common ailments is an important factor that supports disease control and proper child growth and development, with implications into adulthood. Survey data show that full immunisation coverage at national level decreased from 68% in 2014, to 63% in 2017. Immunisation coverage in the Project area is lowest in West Pokot (31% in 2014 and 39% in 2017) (KNBS, 2015; KNBS, 2018). Turkana County has recorded a significant increase in full immunisation coverage from 57% in 2014, to 88% in 2017. Except for measles vaccine (at coverage of 72%) all the other vaccines administered to children in Turkana County reached the minimum recommended coverage of 80% required for herd immunity (KNBS, 2015; KNBS, 2018). However, HMIS data shows that Turkana East and South both recorded low immunisation coverage in 2018, with the coverage of most vaccines not reaching the minimum threshold of 80% (Table 6.12-45).

West Pokot reported coverage below the minimum threshold for all vaccines including measles (58%) and polio (61%) (KNBS, 2015; KNBS, 2018).

Table 6.12-45: Vaccine Coverage in the AoI, 2018

Vaccine/indicator	Turkana County	West Pokot County	Turkana South	Turkana East	Kenya
BCG (Bacille Calmette-Guerin)	>100[(a)]	81.3	90.0	71.8	78.4

Vaccine/indicator	Turkana County	West Pokot County	Turkana South	Turkana East	Kenya
Diptheria- tetanus- pertussis (DPT)/Haemophilus influenzae type B third dose (Hep+HiB)	>100*	75.4	75.3	69.5	81.4
Oral polio vaccine	91.0	67.5	61.6	68.1	80.3
Pneumococcal	99.0	73.5	72.7	69.6	81.3
Measles and Rubella	94.8	55.4	61.7	75.7	79.0
Fully immunised children	**84.2**	**52.7**	**59.8**	**70.1**	**76.8**

Source: HMIS 2018
(a) Coverage >100% indicates incorrect population estimates and gaps in data recording system

6.12.2.33.12.2 Primary Data

Health system issues emerged as a major concern, with the broad challenges and contributing factors presented in Table 6.12-27. Health care services in Sub-county hospitals, health centres and dispensaries in Turkana County are offered free of charge. At Lodwar Hospital only certain services (immunisation, maternity, HIV/AIDS, TB, and GBV treatment) are offered free.

High demand for health services was evident at Lodwar Hospital where the bed capacity has been overstretched beyond 150% with patients sharing beds or sleeping on floors and in corridors. This was attributed to population growth and inefficiencies of the referral system compounded by the limited capacity of peripheral facilities. The County lacks certain specialised services (neurological, neurosurgery, psychiatric, cardiology) and an intensive care unit for critical care. This often necessitates long distance referrals (400 km) to MTRH in Eldoret.

A high demand for services was also evident in Lokichar. The medical officer in-charge of Turkana South indicated that there is need for at least a primary hospital in Lokichar given the ongoing population growth and long distance to Lodwar Hospital. The health centre in Katilu has recently been upgraded to a Sub-county hospital, but the range of services remains limited. Elelea Hospital located in Lokori is the referral centre for entire Turkana East, but the facility is not centrally located and the range of services is similarly limited. Baseline findings show that the local health facilities (including Elelea and Katilu Hospital) are not adequately equipped for emergency obstetric care and both lack surgical, or theatre services. Emergency response also remained a challenge with only one functional government ambulance for Turkana South and a broken (non-functional) ambulance for Turkana East. The cost of hailing the ambulance from Lokichar Health Centre (missionary facility) was considered unaffordable (US$ 100) and therefore inaccessible.

Focus group participants reported challenges in accessing formal healthcare services, with challenges related to the distance from a health facility, inadequate staffing or skills of staff, shortage of medications and inadequate services. When faced with emergency situations, it was mentioned that the public ambulance was rarely available, and generally private transport options would be the only choice, with this rarely available and costly. Motorcycles are sometimes used in emergencies, but not ideal for non-ambulatory patients. Public transport vehicles were almost non-existent.

Maternal health emerged as a concern, especially high maternal mortality linked to poor access to emergency obstetric care and the high rate of home deliveries. For instance, none of the health facilities in Turkana South and East offered surgical services, so it was not possible to perform caesarean sections as a basic and vital emergency procedure. To perform this requires referral to Lodwar Hospital with costs and delays affecting the ability to access timely care.

Poor uptake of family planning services was reported, despite easy availability, because most respondents preferred to have many children. Child health services were generally available and accessible, with these supported by outreach services in remote areas and temporary settlements. Figure 6.12-47 shows a picture plate from health facility assessments.

Figure 6.12-47: Picture Plate from Health Facility Assessments

Responses to the questionnaires in June 2021 indicate that the ability to meet County health targets was generally acknowledged to have initially been significantly impacted, with other health programmes suffering as a result of diverted funds and resources towards tackling COVID-19, as well as reluctance to attend health centres for fear of contracting COVID-19. The effect may have impacted health programmes, including immunisation programmes, but it is unclear to what extent these have been impacted.

6.12.2.34 Education

Educational services in Turkana and West Pokot County, like other parts of the country, are provided by the Government and other NGOs. However, the development of educational facilities is unevenly distributed, and some areas have better facilities than others.

In total, there are only 315 primary schools and 32 secondary schools in all of Turkana County. There are polytechnic institutes in Kakuma and Lodwar; two colleges, one focussed on health and the second on teacher training. The only campus university sites are in Lodwar and Lokichoggio, and a Technical Training Institute is being built in Lodwar (Turkana County Government, 2013). Specific data on school infrastructure in the nearest Sub-locations was not available.

In the Kositei Location, West Pokot Sub-County, there are five primary schools, one each in Turkwel, Kudungole, Chepokachim, Riting and Reres villages. There is only one secondary school at Turkwel (KII, 30 January 2019). There are nine ECD centres, each in Riting, Reres, Karon, Turkwel camp, Wyapit, Kudungole, Chepokachim, Samum and Kamurio villages. There are neighbouring learning centres in Korpu Location in Pokot North and these are in Sukut, Sirwach, Lonyangalem, Takaywa, Kour, Songkok and Ombolion villages (Focus Group Discussion, 02 February 2019).

The low literacy levels of 22.2% in Turkana County can be attributed to many causes that include extreme poverty, understaffing in schools and cultural practices such as early marriages. Other calamities such as drought and inter boundary conflicts also inhibit the provision of proper education resulting in low literacy and education standards (Turkana County Government, 2013).

The literacy level in the West Pokot County stands at approximately 40% but this varies in the Sub-counties and Pokot West Sub-county has a high illiteracy rate of around 67%. Key informants also indicated that the West Pokot County has a high dropout rate from schools. These factors are similar to those influencing high illiteracy rates. The West Pokot County Education Department attributed this to:

- Pastoralist's children who migrate with animals and don't go to school and there are no mobile schools in the region. There is a trend of older children practicing pastoralism while the younger ones go to school;
- Cultural practices also impacting literacy levels. For example, the culture of early marriage detracts women from an education;
- Education is expensive for many people who live a subsistence-based livelihood;
- Security issues surrounding conflict and violent raids; and
- The distance from schools.

Gold mining in Sekerr and Ortom is also noted as a factor keeping children from school. For example, Ortom Secondary School used to produce graduates but now no one has graduated recently (KII, 31 January 2019).

Kositei Location in West Pokot Sub-county has a literacy level which stands at approximately 20% (KII, 31 January 2019). In Chepokachim Sub-location, the literacy level is 2% while it is 1% in Kasitei Sub-location (KII, 02 February 2019).

The Turkana Ministry of Education, Culture and Sports says that the pastoralist lifestyle has contributed to previously low enrolment, but that there has been a 200% increase generated by new education facilities, especially the ECD centres providing free primary education (KII, 29 June 2016). This new emphasis on ECD has also been attributed to increased awareness among parents to make sure they take their children to school. While this is a generally positive trend, it has created shortages of infrastructure (KII, 22 June 2016).

Other challenges cited in improving education include long distances to schools and teacher shortages, particularly as many teachers leave education to seek better paying jobs in the newly developed County Administration (KII, 29 June 2016). School fees in secondary school were also noted as being prohibitively expensive (Focus Group Discussion, 05 February 2019).

In West Pokot County, there is a need to address negative cultural practices in order to improve school attendance and literacy rates. These challenges include, FGM, early marriages and cattle rustling and changing nomadic lifestyle of the community to permanent settlement through provision of water and pastures for animals and development of more adult education centres.

In a response to poor literacy rates and high dropout rates or poor school enrolment due to the pastoralist lifestyle, the County Government recruited 300 adult education tutors to teach the pastoralists. There are no specific classrooms, but the tutors move with the pastoral population wherever they migrate to. The county government has also constructed and fully equipped 3 border schools to promote school enrolment from the border population who are mainly those who practice pastoralism as a source of livelihood. These border schools are located in Akulo, Kanyerus (Kenya and Uganda Border) and Katikomor villages. These schools will also serve the neighbouring counties so as to cultivate values of harmony and peaceful coexistence among the school going children (KII, 1 February 2019).

There are six vocational training facilities in the West Pokot Sub-county which offer carpentry, masonry, brick laying, sewing, baking etc. These are funded jointly by government and private investors. The challenges to the attendance of these facilities is that it is hard to market these courses. Another challenge is that vocational training offers the person an education in a technical trade but once the person graduates, they cannot afford the tools for that trade. The county government offers grants to assist with this situation, but people prefer white collar jobs, so the vocational training is not popular (KII, 31 January 2019).

6.12.2.35 Social Maladies

Social maladies include aspects of alcohol or drug use, crime, commercial sex work, child and forced labour and other work/occupational inequities. While limited data from local administrative units has been received on these topics, social maladies have been investigated through KIIs and focus groups.

According to numerous key informants interviewed in Turkana, alcoholism has increased and greatly influences youth, in some cases causing them to lose jobs. Due to peer groups, youth are drawn into smoking cannabis (*bhang*) and chewing khat (*miraa*), which is linked to individuals becoming homeless. In Kainuk, focus group participants report new types of drugs and alcohol being consumed, in some cases incapacitating people for up to three days. They also report the use of drugs to spike drinks and cause vulnerable women to become disoriented and vulnerable to assault (Focus Group Discussion, 01 July 2016). It has been reported that women are susceptible to alcoholism and being at risk given their current consumption (Focus Group Discussion 4 February 2019).

Youth from the Lokichar Sub-location also suggest that drug abuse has increased with alcoholism. They state that young people in schools are most susceptible to these problems with girls being most vulnerable to be abused by those with “deep pockets”, men who seek to pay for sex. The outputs reveal a more visible display of prostitution, that commercial sex work attracts women from other parts of Kenya (Focus Group Discussion, Youth of Lokichar, 29 June 2016). Similar trends were noticed by the Sub-county Administrator from Turkana Central. In addition to the increase in substance abuse, he reports that the dynamic is especially harmful in the overcrowded and growing settlements around Lodwar. These areas have suffered incidents of fire, stealing and an increase in STIs (KII, 28 June 2016). In Kaputir, officials confirm they too observe a rise in drug use, which they also notice becoming introduced to rural settlements. This has had an impact on children in relation to their drug usage, as well as other indirect affect like child pregnancy, which has been observed in girls as young as 11 (KII, 31 January 2019).

Influx was also cited as a source of new social maladies in the Kochodin Location where the Project is located. The Location Chief links influx to post-election violence in 2007, when ethnic Turkana from other parts of Kenya were displaced and came to the area. This change coincided with substance abuse, as well as a rise in domestic violence (KII, 4 July 2016).

One NGO worker in Lodwar attributes the rise in drinking and other social maladies with pressure to acquire material things and wealth, which is linked to the availability of more amenities. He specifically highlighted the dynamic in a place like Lokichoggio, the settlement in Turkana West that previously hosted a large number of United Nations organisations. The employment had provided people with new amenities and when the agencies left, it became a town with limited opportunities (KII, 25 June 2016). Teachers in one school said that pastoralist children, particularly girls, can be influenced by the pressure to acquire amenities which leads to anti-social behaviour such as crime or, in extreme cases, commercial sex work (KII, 5 February 2019).

Another NGO in Lodwar links social maladies, particularly the rise in HIV/AIDS with the recent infrastructure development. New accommodation facilities and transport stops for truckers have attracted commercial sex workers (KII, 27 June 2016). This scenario is also reported in Kainuk Settlement. The Lobokat Ward Administrator, which oversees Kainuk Settlement confirmed that the truck drivers are generating an increase in commercial sex work, but suggest it is not only women from other counties who are involved. He added that school children are also affected. Pressure on them to earn money leads them to commercial sex work, dropping out of school and early pregnancies, which are said to be more common (KII, 1 July 2016).

While the overall trend is an increase in commercial sex work, the problem has not gone unaddressed. One peer educator in Lokichar said some NGOs have tried to address the issue. Her work includes reaching out to women who have been pulled into the trade, offering counselling and testing services and demonstration of condom use. She reported that some people have been able to get out of the trade (KII, 04 February 2019).

Social Maladies in West Pokot County are similar to those in Turkana. Child Labour is prominent due to livelihoods which entail young boys to herd livestock and young girls who are employed as house girls. The County Government is addressing these issues through the following aspects:

- Enforcement of the National Government Chiefs Act which states that all children have to go to school;
- Provision of bursaries to students; and
- County government give directive to all school head teachers not to send students out of schools for lack of school fees (KII, 1 February 2019).

World Vision is also addressing FGM issues in West Pokot County through their child protection and education program. FGM contributes to high illiteracy levels due to girl's non-attendance of school. This initiative was implemented through sensitisation and awareness programs to reduce occurrences of FGM, early marriages and teen pregnancies (KII, 4 February 2019).

Responses to questionnaires in June 2021 indicated that COVID-19 had resulted in increased violence (including interpersonal violence, gender based domestic violence, and violence towards children), substance abuse and poverty, with vulnerable groups particularly affected. Basic services, food security and malnutrition were all also indicated as having been negatively impacted by COVID-19, but it is unclear to what extent.

6.12.2.36 Discrimination in Employment

With salaried employment being relatively limited among the predominantly pastoralist communities of Turkana, discrimination in employment, whether real or perceived, is a commonly cited problem. Frequent work interruptions in Turkana are related to accusations of unfair hiring or firing. Such protests are sometimes linked to a misunderstanding of a job's terms and conditions, however, there are other inter-ethnic issues as well. Both Turkana and Pokot communities believe that they should be given employment opportunities. For example, *kraal* elders in Turkana South describe how they have been left out of all employment opportunities at the Kenya Electricity Generating Company (KenGen) plant located in West Pokot County, but only a few kilometres from settlements in the Kaputir Location in Turkana County (Focus Group Discussion, 31 July 2016). While such local complaints are not as relevant now from the West Pokot side of the County border, key informants in other parts of West Pokot County commonly voice their expectation for employment from the Operator and other infrastructure projects in Turkana.

Another country-wide problem is related to discrimination based on HIV status. The national HIV and AIDS Tribunal issued a statement on findings in December 2016 that found HIV-positive individuals are likely to experience discrimination in the workplace due to their status. Such discrimination has included individuals being tested for the virus without their consent and in some cases a person's status has been disclosed to a third party without consent, breaching confidentiality and privacy (Daily Nation, 2016).

6.12.2.37 Social Capital, Security and Conflict

Turkana and neighbouring pastoralist Counties in Kenya have well-known histories of conflict and violence, often associated with cattle raiding. This section will characterise some of the historical issues and provide a context for the changing environment. It will cover aspects of interethnic conflict, especially as it relates to West 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.

During Golder's initial field work in July 2016, there were indications of relative calm in comparison to previous years. During a period from March to October 2016 security monitoring registered few violence incidents. From November 2016, there was an increased in violent incidents.

Control Risks conducts a monthly monitoring report of security incidents in the Project area. A total number of 106 security incidents have been registered in Turkana and West Pokot during the reporting period August 2018 to July 2019. These are differentiated as banditry, cattle raids, civil disorder and intercommunal violence incidents. Turkana accounts for 85.8% of the total number of incidents. Figure 6.12-48 suggests that banditry and cattle incidents are predominant in Turkana. West Pokot reports a less substantial number of cattle raids and banditry incidents with respect to Turkana during the same reporting period.

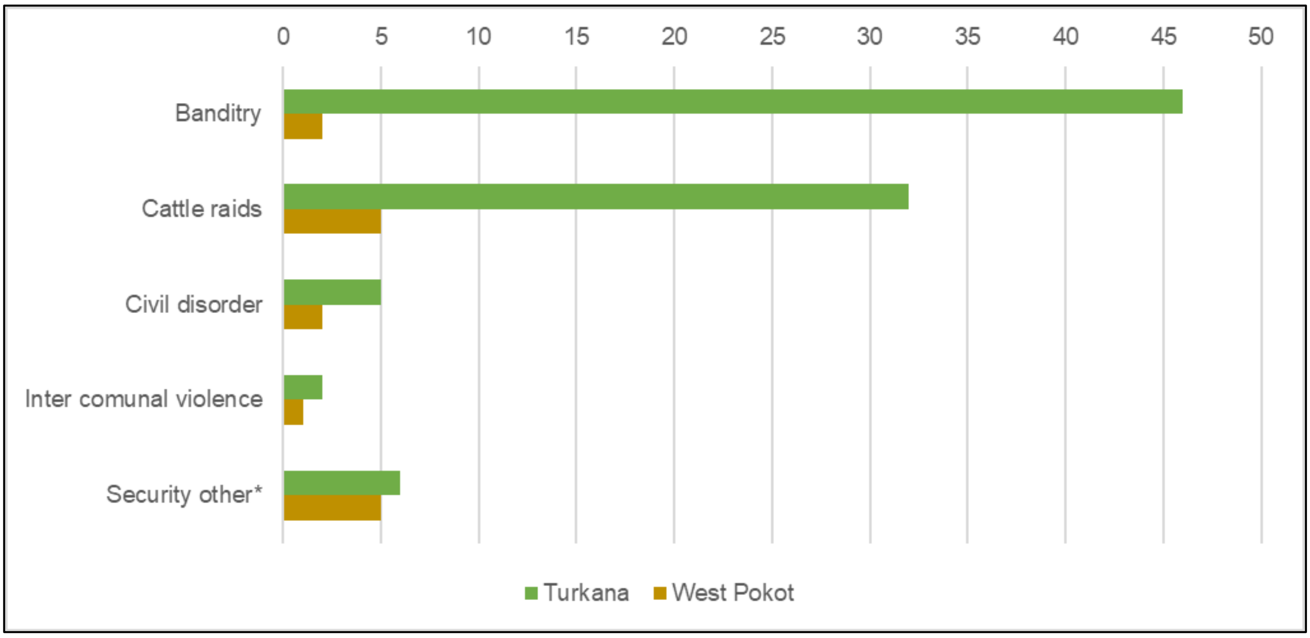


Figure 6.12-48: Incidents per County from August 2018 to July 2019

Source: Control Risks 2018 to 2019 monthly monitoring
**Note: the item "security other" refers to gunshot, arrest of suspect and murder incidents.*

The security reports reveal that the number of incidents related to cattle raiding have increased during the first quarter of 2019. Other security incidents (e.g. civil disorder, gunshot) have been reported with less frequency during the same reporting period (Figure 6.12-49).

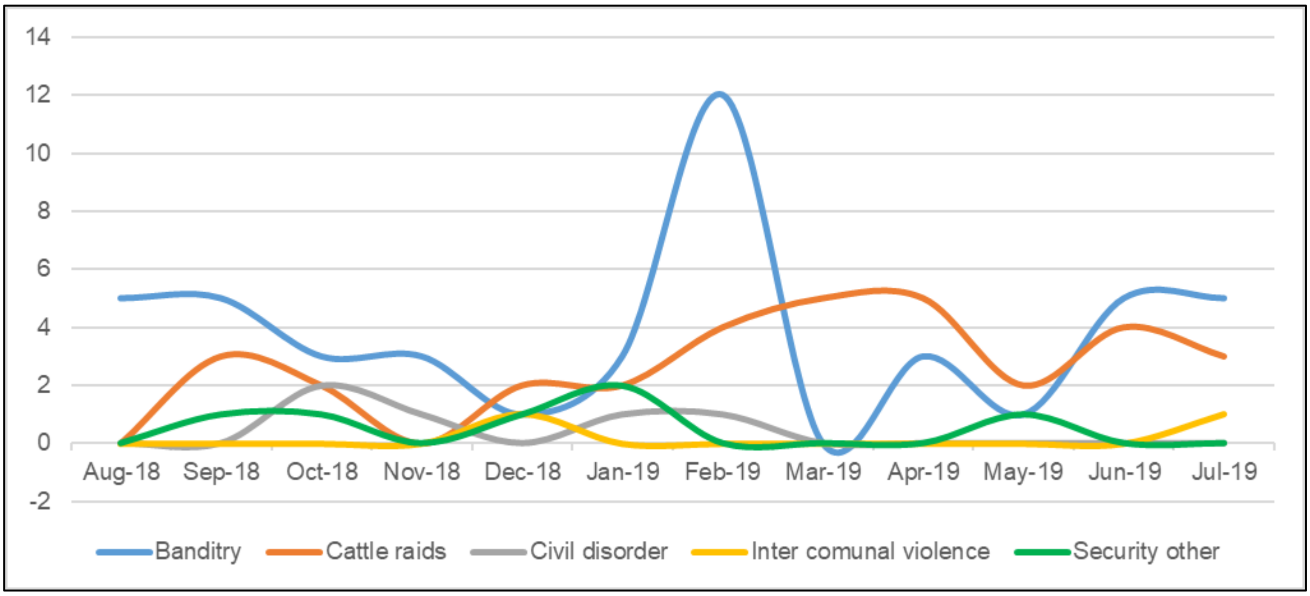


Figure 6.12-49: Incidents Reported in Turkana from August 2018 to July 2019

Source: Control Risks 2018 to 2019 monthy monitoring

West Pokot has fewer reported incidents over the same reporting period with two cattle raids registered during October 2018 and June 2019 (Figure 6.12-50).

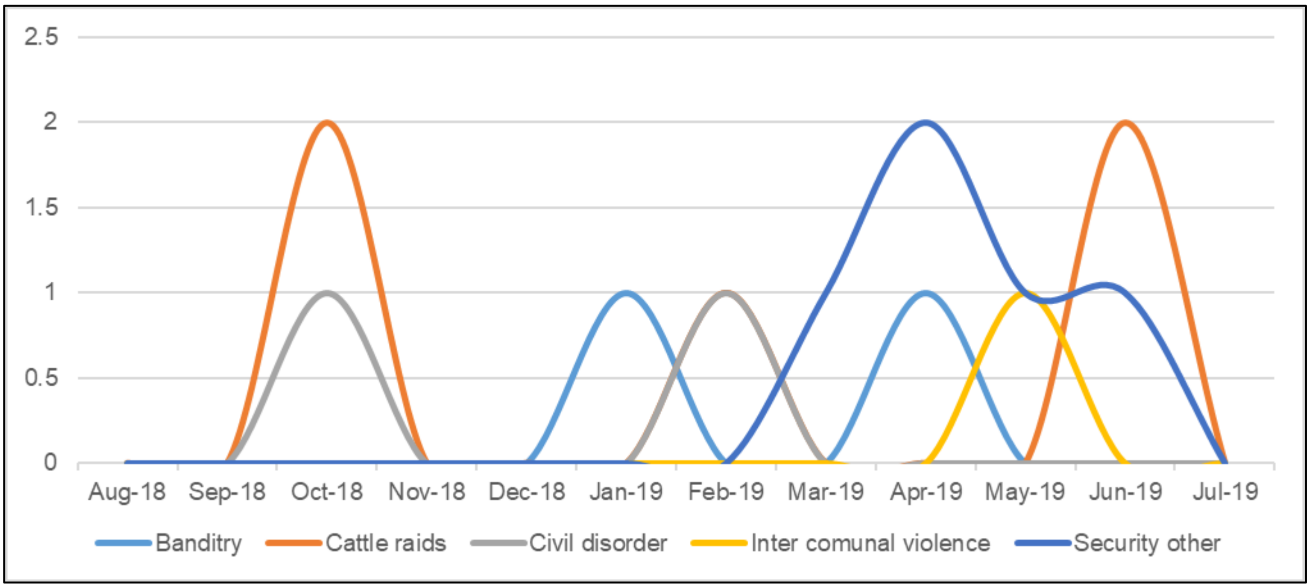


Figure 6.12-50: Incidents Reported in West Pokot from August 2018 to July 2019

Source: Control Risks 2018 to 2019 monthy monitoring

Golder's fieldwork related to security has been conducted by the same team who previously worked for the Operator and completed a 2015 study led by the NGO Small Arms Survey. This work sought to understand community perceptions of conflict in Turkana and West Pokot at a time of heightened violence. The Small Arms Survey report indicates shifts and intensification of armed conflict.

Over the past 10 years, a gradual shift has occurred in patterns of livestock raiding and attacks. While cattle raids still occur, the commercialisation 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 commercialised raiding, something that is believed to be eroding elders' authority (Mkutu, 2010; Kaimba, 2011;

Griener, 2013; Triche, 2014). The majority of Golder's research findings support this overall general trend, but also suggest that there has been a gradual slowing of cattle raiding. Research shows that the current violence is more often linked to disputes over natural resources. A shift from cattle raiding to conflict over natural resources is related to more frequent and longer droughts in the country's dryland areas and the problem is exacerbated by easier access to guns, making battles more deadly. The increase in arms is attributed in part to the regions' proximity to South Sudan, an area with an ongoing civil war, and the porous borders with Kenya. Aid efforts are aiming to improve access to natural resources, in particular access to water, to decrease the likelihood of different ethnic groups crossing boundaries. (Thomson Reuters Foundation News, 2016).

By late 2016, the specific violence between Turkana and Pokot had largely subsided, which was marked by a celebration in September 2016 to acknowledge 18 months without killings from cattle raids between the two groups (Finn Church Aid, 2016). However, tension between Turkana and West Pokot remains, as well as other neighbouring counties of Baringo, Laikipia and Samburu. Despite relative calm and the Kenyan government efforts to reduce arms, the deputy president of Kenya estimates there are still 500,000 illegal firearms in the country and most owned by pastoralists (Al Jazeera, 2016). The relative calm and improvement between pastoralist tribes is still at risk due to the number of weapons and challenge of maintaining a balanced use of natural resources.

During Golder research, one key informant explained that security among different ethnic groups began to improve in December 2015 during a key event that brought together the County governments of Baringo, West Pokot, Turkana, Elgeyo-Marakwet and Samburu. This was said to be the beginning of a strong commitment by the County leadership to end interethnic conflict in the region (KII, 4 August 2016). This meeting led to an idea among the political leaders gathered to initiate a "*peace caravan*" after talks with the President and Deputy President on how to end killings in the pastoral communities. A group of leaders comprised the peace caravan in mid-2015 and they travelled through critical areas urging communities to move beyond the cultural practices of raiding that undermine development in the pastoral communities (Citizen Digital, 2015).

Prior to this initiative, the Peace Coordinator of West Pokot described a volatile situation, particularly between West Pokot and Turkana pastoralists. The low point of this period was between January and May 2015. During this time, the conflict worsened from only cattle rustling to the killing of children. This targeting of people, regardless of the potential to steal animals, prompted the government to intervene and the notable change was an ownership of the problem by regional leaders (KII, 4 August 2016). The low point of this phase of violence is exemplified by a particularly violent period that left 300 people dead in the settlement of Kailoseget in the Kainuk Division of Turkana (Daily Nation, 2015). A protest in March 2015 by many of the widows left destitute from the violence was critical in moving leaders to act. Women in a focus group confirm that this was a difficult period, explaining that they recall it to be like a war zone with times when they were attending funerals every day (Focus Group Discussion, 01 July 2016). The Assistant Chief from the Kainuk Sub-location said certain areas were simply no-go zones prior to May 2015, including the Turkana side of the A1 from Kainuk to Kakongu and similarly to the Sub-location of Sarmach in West Pokot.

The no-go zones also included key grazing areas, such as locations as far east as around the Kalemngorok Settlement in Turkana South (KII, 31 July 2016). The Kakongu Sub-location Assistant Chief recalls conflict escalating from 2012, when the frequency and intensity of raids increased. At that time, Pokot groups claimed areas from a large part of Turkana County territory from Kainuk settlement on the border to area of the Kochodin Location near the Project (KII, 01 July 2016). It was at this time that adakar elders from the same Sub-location explain that they and their enemies decided to cease cattle rustling. They cite recent evidence of the change being two examples where some animals were stolen, but they intervened to ensure that the animals were returned to the rightful owner before any retaliation could take place (Focus Group Discussion, 31 July 2016). Such intervention suggests that the threat of theft may remain, but numerous leaders in the area are diligent to make sure isolated instances of raiding or theft do not cause greater problems and a return to the type of violence witnessed in 2015.

The overwhelming majority of key informants and focus group participants describe an improved situation between Turkana and Pokot herders, which was confirmed again in Golder's most recent research in early 2019 in both Turkana and West Pokot Sub-counties. In 2016, researchers themselves who were familiar with the border area during the worst period of violence noticed obvious differences of improved security in settlements and communities they had visited only a year before in 2015. Many people confirm that the peace caravan marked the turning point in the raiding violence. Numerous interviewees explain that Turkana and West Pokot are grazing animals with each other, trade and business happens regularly between the two groups and West Pokot Adakars are often residing in Turkana County. At that time, even areas to the south such as the Kapedo Location in Turkana East report that Pokot pastoralists regularly and freely move within the Kapedo settlement. The research team observed that people were walking along the road connecting Kapedo settlement to Chemolingot (in Baringo County). This 30 km journey had previously been impossible and there had not been any vehicles on the road a year ago (Focus Group Discussion, 2 August 2016). With the return to peace, there are still affects from the violent period that are visible in Turkana. The Sub-county Administrator for Loima Sub-county reports that some residents from Turkana East Sub-county have remained in his area under the assumption that it is relatively safer in Loima Sub-county, under the assumption that conflict may return to Turkana East (KII, 24 June 2016).

This does not mean that there are no exceptions and that some tensions remain even if the active violence has greatly decreased from 2015. During Golder research in January 2019, research activities were interrupted due to a raid that took place in the Lokori Location.

In the Sub-location of Lochwaangi Kamatak in Turkana South, the Assistant Chief have reported a trend in overuse of natural resources, which is causing disagreements among stationary and migratory pastoralists. Specifically, people compete for pasture and plants used for animal consumption. In some situations, this has led to gun violence. The second problem noted in this Sub-location is the shortage of Kenyan Police Reserve (KPR) officers. Their role is to provide security in the local area, but several have been engaged in the oil and gas work in the County and this has left the Sub-location with one or two KPR officers at any one time, which is not considered enough to maintain law and order (KII, 29 June 2016).

Areas of the Lochakula Location in Turkana East have also reported tensions over natural resources such as watering points. Even though there is a general agreement to share water between the Turkana and Pokot herders, there is tension in trying to encourage Turkana who had previously fled violence to come back to an area that is relatively worse than other migration corridors along the Turkana and Pokot border (Focus Group Discussion, 28 July 2016). While some Turkana have not returned, Pokot pastoralists use the area. Additional issues have arisen from Pokot herders occupying infrastructure, in particular a primary school located in Lochakula Settlement (KII, 29 July 2016).

Another example of the volatility in security is in the Katilu Location of Turkana South, where some Adakar elders state that the Pokot no longer migrate to the same areas as in the past and that this causes disruptions. They also expressed disappointment that there has not been a re-opening of the Narwamoru Settlement (Focus Group Discussion, 29 July 2016). Narwamoru Settlement is located in the Kaputir Location in Turkana South. It borders the Kapokot hills and was previously a gold mining area and an important place for commerce between the two groups. It closed in 1996 after an attack by Pokot on miners in an attempt to scare away Turkana. The dispute over the area was said to have less to do with cattle rustling, but more to do with land acquisition.

Research highlights that while raiding may have subsided from its peak in 2015, there is a persistent problem with violence and robbery along the A1 highway, particularly in areas from Kalemngorok settlement to Kakongu settlement. On this road, the Turkana South Deputy County Commissioner states that robbers harass drivers and passengers, particularly larger trucks. This, he says, is partly to do with individuals who used to participate in cattle raids and refuse or are unable to return to herding and have no other livelihood (KII, 29 July 2016). Other residents near this area suggest that there still may be some involvement of pastoralists who participate in the robberies (Focus Group Discussion, 29 July 2016). Anecdotal accounts explain that pastoralists with phones can sometimes communicate with "*thugs*" or idle warriors. They observe vehicle movements and call ahead to hit vehicles farther along the road. Adakar elders in the Kakongu Sub-location consider the bandit in two categories. The first category are simply common criminals, but the second category includes some people who were left destitute by losing their animals in previous violence. With no animals, but still having access to their weapons, poverty induces them to crime. The elders themselves increasingly see little difference between the two groups and believe that even those who lost animals can survive in aid if they need it (Focus Group Discussion, 31 July 2016).

One of the most dangerous implications of robbery on the road is the possibility that it could lead to accusations across ethnic lines. One Turkana key informant in Lodwar has received information that Turkana youth have carried out some robberies and then sought to blame ethnic Pokot. He also said there are reports of collusion with police (KII, 8 August 2016).

In the Kositei Location in West Pokot Sub-county, the Assistant Chiefs indicated that there has been conflict over the natural resources (grazing areas and livestock) in the area. It was escalated during the construction of the Turkwel Reservoir Dam but then there was peace. They reported that insecurity is high in the Kasitei Sub-location but there have been no incidences of insecurity in Chepokachim Sub-location (KII, 2 February 2019).

The Pokot West Sub-county, Endugh Ward and Kositei Location leadership, in collaboration with external partners, cite the following activities as having created progress in recent years:

- Peace committee, which consists of 60 people (30 Pokot and 30 Turkana) was formed with the sole role of following up and returning any stolen animals from either side;
- Insecurity is addressed through inter-border exchange visits, meetings with Adakar/kraal leaders, admission of Turkana students in Turkwel Secondary school and regular communication between the administrative organs in the two counties;
- The churches (religion) changed peoples mind set through awareness of the consequences of violence and death;
- 70% cattle rustlers became Reformed Warriors (RWs) and their role changed from animal theft to ambassadors of peace. RWs is a group of former militia gangs (Ngoroko). They were given motorcycles to do public transport as an alternative livelihood. Some of them were also casually employed in the NRT conservancy;
- Political leaders from both counties accepted, supported and campaigned for peaceful coexistence;
- Women played a key role by talking to their sons to end killing each other. They campaigned on radio stations (Kalya FM and North Rift) for peace among Pokot and Turkana and participated in the peace caravan; and
- Elders have performed traditional rituals cursing (*Muma*) cattle rustlers, inciters and highway banditry. These functions were carried out in Lami Nyeusi (Pokot side) and Kalemngorok (Turkana side) (Focus Group, 2 February 2019).

6.13 Cultural Heritage

6.13.1 Introduction

The purpose of the cultural heritage baseline study was to collect objective, scientifically defendable data of sufficient breadth and quality to allow the characterisation of the baseline cultural heritage conditions in the AoI.

Cultural heritage, in both tangible and intangible forms, is a unique and non-renewable resource. Tangible cultural heritage is defined as moveable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic and religious values, or unique natural features or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, and waterfalls (IFC, 2012a).

Archaeology is considered in this study to comprise all the material remains of past human occupation, land-use and associated activities, as well as any resultant environmental remains and it covers all periods, from prehistory (before written records) to the modern period (20th century).

Cultural heritage assets[44] that are not archaeological are described in this study as 'living cultural heritage'. This includes intangible cultural heritage, which is described as elements of culture such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles (IFC, 2012a).

The archaeological time periods referred to in this baseline report, their approximate date ranges and how they relate to known geological periods are outlined in Annex I.

A combination of desk-based study, archaeological field survey and KIIs were undertaken to establish the baseline cultural heritage conditions in the AoI.

Baseline cultural heritage data has been collected over an extended period of time (2016 to 2021), with each field survey guided by the likely design of the Project as it stood at that time. As such, baseline cultural heritage data has been collected across an extensive area of the South Lokichar Basin. Baseline data that has been collected from across this extensive area is included in this baseline study as it allows individual cultural heritage assets to be interpreted in the context of the wider dataset.

Supporting information is provided in Annex I, including:

- Cultural Heritage Gazetteer;
- Catalogue of KIIs;
- Photographs of sampled materials;
- Archaeological chronology for Kenya;
- Summary reports of 2016 KIIs; and
- Summary of Turkana burial practices.

Supporting Drawings (Drawing 6.13-1 to 6.13-22) are presented in the Drawing section.

6.13.2 Secondary Data

Secondary data was collected through desk-based study, including an appraisal of the following:

- Existing national datasets collated and maintained by the NMK;

[44] 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.

- Results of previous archaeological surveys, conducted by NMK specialists in 2014, in advance of seismic surveys across Licence Blocks 10BB and 13T; and
- Specific Site Assessments (SSAs) completed for each wellpad during E&A, which included an archaeological survey.

A review of the available literature was also completed to identify other sites in the area and to provide regional context in which to interpret the established baseline conditions. The Lake Turkana basin, of internationally recognised archaeological and palaeontological significance, has attracted a wealth of academic research, which is used to inform the NMK dataset.

The NMK archives were the main source of secondary information for sites and monuments of historic or cultural value (including any statutory protections afforded to them). They also record sites of significant national/international archaeological interest.

The data captured by NMK during seismic survey activities in 2014 provided a higher resolution to the archaeological dataset, with sites recorded of relatively lesser significance, such as individual findspots. The SSAs did not record any archaeological sites.

The desk-based study was completed by a member of NMK staff and sought to identify previously recorded cultural heritage sites of all types, including:

- Archaeological;
- Palaeo-environmental;
- Sites containing hominid remains;
- Palaeontological;
- Historic; and
- Other culturally relevant sites (e.g., religious buildings and places, burials, sacred sites).

6.13.3 Primary Data

6.13.3.1 Methods

This methodology was developed in accordance with Kenyan legislation and guidance pertaining to cultural heritage protection, in particular the EMCA 1999 and the National Museums and Heritage Act (2006, revised 2012). It also aligns with the guidance provided in IFC PS 8: Cultural Heritage and IFC GN 8: Cultural Heritage.

6.13.3.1.1 Archaeological Field Survey

Archaeological field survey, which involved walking over a representative sample of the proposed Project footprint (as it was defined at the time of survey) looking for evidence of past human and paleoenvironmental activity and recording the locations of identified cultural heritage assets, was completed in five phases. The first two were undertaken in April and July 2016 (the combination referred to as ‘the 2016 Survey’), with the third completed in February 2019 (‘the 2019 Survey’). Further supplementary phases of survey were completed in June 2019 (‘the Turkwel Survey’) and March 2021 (‘the 2021 Survey’). Due to the evolution of the Project design in the periods between each phase of survey, the methodology for the archaeological field survey was also evolved for each phase, as described below.

For the first three phases of survey, the fieldwork was completed by NMK specialist staff under the supervision of a Golder cultural heritage specialist and was undertaken in those areas considered likely to be directly affected by the Project (e.g., by ground disturbance). The Turkwel Survey and 2021 Survey were completed unsupervised, with remote support by a Golder cultural heritage specialist. On each occasion, the survey team completed the walkover survey systematically, covering the area by walking regularly spaced transects. The rationale of the archaeological field survey was not to survey the Project footprint in its entirety, but rather to survey a representative sample to provide a robust dataset that could be used to characterise the baseline conditions over the wider area. Although the archaeological field survey was limited to remains visible at the surface, for the purposes of baseline data collection, this is considered appropriate.

6.13.3.1.1.1 2016 Survey

The 2016 Survey focused on the areas of Amosing, Ngamia and Etom, with the aim of undertaking an approximate 15% survey coverage. To achieve this, each survey area was divided into a series of 500 m x 500 m grid squares, with a 15% sample of these grid squares randomly surveyed.

The second phase of survey also utilised this approach to achieve a 15% survey coverage of the areas of Twiga, Agete and Ekales. Some additional areas in the vicinity of Amosing and Ngamia were also targeted, based on potential Project infrastructure locations.

6.13.3.1.1.2 2019 Survey

The 2019 Survey was focused on Twiga, Amosing and Ngamia. All potential locations at Twiga and Amosing were surveyed and 74% of those at Ngamia were covered. Survey coverage is presented in Drawing 6.13-1.

Primary data gathering through archaeological field survey was limited to those areas that were safely accessible and amenable to survey. Consequently, heavily vegetated areas either could not be surveyed (as they could not physically be accessed) or were discounted for survey as the vegetation cover prevented artefacts from being visible on the surface. Equally, areas that had already been developed during E&A were also discounted for survey.

6.13.3.1.1.3 Turkwel Survey

The Turkwel Survey was undertaken adjacent to the Turkwel River upstream of its confluence with the Malmalte River, as part of a multi-disciplinary field expedition to the area, which was previously inaccessible due to security concerns. As with previous surveys, archaeological field survey was limited by the heavy vegetation, but walkover survey of a representative proportion of the area was achieved.

6.13.3.1.1.4 2021 Survey

The 2021 Survey focused on covering areas within Ekales, Agete and Etom fields that had previously not been surveyed, targeting the footprints of potential Project components. Survey coverage of potential Project components is presented in Drawing 6.13-1. As during the 2019 Survey, areas that had already been developed during E&A were discounted for survey.

6.13.3.1.1.5 Recording and Finds Processing

The location of each identified asset was recorded using a handheld GPS. A short, written account of the asset was also made (including information such as description, dimensions, setting and associated finds) and accompanied by digital photographs, where appropriate. Where finds were collected, these were placed in sample bags and marked using indelible ink with the finds' location and date of discovery. These finds were washed and processed, with a photographic record made of each. These collected finds are not a comprehensive catalogue of all materials discovered during the survey, rather, they are a representative sample. The finds are stored in NMK's offices in Nairobi.

6.13.3.1.2 Key Informant Interviews

KIIs were undertaken with community members in 20 settlements across the South Lokichar Basin during the 2016 Survey, in order to achieve the following objectives:

- To identify sites of cultural significance (e.g., religious, sacred or ritual sites, cemeteries or burial areas), record their locations and extents and understand how they are used/accessed;
- To record the history of the settlement and land use in the area; and
- To document an understanding of local traditions and practices (e.g., belief systems) that are important to the communities (intangible cultural heritage).

The 20 settlements in which KIIs were conducted in 2016, the locations of which are depicted in Drawing 6.13-2, were:

- Akibuket;
- Amoruakwan;
- Asikiim;
- Dapar;
- Kaikol;
- Kaloucholem;
- Kapese;
- Kapetatuk;
- Kaaroge;
- Kasuroi;
- Lochwaa;
- Lokicheda;
- Lokook;
- Lomokamar;
- Lopuroto;
- Lotimaan;
- Lowoidapal;
- Nakukulas;
- Nawoyalim; and
- Nayanae-engol.

KIIs were completed in partnership with an NMK specialist and assisted by the Operator's SPT. The KIIs were conducted primarily in Swahili and were digitally recorded with the consent of the participants. Where interview participants did not speak Swahili, a member of the SPT translated from Swahili into the local language (Turkana). A translated summary was provided in English by the NMK specialist leading the interview.

Initial contact with community members was made by the SPT, which was followed up by an introductory meeting with the Golder cultural heritage survey team. During this introductory meeting, arrangements were made to conduct the KII and an explanation provided of the objective of the interview. To maximise the data gathered from members of the community, interviews were held with different groups, including chiefs, seers, elders, women and youth. A catalogue detailing where and when KIIs were held, as well as who was in attendance, is provided in Annex I. Summary reports detailing the KIIs are also provided in Annex I.

Subsequent to the KII, identified cultural sites were visited to capture precise coordinate information (using handheld GPS) and to record details of each asset to allow the scale, form, function, date and relative importance of each to be ascertained.

An additional series of KIIs with community leaders from settlements located between the A1 and the Turkwel Gorge Dam was undertaken in Kapenguria between 21 January and 5 February 2019. Further supplementary KIIs were also completed during the Turkwel Survey between 11 and 15 June 2019. During these KIIs, including one meeting with a Pokot cultural specialist on 15 June 2019, information relating to the cultural heritage of those communities was gathered, although locations of specific assets were not mapped during baseline data gathering.

6.13.3.1.3 Data Management and Spatial Analysis

Due to the volume and coverage of data collected from secondary sources, primarily as a result of the extensive seismic survey work that has been undertaken, and the relative lack of detail associated with each record from the seismic survey, two separate datasets have been established; one from secondary data and one from primary data.

Cultural heritage assets identified during the primary data gathering activities were compiled, with each asset given a unique identifier (Golder ID). The secondary data dataset, which includes in excess of 1,500 assets, has not been ascribed unique identifiers, but has been classified on a broader basis, based upon the materials recorded. Both datasets have been analysed spatially using GIS software in order to establish their locations in relation to the Project.

The unique Golder ID for each asset includes a two-letter prefix, which defines whether it is an archaeological or living cultural heritage asset, followed by a sequential numbering system. The two letter prefixes used are:

- AR – Archaeology; and
- CH – Living Cultural Heritage.

6.13.4 Results

The results are presented in two sections, addressing the secondary and primary datasets, respectively. The combined primary dataset (the ‘Cultural Heritage Gazetteer’) is presented in Annex I and encompasses 557 cultural heritage assets.

The secondary data dataset, which covers a large swathe of Turkana county, includes a total of 1575 cultural heritage assets. A summary of the secondary dataset can be provided upon request. The locations of all identified cultural heritage assets from the primary and secondary datasets are shown in Drawings 6.13-3 to 6.13-22.

There are seven sites in Kenya designated by UNESCO as a WHS, comprising four cultural sites and three natural sites. These are listed in Table 6.13-1.

Table 6.13-1: UNESCO World Heritage Sites in Kenya

Site Name and Location in Kenya	Year of Inscription; Type
Thimlich Ohinga Archaeological Site	2018; Cultural
Fort Jesus, Mombasa	2011; Cultural

Site Name and Location in Kenya	Year of Inscription; Type
Kenya Lake System in the Great Rift Valley	2011; Natural
Mijikenda Kaya Sacred Forests	2008; Cultural
Lamu Old Town	2001; Cultural
Lake Turkana National Parks	1997; Natural
Mount Kenya National Park and Natural Forest	1997; Natural

None of these seven sites lie in proximity to the Project. The nearest WHS to the Project, the Lake Turkana National Parks (natural; WHS Ref – 801bis), is over 100 km to the east.

6.13.4.1 Secondary Data

A total of 1,575 cultural heritage assets have been identified from secondary sources, the location and distribution of which are shown in Drawings 6.13-3 to 6.13-7. The majority of these assets were recorded during previous archaeological surveys undertaken in advance of the seismic survey, which was carried out over an extensive area between Lodwar and Amosing. It is understood that no sampling of materials was undertaken during these surveys. The materials recorded at each asset have been categorised into eight broad categories, comprising:

- Burial (Living Cultural Heritage);
- Monument/Sacred Site (Living Cultural Heritage);
- Faunal (Archaeology);
- Grindstone (Archaeology);
- Jewellery (Archaeology);
- Lithic (Archaeology);
- Palaeontological[45] (Archaeology); and
- Pottery (Archaeology).

Some assets, which contain multiple materials, fall into more than one category. All burials identified from secondary sources are assumed to be modern burials, based upon the limited information available[46].

A summary of materials recorded across the 1,575 assets is presented in Table 6.13. As shown, the most prevalent materials recorded were pottery and lithic remains, with 61% and 36% of assets containing them respectively. A total of 251 burials were recorded, comprising 16% of cultural heritage assets identified from secondary sources. Faunal, palaeontological and other archaeological remains (jewellery and grindstones) were recorded at far fewer cultural heritage assets.

[45] There is only limited information available from secondary sources regarding the majority of palaeontological materials. A proportion are recorded with associated material culture, although there are a number that contain only zoological remains, with no human aspect. In light of the limited information available, and for ease of interpretation, all palaeontological finds are presented as being 'archaeological' for the purposes of this baseline study.

[46] It is not possible to verify the date of these burials from the information recorded in secondary sources, and so there is a possibility that a proportion of these may be historic burials. They have all been assumed to be modern burials as it is considered that this represents the 'worst-case' – i.e., it is assumed that there are human remains and potential living relatives to be considered.

Table 6.13-2: Materials Recorded at Cultural Heritage Assets (Secondary Data)

Material	Number of assets where material was recorded	Percentage of assets where material was recorded
Burial	251	16%
Monument/Sacred Site	7	<1%
Faunal	64	4%
Grindstone	1	<1%
Jewellery	3	<1%
Lithic	571	36%
Palaeontological	37	2%
Pottery	958	61%

6.13.4.1.1 Burial

Burials were recorded throughout the region, although there are notably fewer burials recorded between Lokichar and Ngamia (as shown on Drawing 6.13-4). The densest concentration of burials is observed around Lokichar and extending to the north. In particular, burials appear to be clustered to the western side of the survey coverage, in the area adjacent to the A1 road. A similarly dense distribution of burials is observed south of Ngamia, around Amosing.

6.13.4.1.2 Monument/Sacred Site

Seven assets have been identified as ‘monuments’. Based upon the limited information available from secondary sources, these are best interpreted as sacred sites used by the community and include three ‘shrines’ used for feasting and three small mounds topped with cairns. One asset is simply described as a monument.

6.13.4.1.3 Faunal

Faunal remains, comprising non-fossilised animal bone and tooth fragments, as well as ostrich egg-shell, were recorded at relatively few locations in the region (4% of identified cultural heritage assets). These are distributed throughout the region, although a large proportion of these faunal remains are recorded north of Lokichar. There is also an apparent absence of materials between Ngamia and Lokichar.

6.13.4.1.4 Grindstone

A single grindstone was recorded, adjacent to the A1, north of Lokichar. Grindstones are used for food processing, such as grinding grain.

6.13.4.1.5 Jewellery

Examples of jewellery, comprising various beads and including one ostrich egg-shell bead, were recorded at three of the identified cultural heritage assets.

6.13.4.1.6 Lithic

Lithic remains were recorded at 36% of the identified cultural heritage assets, making them the second most prevalent archaeological material observed. These comprised a variety of stone tools, including flakes and cores from a range of different materials. As shown in Drawing 6.13-5, lithic remains are recorded throughout the region, although there is a particularly dense cluster around the areas of Etom and Agete. South of Agete, as far as Amosing, the distribution of lithic remains is relatively sparse, with a denser concentration south of Amosing.

6.13.4.1.7 Palaeontological

Palaeontological remains, comprising a range of fossilised bones and teeth from a variety of species, were recorded at 37 (2%) of the identified cultural heritage assets identified from secondary sources. As such, they are relatively uncommon in the area compared to other materials identified. Isolated examples are recorded throughout the region, but the densest concentrations are noted near Amosing and to the east of the Etom area. Based upon the information available, none of these palaeontological remains are hominid fossils.

6.13.4.1.8 Pottery

Pottery remains were the most commonly recorded material, with pottery present at 61% of the identified cultural heritage assets. As shown in Drawing 6.13-6, these are distributed throughout the region, with no discernible clustering of material. Unlike the other materials recorded, pottery appears to be the only consistently recorded material between Lokichar and Amosing.

6.13.4.2 Primary Data

A total of 557cultural heritage assets were recorded during primary data gathering, the location and distribution of which are shown in Drawings 6.13-8 to 6.13-22. These comprise 452 archaeological assets and 105 living cultural heritage assets. The details of each asset are presented in the Cultural Heritage Gazetteer in Annex I.

6.13.4.2.1 Archaeology

Consistent with the results of the desk-based study, archaeological remains were observed throughout the landscape during field survey. Archaeological remains were limited to lithics and pottery at all but three assets; AR-142, where a cowrie shell bead was recorded; AR-425 (near the Amosing area), where a potential fossil was recorded and AR-461, where an ostrich eggshell bead was recorded. A summary of the materials recorded at archaeological assets is presented in Table 6.13-3

Table 6.13-3: Materials Recorded at Archaeological Assets (Primary Data)

Material	Number of assets where material was recorded	Percentage of assets where material was recorded
Pottery	124	27%
Lithics	367	81%
Jewellery	2	<1%
Palaeontological	1	<1%

The vast majority of pottery was undecorated (recorded at 118 assets), with decorated pottery recorded at just eight assets. Examples of undecorated and decorated pottery are presented in Figure 6.13-1 and Figure 6.13-2, respectively. Rim and neck sherds were also recorded at 15 assets. Thick-walled, undecorated pottery is generally associated with the Iron Age in Kenya, dating to between 2,500 and 500 years Before Present (BP). It is typically younger in age than decorated pottery recorded in the area. Pottery occurs in the archaeological record of the Lake Turkana region from approximately 4,500 years BP. Its earliest occurrence is recorded at a site to the east of Lake Turkana, and its appearance is associated with the presence of domesticated livestock. This early pottery type is known as 'Nderit ware' and is decorated with incised wavy lines. Another form of decorated pottery with incised lines, known as 'Ileret ware', is also present in the region around this time, but is characteristic of later pastoralists who occupied the region. Nderit and Ileret wares disappear from the archaeological record circa 3,000 years BP.

Figure 6.13-1: Undecorated Pottery (AR-217)

Figure 6.13-2: Decorated Pottery (AR-317)

There was greater diversity of lithic objects recorded, comprising a variety of flakes, cores and debitage (chunks and other waste material). There was also a variety of different materials identified, with stone tools manufactured from quartz, chert, obsidian and rhyolite recorded, as well as several tools manufactured from poorer quality materials like basalt. Figure 6.13-3 shows a lithic assemblage with examples of rhyolite, quartz, obsidian and chert tools. A summary of the prevalence of different lithic remains is presented in Table 6.13-4. Overall, quartz and rhyolite tools were the most prevalent, recorded at 45% and 37% of archaeological assets, respectively. Chert and obsidian were recorded at 22% and 16% of archaeological assets, respectively.

Table 6.13-4: Lithic Remains – Materials Recorded

Material	Number of assets where material was recorded	Percentage of assets where material was recorded
Quartz	202	45%
Chert	100	22%
Obsidian	70	15%
Rhyolite	165	37%
Other (e.g., Basalt, Chalcedony)	75	17%

Figure 6.13-3: Lithic Assemblage (AR-251). Stone Tools Ranging from Large Rhyolite Flakes to Worked Quartz to Smaller Obsidian and Chert Flakes (Including Some Microliths).

The presence of quartz tools within the survey area is explained by the relative abundance of source material in the local environment. The mountains to the west of the region are the likely origin of this material, but nodules of quartz are ubiquitous in the numerous luggas that traverse the landscape where they have been transported and deposited by ephemeral surface water flow.

Chert and obsidian, however, do not occur in the surrounding landscape. The nearest known source of obsidian lies 100 km to the north-east, on the Central Island of Lake Turkana, although the exact provenance of the recorded finds is not currently known.

It is considered that, in the absence of definitive stratigraphic evidence, stone tools of different materials that were found in the same context should be deemed contemporaneous in date.

Samples of archaeological materials were taken during survey, although it was not feasible to collect every artefact recorded. A detailed breakdown of the quantity of each find type across the survey area is, therefore, not possible. The sample assemblage totals approximately 2,100 individual artefacts. Photographs of a representative sample of the collected materials are presented in Annex I.

6.13.4.2.2 Living Cultural Heritage

A total of 105 living cultural heritage assets were identified during primary data gathering, the locations of which are shown in Drawings 6.13-17 to 6.13-22. A summary of these living cultural heritage assets is provided in Table 6.13-5.

Table 6.13-5: Types of Living Cultural Heritage Assets Recorded (Primary Data)

Asset Type	Number of asset type recorded	Percentage of all assets
Burial/Grave	40	38%
Meeting Tree	39	37%
Fire Pit	10	10%
Religious Building	3	3%
Other	13	12%

Generally, living cultural heritage sites in the region are found in close proximity to the settlements with which they are associated. Away from these settlements, living cultural heritage sites are limited to individual, isolated burials. Burials are typically demarcated by a small pile of rocks and can be found scattered throughout the landscape. More formal graves were also recorded, specifically those of eminent elders and group leaders. In Turkana culture, an individual's social standing within a community determines the type of burial they receive, the location and size and scale of any grave markings. The graves of respected leaders and elders are typically marked with a recognisable memorial (e.g., headstone, cross) and are located near the settlement. A more detailed description of Turkana burial practice is provided in Annex I. A total of 40 burials/graves were identified during survey or from KIIs.

Another frequently recorded asset was specific 'meeting' trees, which are culturally significant to different members of the community within Turkana. Some meeting trees are reserved for groups of elders, whilst others are reserved for the youth of the community. Each *ere*[47] has a specific tree, or several trees, where men meet, known as *ekitoe a ng'ikiliok*[48]. Community meeting trees are used by all members of the settlement, and are used as the location for ceremonies, community events and group discussions (regarding issues of concern, like drought). Trees are also significant locations in terms of conducting weddings, initiations and other religious

[47] *Ere (pl: ng'ereria)* describes the ancestral domain of a family. An ere may be described by the current household (including grand-parents, siblings and children) as the location from where the family derives and, to a variable extent, may live (seasonally or more permanently for the old, women and children) and graze their livestock. Borders of the ere are usually delineated by features such as a luggas, ridgelines, livestock tracks (for moving stock long distances), roads and occasionally certain species of trees. These borders are generally known by everyone living in the vicinity.

[48] Alternatively known as *Ekitoe a Ngikileok*

functions. A total of 39 meeting trees were recorded. Associated with the meeting trees are fire pits and roasting pits, which are used during feasts held at these locations. Ten such pits were recorded during data gathering.

Often the graves of eminent leaders are in close proximity to meeting trees, and there are occasional instances of fire pits associated with the graves of eminent elders, where feasts associated with consulting the deceased ancestor have been held.

Two churches and one mosque were recorded in Lokichar (CH-050, CH-051 and CH-049, respectively). A total of 13 'other' living cultural heritage assets were also identified. These include two grazing fields (CH-010 and CH-013) and an irrigation dam/channel (CH-054 to -056). These 'other' living cultural heritage assets also include several ceremonial meeting places where the feasting tradition of *akiriket*[49] takes place (CH-041, CH-063, CH-065, CH-070, CH-083, CH-094, and CH-108), as well a place where a game, known as *Nikales*, is played on a 'board' drawn into the sand (CH-093).

Whilst it was not possible to physically record the locations of specific living cultural heritage assets in West Pokot, it is understood from the KIIs completed in 2019 that similar assets, especially specific meeting trees, are also important in West Pokot culture.

6.13.4.2.3 Intangible Cultural Heritage - Turkana

The KIIs provided a perspective on the typical practices and beliefs carried out in the surrounding areas.

A widespread and distinct 'Turkana culture' is evident throughout the region, comprising several related practices and beliefs. Widely observed practices include a nomadic pastoralist way of life and use of the local environment for subsistence. The latter includes grazing, hunting and the collection of medicinal plants, although the more general use of different tree species (such as *Ewoi, Edome* and *Ekadeli*) for a variety of functional and spiritual purposes was also recorded (further detail is provided in the ecosystem services baseline; Section 6.10). Associated with this is a social structure and belief system which permeates all aspects of life and is ingrained in the culture of the local people. In addition, the local population have sincerely held religious beliefs, spanning multiple denominations of Christianity, Islam and local polytheist/animist religions, with the significance of 'seers' also recorded during the KIIs.

Turkana culture is widespread, and practices such as nomadic pastoralism and the use of the landscape for subsistence are carried out over large geographical ranges. A brief overview of the recorded 'Turkana culture', with supplementary information from Herlocker et al., (1994), is presented here, although this should not be considered a comprehensive or definitive description.

6.13.4.2.3.1 Turkana History, Society and Belief System

Turkana culture and identity are closely associated with the history of the people and the region. This history is primarily recorded and transferred between generations through the recounting of oral histories, and these histories inform how Turkana society is structured and how the relationships between the Turkana people manifest themselves.

Fundamental to Turkana social structure are the concepts of 'sections'[50] and 'clans'[51]. Sections are geographical areas of varying size, some of which overlap, which cover the entirety of the Turkana region and define different territorial boundaries. Sections provide a social identity and a sense of protection as they define limits of ownership and accessibility to resources. There are 15 sections (and 4 sub-sections) in Turkana,

[49] Akiriket is where both groups cut two pieces of meat (*apol*) from the hind-quarters of the carcass, comprising a bigger piece (with the kidney attached) and a smaller piece. The *Ngicuro* cut the small *apol* from the left side of the carcass and the big *apol* from the right, whilst the *Ngimonia* do the reverse. The *Ngicuro* also remove the kidney prior to roasting, whilst the *Ngimonia* only remove it once the meat is roasted.

[50] Section - *ekitela* (single), ng'itela (plural)

[51] Clan - *emacar* (single), *ngimacarin* (plural)

separated into two groups – *Ngicuro*[52] ('those of the waterfalls') and *Ngimonia*[53] ('those of the dense forest'). These comprise:

- ***Ngicuro*** – Ngikamatak; Ngilukumong; Ngiwoyakwara; Ngibilae; Ngikebootok; and
- ***Ngimonia*** – Ngikwatela; Ngijie (Iu Akorumwa Anarengan); Ngisiger; Ngisir; Ngiyapakuno; Ngimonia a Anyangataok; Ngiboceros; Ngikajik; Ngisonyoka; Ngiesetou.

This distinction represents two separate phases of migration into Turkana, with five sections in the earlier *Ngicuro* group (believed to have settled in Turkana in the early 16th century) and ten in the later *Ngimonia* group (believed to have settled in Turkana in the 18th century). The *Ngicuro* sections occupy the western and southern areas of Turkana, whilst the later *Ngimonia* sections are located in the central, northern and eastern areas, described in 1994 as being bounded to the north by Lothagam Hill, on the west by the Turkwel River and on the east and south-east by the Kerio River. The distinguishing feature between the two groups, as documented by Müller-Dempf (1994), is the way in which they slaughter, prepare and roast an animal for *'akiriket'*. The potential AoI is located within the *Ngisonyoka* and *Ngikebootok* sections (*Ngimonia* and *Ngicuro* group, respectively).

Clans are based on kinship, defined as groups of people 'related through their animals' (Herlocker et al.; 1994), and can be identified and distinguished from each other by slight variations in dress, customs and livestock brands. There are 29 clans in Turkana, which can be separated into three rough categories:

- Those found primarily within the *Ngicuro* sections (15 clans);
- Those found primarily within the *Ngimonia* sections (6 clans); and
- Those found throughout both *Ngicuro* and *Ngimonia* sections (8 clans).

Despite these groupings, clans are not bound to a fixed territory and so different clans can be found in any section. Clans act as units of cooperation and members ensure proper distribution of property and livestock amongst family members. This kinship system also links individuals throughout the Turkana region and when a group of individuals move to a new territory, they would customarily approach their clansmen in that new area for support and guidance. Men and women of the same clan are not permitted to marry; when a woman marries a man, she joins her husband's clan. Clan affiliation is hereditary through the male line, with the elders of each clan the custodians of their clan's unique customs.

Elders of a clan or family (both male and female) are grouped into two alternating age-sets; the senior age set (*Ngirisae*) and the junior age set (*Ngimor*). Customarily the *Ngirisae* wear gold jewellery (such as rings or earrings) and the *Ngimor* wear silver jewellery (KII, 7 April 2016). The designation of senior or junior alternates each generation, so the children of *Ngirisae* are *Ngimor* and the children of *Ngimor* are *Ngirisae*. During *akiriket*, where the group sits in an arc, the most senior of each age set sit at the centre, with the *Ngirisae* seated on the right side of the arc and the *Ngimor* on the left. Seers are not actively involved in decision making but do advise both age sets.

Clan affiliation and the section from which an individual is from can be used to identify and differentiate them from other individuals. If an individual travels and settles in a new section, they still identify themselves as being from their original section. Importantly, this links an individual back to their heritage and the history of the Turkana people, which in turn entrenches the significance and strength of Turkana culture within society. An individual's surname, derived from the grandfather's forename, also provides an insight back into their heritage and allows them to trace their lineage, reaffirming their Turkana identity.

[52] Also commonly referred to as *Ngikamataka* ('those of the Apol Nakamatanit')

[53] Also commonly referred to as *Ngisir* ('those of Apol Nasirit')

Other features of Turkana culture include their own calendar, special initiations, distinct burial practices and marriage customs (including 'official' and 'unofficial' marriages) and perceptions of the landscape. There are also established concepts of land ownership and wealth, which are founded on principles of communal ownership and communal obligations. As such, they do not necessarily conform to 'Western' concepts of land ownership.

6.13.4.2.3.2 Nomadic Pastoralism

A significant element of Turkana culture is nomadic pastoralism, which is practised by a large proportion of the population of Turkana. This way of life, determined by seasonal fluctuations in the availability of water and grazing, has been practised for generations and is integral to Turkana culture and values. Its influence over the landscape in terms of settlement, land use and tangible cultural heritage is profound. Indeed, the Turkana pastoralists have developed robust strategies to cope with the risks inherent to survival in their arid and semi-arid environment. These include:

- Splitting livestock in smaller herds and distributing them over a wider area to reduce grazing pressure;
- Being highly mobile to exploit and react to the changing conditions of the landscape;
- Following a seasonal grazing pattern;
- Reserving specific areas of grazing land for the dry season;
- Exploiting a wide range of natural resources to overcome food scarcity and also pragmatically selling livestock to access the produce of agriculturalists; and
- Effective distribution of roles and responsibilities.

A key feature of nomadic pastoralism in Turkana is the distinct social structure and settlement pattern it has engendered. At the smallest scale communities are based on an extended family unit. This is headed by the male leader of the household (*elope*), and would include his wives and children, as well as, potentially, any younger brothers and their families. Each wife and her children would typically have their own individual home[54] which would be clustered together, along with pens for livestock, within a homestead[55]. The *elope* (and any other men within the homestead) would typically sleep outside to protect the animals.

During the wet season, the homestead is established in the family's '*ere*'. It is during this period, typically, that social activities such as marriages take place. Multiple homesteads may be established within an *ere* by different family members. Each *ere* is different in terms of size and shape, and typically there is overlap between neighbouring *eres*. The process for establishing a new *ere* is overseen and organised by clan and family elders.

During the dry season, when grazing and water at the *ere* becomes sparse, households must move their herds to other areas to find sufficient food and water. During this time, the elderly (potentially including the *elope*) and the very young may stay at the *ere* with a small number of livestock, whilst the remainder of the household move to other areas. Those who remain at the *ere* are referred to as the '*eegos'*, literally meaning 'baggage'. Throughout this time the household lives more transiently in the landscape, moving from location to location in search of grazing. During this transient period, households may establish temporary homesteads[56] within the *ere* of another family, with some households following an established route, developed over multiple years, through several different *eres*. In this sense *ere* boundaries are widely acknowledged and understood but they are permeable – it is accepted by the Turkana people that others may temporarily settle and use an area, but

[54] Home/shelter – *ekol* (singular), *ng'ikolia* (plural)

[55] Homestead – *awi* (singular), *ng'awiyei* (plural)

[56] Temporary homestead – *abor* (singular), *ng'aborin* (plural)

this is done so in consultation with each other so as to avoid conflict. The ultimate ownership of an *ere* by a specific family is recognised by all Turkana people.

Multiple homesteads from the same area will often come together to form a larger mobile unit, known as an adakar[57], when moving herds to new grazing. When travelling long distances, several adakar will often merge to form a larger group known as an *arumrum*[58]. This is for the purpose of security (KII, 9 May 2017).

6.13.4.2.3.3 Environmental Subsistence

As a traditional practice, environmental subsistence is an element of intangible cultural heritage and is recognised as such. Details of the specific materials gathered (plant and animal species and soil and mineral types), where they are collected and how they are used by the local people is provided in the ecosystem services baseline (Section 6.10). This practice is carried out throughout the region and is not specific to any single settlement or location.

6.13.4.2.4 Intangible Cultural Heritage - West Pokot

The KIIs completed in 2019 provided an insight into social structure and traditional beliefs within West Pokot. A brief overview of the recorded 'West Pokot culture' is presented here but this should not be considered a comprehensive or definitive description.

The Pokot migrated to West Pokot as a result of conflict in surrounding regions and, as a traditional society, are structured based on 'clans'. There are 36 clans, which are each divided into several 'sub-clans'. There are 330 sub-clans, in total. Pokot society is patriarchal, with decisions predominantly made by men. However, powers and positions of authority that are inherited through an individual's clan lineage are considered to be divine rights (i.e., bestowed by their deity) and are not gender specific.

Groups within the traditional Pokot society structure include:

- *Kirwook* (Judges) – a group of powerful and influential individuals who have ultimate authority within the traditional leadership structure. Individuals come from various clans and they are believed to have been gifted with wisdom, a sense of justice and the ability to solve problems. Clans associated with *Kirwook* are *Siwotoy* (buffalo), *Sotot* (sun), *Ngisurot* (rain), *Kasera* (dove), *Pkomor* (wild pig) and *Soko* (lion);
- *Karoyok* (Intestine Readers) – these individuals are believed to have the ability to read prophecies from animal intestines following animal sacrifice.
- *Werkoy* or *Laibon* (Seers) – these are individuals that are believed to be gifted with spiritual insight. Due to security concerns, KII participants indicated that seers prefer to keep their identity secret. Seers are believed to derive their ability from their clan lineage and only specific clans are known to produce seers (*Siwotoy* (buffalo), *Sotot* (sun), *Solyongot* (thunder rain), and *Talai* (crow/lion)). *Werkoy* are not common and can be women, depending upon their gifts.
- *Kokwo* (Tree of Men – Elders gathering) – considered to be the Pokot 'Parliament', where decisions are deliberated on by *Kirwook*. The size and representation of the gathering depends on the magnitude of the issue to be deliberated. Nearby *Kirwook* (typically one or two individuals) and representatives from affected collections of homesteads, known as M*ongot*[59]*,* will convene at *Kokwo*. These *Mongot* representatives are selected by members of the homestead based on their effective communication, good judgement,

[57] ng'adakarin - plural

[58] ng'arumrumio - plural

[59] Manyatta – singular homestead, Mongot – multiple homesteads; consists of group of households with familial ties, for example grandfather, children, their spouses and grandchildren, as well as more distant relations (e.g., cousins). A 'kau' is a household with father, mother and children. A large household could also consist of one man with many wives and children.

intelligence and quick thinking. *Kokwo* is convened under special trees significant to the area. These are either fig, sycamore or tamarin indica trees.

- *Mpoy* (Women's' gathering) – this is a meeting of women held to disseminate the information and the decisions made at *Kokwo*. This group has no decision-making authority. This group does, however, deal with the discipline of men who abuse women. They are allowed to enact justice for any crime a man commits against women and have the power to arrest, fine or beat men, depending on the crime and irrespective of the man's position in society.
- *Akiko* (Large-scale gathering) – this is a summit that is used to assemble a large group of leaders that covers a larger geographical area, to discuss major issues/decisions of importance to the wider population. *Akiko* are not held frequently, maybe once a year, as it requires a lot of planning and travelling to mobilise all the relevant people. Typically, *Akiko* would be attended by *Kirwook* from different *Mongot*, who come together to discuss major issues affecting the broader community. It is the ultimate decision-making power within Pokot community. Women don't participate in the decision-making process of *Akiko*, but they are present to organise the event. During *Akiko*, between 15 and 20 bulls are slaughtered to feed the people and to bless the proceedings or issue that needs to be resolved.

This traditional society structure has been integrated into Government structure, with *Kirwook* advising government administrators.

Young people in Pokot culture are not involved in decision making, but they are considered to be the 'defenders' of the community (described during KII as the 'military arm' of the community). They are guided by *Kirwook* and *Werkoy*, and act as messengers to disseminate the decisions made by *Kokwo* to those who were unable to attend.

It is understood that nomadic pastoralism and environmental subsistence are also practices that are common within Pokot society.

6.13.5 Discussion

The baseline study has identified a large number of cultural heritage assets across an extensive area. The combined total of both the primary and secondary datasets is 2,129 cultural heritage assets. As discussed below, this provides a useful and robust context within which individual assets can be interpreted and from which assumptions can be made. However, the coverage of baseline data exceeds the AoI, and so only a fraction of these assets will be considered further in the impact assessment.

This section presents the over-arching conclusions regarding the cultural heritage baseline conditions, based upon the data collected and observations made in the field.

6.13.5.1 Archaeology

As shown in Drawing 6.13-3, secondary sources indicate that there are archaeological remains distributed across a very large area. Combined with the results of the archaeological walkover survey, the baseline data indicates a consistent density and distribution of archaeological remains, particularly lithic and pottery remains, across the region. From this, it is inferred that areas within the potential AoI that have not been subject to survey are likely have a similar distribution of artefacts.

The archaeological walkover survey provided an opportunity to ground-truth the observations derived from the secondary data. For example, although the secondary data indicated an apparent clustering of lithic remains to the north (between Etom and Lokichar) and to the south (around Amosing), the results of the archaeological walkover survey indicate that this is inaccurate and that, in fact, lithic remains are present throughout the region, including the area of apparent absence between Lokichar and Amosing. It is considered therefore, that there is potential for archaeological remains to exist throughout the landscape, with very few discernible patterns to distribution at the wider scale.

The archaeological walkover survey also made it possible to make finer scale observations regarding the distribution of artefacts. Whilst there is no apparent spatial pattern to the distribution of artefacts at the wider scale, it was observed in the field that archaeological remains were typically observable at the surface where the overlying sandy soil had been removed – either by aeolian erosion or transported by surface water runoff (sufficient to remove the overlying sediment, but not sufficient to transport larger particles, or artefacts). As such, there are localised concentrations of artefacts within these areas of erosion. The action of surface water runoff to remove sediments means these localised distributions are linked with the location of luggas. Immediately adjacent to luggas, where surface water flow has greater energy, all materials (including artefacts) appear to be eroded from the surface and transported along lugga channels until they are deposited when the ephemeral water flow recedes. Slightly further from the luggas, particularly on ground that is relatively elevated, surface runoff seemingly has less energy and so removes the overlying sediment but leaves archaeological remains *in situ*.

Very few artefacts were observed in heavily grazed areas, where the vegetation cover and sandy surface obscured any potential surface finds. However, based upon the distribution of archaeological remains throughout the region, the absence of archaeological remains on the surface in these locations should not be considered evidence that no archaeology exists. It is considered likely that remains exist beneath the surface.

Although archaeological remains have been observed throughout the landscape, the source of these materials (e.g., settlement sites) remains unknown. No ‘monumental’ or architectural remains were observed during survey, and very few scatters of artefacts were considered to signify the potential for any significant sites. The potential for undiscovered settlements to exist below the surface is, therefore, considered to be low. On the assumption that use of the land was transient, buildings would have been constructed from organic materials and therefore little evidence for their existence remains. This is consistent with a nomadic pastoralist way of life, which is known to have existed in the region for several thousands of years. Three locations, however, were identified as having higher potential of more significant archaeological remains below the surface:

- to the north-east of the Ngamia area, where a large scatter of particularly old lithic remains was discovered; dating to between 300,000 and 1.76 million years Before Common Era (BCE) (Drawing 6.13-14);
- the vicinity of AR-105, where a dense collection of lithic tools and pottery were discovered (Drawing 6.13-13); and
- the vicinity of AR-109, where a dense deposit of worked quartz was identified forming a plateau along an elevated ridge (Drawing 6.13-13).

Other observations made during archaeological survey include:

- The areas with higher numbers of archaeological finds were located relatively close to the major luggas;
- Based on typological evidence and Holocene surface deposits, the majority of the finds date to the Later Stone Age onwards, although the possibility of earlier stone tools within the assemblage cannot be discounted; and
- Surface sediments are interpreted as being Holocene in date with older Pleistocene, Pliocene and Miocene sediments absent or deeply buried. It is within these earlier sediments that significant hominid discoveries have been made previously at Loperot, Lothagam and Nuchukui.

It is considered, that, despite the acknowledged limitations, the approach to representative data gathering provides a robust basis for characterising the baseline cultural heritage conditions and provides a strong evidence base for areas not surveyed.

6.13.5.2 Living Cultural Heritage

A robust understanding of the living cultural heritage assets in the region have been established, with burials and ceremonial meeting locations (e.g., trees, roasting pits, feasting locations) associated with the majority of semi-permanent settlements.

6.13.5.3 Intangible Cultural Heritage

In both Turkana and West Pokot, identifiable traditional cultures have been recorded. Both cultures practice nomadic pastoralism and have commonalities (e.g., meeting trees), but each is distinct in terms of its history, structure and perception of the world. In particular, they have distinct perceptions of each other, and intangible cultural heritage between Turkana and West Pokot may be sensitive to change.

7.0 POTENTIAL IMPACTS AND MITIGATION

7.1 Air Quality

7.1.1 Introduction

The potential impacts on air quality as a result of the Project have been determined using a combination of quantitative and qualitative assessment methodologies. Where potential impacts have been identified, these are considered in turn and mitigation measures are set out where necessary to ensure that any potential impacts are reduced as far as practicable.

7.1.2 Area of Influence

For construction, the Air Quality AoI considers a 250 m zone around the perimeter of all infrastructure fence-lines and an area of approximately 2 km around the emission points of infrastructure associated with wellpad drilling.

For operation, an area of around 2 km is considered around the fence-lines of the CFA, wellpads, IWMF and all associated operational infrastructure.

From a visual inspection of the modelling results, it is evident that the plume is grounding within the 2 km area around the various emission points and therefore the maximum predicted concentrations are being considered and reported in this assessment.

These areas are encompassed in the Project AoI as defined in Section 3.13.

7.1.3 Receptor Importance

In order to identify the importance of the receptors, the scale of relative importance presented in Table 7.1-1 has been used with reference to the information collated in the baseline to classify the selected receptors.

Table 7.1-1: Criteria for Determining Importance of Receptors

Receptor Importance	Example Receptor Types
Very high	■ Receptor with a high quality and/or rarity on a regional or national scale and limited potential for substitution/replacement (not applicable to this Chapter).
High	■ Human health of permanent residential or transient PAP; ■ Receptor with a high quality and/or rarity on a local scale and limited potential for substitution/replacement.
Medium	■ Receptor with a medium quality and/or rarity on an international, national, regional, or local scale and limited potential for substitution/replacement; and/or ■ Receptor with a low quality and/or rarity on a regional or national scale and limited potential for substitution/replacement. ■ Human amenity receptor (associated with nuisance rather than health impacts)
Low	■ Receptor with a low quality and/or rarity on a local scale.

7.1.4 Magnitude of Impact

The characterisation of the magnitude of the impact considers the description of Project processes and how the Project could result in a change at each of the receptors. The potential for an impact to occur at a receptor has been determined using the understanding of the baseline environment and consideration of whether there is a feasible linkage between a source of the potential impact and each receptor. For air quality, the magnitude of each potential impact has then been classified between 'negligible' and 'high', as described in Table 7.1-2. Magnitude criteria relating to climate change and GHG are not defined but impacts are discussed and the quantum of emissions is compared to Kenyan and global annual GHG emissions.

Each potential impact can be either negative or positive (not applicable for air quality) to the receptor of interest and vary in its duration (i.e. can be long-term, medium or short-term and either permanent or temporary). For the Project phases the following durations apply:

- A short-term impact is defined as up to 66 months (the maximum anticipated construction period). The CFA/CPF will be constructed within the first 36 months;
- A medium-term impact is defined as between 66 months and 25 years (anticipated duration of operations); and
- A long-term impact is defined as one that is predicted to last beyond the end of operational life of the Project (>25 years).

For air quality impacts, the duration is also defined by the averaging periods of the AQS. The AQSs for each duration or averaging period are based on the now extensive body of scientific evidence relating to air pollution and its health impacts (WHO, 2005). Where the duration of an impact is defined using the durations stated above, the AQSs are also assessed for each duration, where applicable. For example, a short-term impact is defined as up to 66 months but within the 66-month duration, all relevant AQS (10-minute, 1-hour, 8-hour, 24-hour and annual averaging periods) are considered. Only the relevant averaging periods are assessed; for example, if a PAP is likely to be present in an area for 24 hours, only the AQS for averaging periods equal to or less than 24 hours will be appropriate and applicable.

A permanent impact is defined as a change to the baseline that would not reverse itself naturally. A temporary impact is defined as a change to the baseline conditions that would reverse naturally once the source of the impact is exhausted or has ceased.

Potential impacts are also assigned descriptors to identify whether the impact is direct or indirect. For the purposes of this assessment, a direct impact is one that occurs as a direct result of the Project and is likely to occur at the Project itself. Indirect impacts (or secondary/tertiary impacts) are those where a direct impact on one receptor has another knock-on impact on one or more other related receptor(s). Indirect impacts are likely to occur away from the Project.

Table 7.1-2: Criteria for Assessing Magnitude of Impact

Magnitude of Impact	Description Criteria
	Adverse
High	Change in air emission concentrations or deposited dust predicted to exceed relevant[a] AQS at indicative sensitive receptor locations with process contribution greater than 25% of AQS.

Magnitude of Impact	Description Criteria
	Adverse
Medium	Change in air emission concentrations or deposited dust predicted to exceed relevant[a] AQS at indicative sensitive receptor locations with process contribution less than 25% of AQS; or Change in air emission concentrations or deposited dust predicted to exceed relevant[a] AQS at non-sensitive receptor locations, with process contribution greater than 25% of AQS.
Low	Change in air emission concentrations or deposited dust predicted to exceed baseline, but not exceed relevant[a] AQS at indicative sensitive receptor locations; or Change in air emission concentrations or deposited dust predicted to exceed relevant[a] AQS at non-sensitive receptor locations, with process contribution less than 25%[b] of AQS.
Negligible	No expected detectable change in measurable air emission concentrations, deposited dust or odour to ground at sensitive or non-sensitive receptor locations.

a) Not all AQS will be relevant for each receptor type e.g. transient receptors will not be present in a location for more than one year and therefore the annual AQS will not be applicable.
b) In alignment with WBG EHS Guideline: Air Emissions and Ambient Air Quality

7.1.5 Key Guidance and Standards

The Kenyan policy and legislation documents presented in Section 2.2 and the international guidance and standards presented in Section 2.3 are relevant to this assessment. The following are of particular relevance:

- Kenyan Government EMCA, 1999 and Amendments, 2018;
- Kenyan Government, Environmental Management and Co-ordination (Air Quality) Regulations, 2014;
- WHO Air Quality Guidelines Global, 2005;
- IFC Performance Standards on Social and Environmental Sustainability, 2012; and
- WBG EHS Guidelines, 2007.

The Project standards (also in Annex I) are presented in Table 7.1-3. All emissions are calculated and reported at the 100th percentile, except for 24-hour PM_{10} and $PM_{2.5}$, which are reported at the 99th percentile.

Table 7.1-3: Summary of Project AQS

Emission	Time weighted average	Concentration ($\mu g/m^3$, unless stated)
SO_2	Annual	50
	24-hour	20[(a)]
	10-minute	500
CO	1-hour	4000

Emission	Time weighted average	Concentration (µg/m³, unless stated)
	8-hour	2000
NO_2	Annual	40
	24-hour	188
	1-hour	200
NO_x	Annual	60
	24-hour	80
PM_{10}	Annual	20
	Annual IFC Interim Target 2	50
	24-hour[(a)]	50
	24-hour IFC Interim Target 2	100
$PM_{2.5}$	Annual	10
	Annual IFC Interim Target 2	25
	24-hour	25
	24-hour IFC Interim Target 2	50
Deposited Dust	24-hour	200 mg/m²/day
Total VOC	24-hour	600

Abbreviations: µg/m³ = micrograms per cubic metre; mg/m²/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
a) The 24-hour standard is lower than the annual as the annual standard is a Kenyan standard and the 24-hour standard is an IFC standard. The equivalent Kenyan 24-hour standard is higher than the annual Kenyan standard. As detailed in Annex I, the Project standards consider the most conservative of the available standards

There are no specific IFC standards for air quality relating to vegetation or ecosystems. There are Kenyan standards for NO_2, SO_2, and PM_{10} in controlled areas, which include National Parks, Reserves and Sanctuaries and Conservation Areas. Due to the minor sources of emissions to air of these pollutants as a result of the Project (i.e. limited to vehicles and combustion), which will occur away from controlled areas, this has been screened out of the assessment.

Additional pollutants (benzene, toluene, ethylbenzene and xylene) were quantified for the characterisation of the baseline (Chapter 6.5) to provide a concentration against which any change can be monitored during operations.

Results of the baseline monitoring and how the monitoring results compare to the AQS at each location are presented and discussed in the Section 6.5.

7.1.6 Receptors of Interest and Importance

Higher importance air quality receptors are considered to be areas with rare species of vegetation that are susceptible and sensitive to changes in air quality concentrations and any specific locations where people reside or spend periods of time (for example, for the purposes of grazing). Lower importance receptors are areas where there are no sensitive species of vegetation identified.

Receptors included in the assessment, where present, are defined in Table 7.1-4 and summarised as follows:

- Homesteads - PAP;
- Transient human receptors/PAP - due to the prevalence of nomadic pastoralism in the region and the associated transience of settlement, all areas where transient receptors could be present have been included in the construction and operational assessment;
- Amenity Receptors - where nuisance may be caused due to deposited dust but there will not be associated health impacts; and
- Ecological receptors - plant species in assemblages of vegetation that are not rare and are not sensitive or located in a protected area.

Table 7.1-4: Receptors and Importance

Receptor	Importance	Reason for receptor classification
Homesteads	High	Potential human health impacts on PAP at identified homesteads.
Transient Human Receptors	High	Potential human health impact on people using areas anywhere outside of the Project fence-line for grazing / livelihoods.
Human Amenity receptors	Medium	Potential impact relating to the loss of amenity and nuisance through dust deposition and soiling (not human health impacts).
Other vegetation species	Low	Potential impact to plant species in assemblages of vegetation that are not rare and are not sensitive or located in a protected area.

7.1.7 Sources of Impacts

Potential sources of impact of a range of magnitudes will occur throughout the life of the Project are set out below by Project phase.

7.1.7.1 Construction Phase

Based on the Project Description and the understanding of the baseline air quality conditions, there are aspects of the Project that have been identified as having the potential to present sources of impact to air quality during the construction phase. The potential sources of impact and routes by which they could impact air quality are as follows:

- Dust generated during construction of Project infrastructure, including wellpads, infield flowlines, the CFA and associated infrastructure and the landfill. Construction activities include, for example, land clearance, trenching, backfilling, concreting and concrete batching at the CFA;
- Dust generated from the development of borrow pits for the sourcing of Project construction materials;
- Vehicle emissions during the construction phase;

- GHG emissions predominantly related to combustion emissions from power and heat generation, road vehicles, mobile and static construction plant and waste management; and
- VOC emissions from use of solvents, chemicals, paints, coatings etc associated with construction activities and materials

7.1.7.2 Operational Phase

Based on the Project Description and the understanding of the baseline air quality conditions, there are aspects of the Project that have been identified as having the potential to present sources of impact to air quality during the operational phase. All potential sources of emissions to air will not occur simultaneously but at different times throughout the life of the Project. The potential sources of impact and routes by which they could impact air quality are as follows:

- Three SGT-700 GTGs with associated waste heat recovery units located at the CPF/CFA;
- Up to four heaters located at the CPF/CFA (one will be used for the standard operation scenario during peak production and four for the alternative peak production scenario);
- An incinerator located at the IWMF;
- Diesel generators powering well drilling, each located at a separate wellpad (assessed under operations, to allow for a cumulative assessment, as these will operate simultaneously with the CFA);
- Vehicle emissions during the operational phase;
- Dust generation during operations from traffic on roads;
- Odours generated from operational activities and waste storage at wellpads
- Odours generated from the IWMF and landfill;
- Fugitive VOC emissions from pressure relief valves, tanks, pipes, flanges etc.; and
- GHG emissions predominantly related to combustion emissions from power and heat generation, road vehicles, mobile and static plant and waste management. Fugitive GHG emissions may also occur from tanks, pipes, flanges, pressure relief valves etc.

Sources of non-routine/ emergency emissions to air have not been included in the assessment, as they will only operate for very short periods under emergency scenario. These include an enclosed ground flare located at the CFA and temporary/ emergency generators.

7.1.7.3 Climate Change

Project activities have the potential to contribute towards climate change. An assessment of the Project's impact on climate change has been undertaken through the quantification of Scope 1 (direct) and Scope 2 (indirect) GHG emissions for both the construction and operational phases. A detailed GHG assessment has been undertaken for the construction and operations phases of the Project and is included in Annex I. The results and impacts are reported and considered as part of this assessment (7.1.9.1 for construction and 7.1.9.6 for operation).

Climate change predictions for Kenya and how they may impact the Project have been considered. Climate change predictions with respect to meteorological data can be highly variable. The uncertainty in precipitation projections for Kenya arises from the wide disagreement of different climate models in the projected change in amplitude of future El Niño events. Most climate predictions suggest there will be an increase in temperature and rainfall and of extreme weather events (i.e. rainfall intensity and droughts). The following air quality related impacts may be experienced:

- An increase in summer and winter rainfall volume and periods of higher intensity rainfall (storms) could lead to increased dust dampening and suppression; this could result in less dispersion of dust as the increased rainfall would result in particles being less available to be entrained by the air;
- In the summer, higher air temperatures could result in changes to atmospheric chemical reactions; and
- Changes to wind speed could change the dispersion patterns of pollutants.

7.1.8 Incorporated Environmental Measures

The Project has been designed and planned to incorporate a range of incorporated environmental measures to avoid potential impacts or reduce their magnitude, prior to the impact analysis being completed.

The measures presented in this section either relate to design measures or are widely accepted Good Industry Practice.

7.1.8.1 Design Measures

The following measures are part of the Project design and reduce the potential impact of the Project on air quality:

- No routine flaring of excess gas will be undertaken;
- All point source emissions to air will be in compliance with the relevant Kenyan and IFC emission limits defined in Annex I;
- Point source emission to air will be monitored in accordance with Kenyan and IFC requirements; and
- Construction works will be staggered.

In addition to the normal operational scenario for the CPF (supplemental firing with gas), there is an abnormal operating scenario where 3 x GTGs and 4 x fired heaters can be run with no supplementary firing with gas. If this abnormal operating scenario is required, it will only operate for short durations (a maximum duration of 12 hours) and will not operate twice in any 24-hour period. This will be stipulated in the operating manual for the facility.

7.1.8.2 Good Industry Practice

Project activities will consider the measures defined below, to reduce the potential for creating an impact:

- Prompt removal of materials that have a potential to produce dust (including spoil), unless being re-used on site;
- No waste burning will be undertaken, outside of the incinerator;
- Where practical, trucks transporting dusty material associated with the Project will be covered to prevent escape of materials during transport, vehicles will be serviced and maintained, idling will be avoided, and speed limits will be adhered to;
- All equipment will be operated, maintained and tested in accordance with the manufacturer's recommendations and using the appropriate fuel;
- Although the use of water sprayers is considered a best practice method of dust suppression and control, this will not routinely be undertaken by the Project due to the limited water availability in the region. If water spraying is deemed necessary, non-potable water will be used;

- In relation to odour management:
  - Any spills will be promptly cleaned up with spill kits.
  - Waste will be removed and transported to the IWMF for treatment on a regular basis; wastes will be segregated and stored in specific storage areas.
  - Putrescible wases will be segregated and treated on a regular basis.
  - Odorous materials will be stored in sealed containers. Routine weekly inspections of containment system will be undertaken and recorded.
  - Odour generation will be limited by the use of odour abatement techniques such as minimising the rate of evaporation, for example by controlling acidity/ alkalinity, using surface treatments to create temporary barriers and reducing the surface area. Other abatement techniques such as addition of activated carbon or other odour abatement chemicals will also be used as appropriate.
  - Drilling muds will be stored in bunded sealed ponds and containers The system will be visually inspected weekly for any issues or leaks Equipment will be tested for leaks in accordance with a leak detection programme.
  - All wellheads will be pressure tested prior to use The system will be visually inspected weekly for any issues or leaks. Equipment will be tested for leaks in accordance with a leak detection programme.
  - Diesel generators will be serviced and maintained in accordance with the manufacturer's specifications. Units will be visually inspected weekly for any issues or damage.
  - Fuel, chemicals and waste will be stored in areas provided with secondary containment e.g. impermeable surfaces and bunds. Storage areas will be clearly marked and COSHH information will be provided where required. All employees will be inducted on storage requirements.
  - Personnel will be trained in emergency response procedures.

7.1.9 Impact Classification

Taking into account baseline air quality (Section 6.2), the relevant incorporated environmental measures (Section 7.1.8) and the potential sources of impact (Section 7.1.7) determined from the Project Description, the potential source-pathway-receptor impact linkages for the construction and the operational phases are presented in this section.

A discussion regarding feasible impact linkages during each of the Project phases is presented in each of the sub-sections below. Each discussion is followed by a table where the potential sources of impact and relevant additional mitigation applicable to each receptor are summarised.

7.1.9.1 Construction

7.1.9.1.1 Infield Traffic Emissions

In the absence of any International or Kenyan guidance, the UK Design Manual for Roads and Bridges (DMRB) screening criteria has been used to determine the level of assessment required for public roads based on the projected additional traffic flows associated with the development. The additional traffic flows are assessed against the following assessment screening criteria:

- Existing road alignment will change by 5 m or more;
- Daily Light Goods Vehicle (LGV) traffic flows will change by 1,000 Annual Average Daily Traffic (AADT) or more;

- Heavy Goods Vehicle (HGV) flows will change by 200 AADT or more;
- Daily average speed will change by 10 km/hr or more; or
- Peak hour speed will change by 20 km/hr.

The AADT is the total traffic flow for the year (2-way) divided by 365 and is the industry specific way of comparing or describing traffic flows on roads. If none of the above screening criteria are met, then a detailed assessment is not required.

The estimated maximum number of infield truck journeys per year in the construction period is approximately 34,000, which equates to an AADT of 93, which is below the DMRB screening criteria. The annual number of additional vehicle trips associated with the development could be as high as 73,000 before a detailed traffic assessment would be required based on the DMRB screening criteria. No changes are anticipated to the alignment of the public roads, and it is not anticipated that there will be any increases to the speed limit on public roads.

A recent 2021 baseline traffic survey was completed along the C46 and A1. The survey details and results are detailed in Table 7.1-5.

Table 7.1-5: 2021 Traffic Survey data

Survey Location	Survey Date	Survey Duration	Number of Light Goods Vehicles[1]	Number of Heavy Goods Vehicles[2]	Total Vehicles	Approximate AADT equivalent[3]
C46	14/04/21	13 hours (6am to 7pm)	215	15	230	425
A1 North of Lokichar	15/04/21	12 hours (6am to 6pm)	331	211	542	1,084
A1 South of Lokichar	15/04/21	12 hours (6am to 6pm)	509	133	642	1,284

a) *Includes motorcycles and light vehicles*
b) *Includes buses, commercial vehicles, tractors, farm vehicles, articulate trucks and construction trucks*
c) *Calculated by (Total (HDV + LDV) / survey duration) *24*

Based on the screening criteria, with the additional 93 vehicles per day (equivalent to approximately 25% of the traffic on the least travelled road), a detailed assessment of traffic emissions is not required. There will be an increase in the emissions above the baseline but a low impact magnitude is predicted on a high sensitivity receptor with a resulting **Minor** impact significance. There is no mitigation to be applied and therefore there will be no further impact classification.

7.1.9.1.2 Construction Transport Route Emissions

The estimated number of truck journeys per year associated with the movement of cargo and construction materials from Mombasa to the Project Site in the construction period is approximately 75 AADT, which for conservatism has been assumed to be doubled to 150 AADT to account for outbound and inbound traffic movements. No changes are anticipated to the alignment of the public roads, and it is not anticipated that there will be any increases to the speed limit on public roads.

A recent 2021 baseline traffic survey was completed KJV along the C46 and A1. The survey details and results are detailed in Table 7.1-5. A previous baseline traffic survey was undertaken in 2016 as part of the ESIA for the EOPS Phase II project, with traffic counts undertaken during daytime hours at nine locations along the likely route from Mombasa to the Project Site. The two-way traffic flows ranged from 638 on the A1 near the Marich Pass to 40,724 on the A1 near Kitale.

Based on the screening criteria, with the additional 150 vehicles per day (equivalent to approximately 24% of the traffic on the least travelled road), a detailed assessment of traffic emissions is not required. There will be an increase in the emissions above the baseline but a low impact magnitude is predicted on a high sensitivity receptor with a resulting **Minor** impact significance. There is no mitigation to be applied and therefore there will be no further impact classification.

7.1.9.2 Deposited Dust

Dust typically comprises particles ranging from 1 to 75 micrometres (μm) in aerodynamic diameter, which are formed through a mixture of crushing and abrasive forces on materials. Due to the relatively large particle size of dust, dust particles are airborne for short durations following initial release to the atmosphere. The larger dust particles generally fall out of suspension rapidly and in relatively close proximity to the emission source (usually within 250 m).

Dust particles, therefore, are unlikely to cause long-term or widespread changes to local air quality and have little effect to human health; however, the deposition of dust particles can result in the local soiling of surfaces which may result in complaints due to amenity loss or perceived damage caused and very high levels of dust can result in damage to plants, through reduced photosynthesis. During construction, the potential for dust impacts are likely to be transient and sporadic. During site operations dust impacts may be intermittent at nearby receptors if emissions are not adequately mitigated and managed.

For the purpose of this assessment, potential dust impacts are considered to be significant where sensitive human and ecological receptors are located within 250 m from the Project and international air quality guidelines for dust have been adopted as the working air quality standard (in the absence of a relevant Kenyan standard).

The transport of dust emissions is determined primarily by the following local meteorological conditions surrounding the development Site:

- The wind speed determines the likely entrainment and deposition of dust and the distance of travel from the Site;
- The wind direction controls the area over which the dust particles are carried; and
- Moisture/precipitation influences adhesion (i.e. less likely to be entrained) and deposition (via rainfall) of particles in the air.

In the qualitative assessment of construction impacts, wind data has been considered from a MMIF modelled meteorological dataset for the Project location (consistent with the Air Dispersion Model (ADM)) and the Ngamia and Kapese monitoring stations. Precipitation will suppress dust and prevent it from becoming airborne, as well as increasing the rate at which dust is deposited onto ground surfaces (i.e. no longer airborne) due to surface wetting. Precipitation levels in excess of 6 mm/month[1] are considered sufficient to effectively suppress potential airborne dusts for most of the year (AP42, 2006). According to the 5-year average MMIF dataset and the 2018 Ngamia and Kapese data the greatest amount of rainfall occurs between March and June, with a peak again in November. The driest periods, according to all datasets are between December to February and the Ngamia dataset also shows low rainfall in July to September. For all months, excluding January (all data sets), February (Kapese), July (Kapese), September (Ngamia dataset) and December (Kapese dataset) the monthly average rainfall is above the 6 mm threshold described, acting as a natural dust suppression mechanism.

[1] 0.254 mm/day x 30 days = 6 mm/month (conversion to allow comparison with the available precipitation data)

The windroses provided in Figure 7.1-1 indicate the prevailing wind direction. There is variation between the sources, but they all indicate a similar north-easterly to south south-easterly prevailing wind direction. With a dominant north-easterly to south south-easterly wind direction, it is considered likely that any dust sensitive receptors located to the north-west to south-west of the Project are most likely to be affected by deposited dust emissions associated with the construction and operation of the Site. There are several PAP identified during the 2021 social survey, located downwind of construction activities.

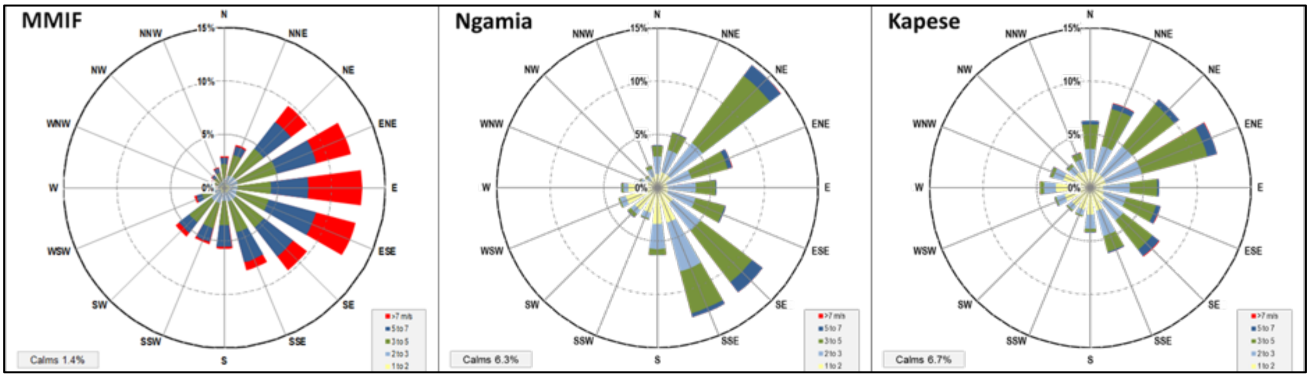


Figure 7.1-1: Windrose for MMIF, Ngamia and Kapese Meteorological Data

Details of specific construction works and timescales are not available at this time although construction of the Project will be phased and there will not be prolonged construction activities in each location, apart from at the CFA. The potential for impacts from dust emissions to air are likely to be generated predominantly by land clearance activities, trenching and backfilling and on-site transport vehicle movements, construction of wellpads and construction of associated Project infrastructure.

The Stakeholder Engagement Plan will include a procedure for informing local stakeholders of the construction schedule, which will be sensitive to any identified culturally sensitive days. Daily visual dust monitoring will be undertaken by the Environmental Supervisor and if high levels of dust are observed causing a nuisance to local receptors, any appropriate changes to working practices (e.g. the use of dust barriers and netting) will be undertaken to limit the dispersion of dust.

Dust trackout and dispersal from vehicle movements will be managed though the establishment and implementation of Project speed limits which will be complied with by all Project vehicles. Night-time driving will be prohibited unless specifically authorised and off-road driving will also be prohibited.

The procedure for developing borrow pits will include a pre-construction survey to identify and map receptors within 500 m of proposed borrow pit locations. These receptors will be considered as part of site selection and risk assessment processes. NEMA, DCCs and relevant local stakeholders will be engaged through a procedure defined in the Stakeholder Engagement Plan to inform and consult on assets which could be affected by deposited dust relating to the development and operation of borrow pits.

With the incorporated best practice and the mitigation outlined above, air quality changes relating to deposited dust will result in a low impact magnitude (as an increase in dust levels above baseline is likely but not anticipated to be greater than the relevant standard considering baseline dust is approximately 65% of the standard depending on location) on medium sensitivity receptors (human amenity receptors as deposited dust is a nuisance and not a human health issue) located within 250 m of construction of Project related infrastructure. This results in a **Minor** residual impact significance.

With incorporated best practice, air quality changes relating to dust deposition on known vegetation species in the AoI defined in Section 7.1.2 are predicted to be of low to negligible impact magnitude. These receptors are classified as low importance/ sensitivity resulting in a **Negligible** impact significance. There is no mitigation to be applied and therefore there will be no further impact classification.

7.1.9.3 Greenhouse Gas

As part of a GHG Assessment (see Annex I), the GHG emissions anticipated to be generated during construction have been quantified and are presented in Table 7.1-6 below. The use of diesel generators is predicted to be the largest source of GHG emissions during the construction phase and annual emissions are predicted to reduce each year during construction.

The maximum annual total ktpa CO_2e predicted to be generated during the construction phase is less than approximately 0.6 % of Kenya's annual GHG emissions in 2019 (last year of publicly available data) and less than 0.0002% of Global GHG emissions in 2016[2].

Predicted annual total kpta CO_2e during construction is greater than the IFC PS3 reporting threshold[3] of 25,000 tpa of CO_2e. The Operator will undertake an annual review of additional performance improvement options defined in Annex I.

Table 7.1-6: Predicted Annual CO_2e from Construction Years (Years 1 – 3).

	Construction Traffic ktpa CO_2e	Diesel Generators ktpa CO_2e	Total ktpa CO_2e
Year 1	28.8	81.6	110.4
Year 2	21.5	81.6	103.1
Year 3	13.8	73.4	87.3

7.1.9.4 VOC Emissions

VOC emissions are anticipated to be low due to the limited quantities of VOC containing paints, coatings, solvents etc which will be used on-site during the construction process. Any VOC emissions will be short- term and intermittent and these will be minimised or alternatives sources where possible and practicable. VOC emission may increase above the background levels (which are only ≤0.5% of the AQS as detailed in Chapter 6.5) and therefore a low magnitude impact is anticipated on a high sensitivity receptor resulting in a **Minor** impact significance. The AQS has a 24-hour averaging period and therefore VOC emission would need to occur consistently over a 24-hour period for the averaging period to be applicable. There is no additional mitigation to be applied and therefore there will be no further impact classification.

7.1.9.5 O_3 emissions

Ground level ozone is formed primarily from photochemical reactions between nitrogen oxides (NOx) and VOCs). The NO_x emissions predicted to arise as a result of infield traffic fall below the screening criteria for impact assessment (Section 7.1.9.1.1) and VOC emissions are anticipated to be low, short- term and intermittent (Section 7.1.9.4). Therefore, the impact of ozone is anticipated to be of a low magnitude on a high sensitivity receptor, resulting in a **Minor** impact significance. There is no additional mitigation to be applied and therefore there will be no further impact classification.

2 World Total GHG emissions of 49358030 ktpa (Greenhouse gas emissions - Our World in Data)

3 Reporting to IFC is not mandatory, so as a minimum the Operator must keep sufficient auditable records on energy usage, fuel usage and waste generation and disposal to allow actual emissions to be calculated annually, if required or requested.

Table 7.1-7: Construction Phase Impact Assessment

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
PAP and transient receptors located in the vicinity of infield and construction routes (high)	Vehicle emissions associated with infield roads and the construction route from Mombasa	Low (indirect - short term - temporary)	Minor	No additional mitigation proposed	Low (indirect - short term - temporary)	Minor
PAP located within 250 m of construction works (high)	Dust from the construction of Project related infrastructure	Low to Negligible (direct - short term - temporary)	Minor	Local stakeholders will be informed of the construction activity dates through the procedure defined in the Stakeholder Engagement Plan which will take account of any identified culturally sensitive days. Daily visual dust monitoring will be undertaken by the Environmental Supervisor. If high levels of dust are observed causing a nuisance to local receptors any appropriate changes to working practices (e.g. dust barriers or netting) will be undertaken to limit the dispersion of dust.	Low to Negligible (direct - short term - temporary)	Minor
Transient receptors located within 250 m of construction works (high)	Dust from the construction of Project related infrastructure	Low to Negligible (direct - short term - temporary)	Minor		Low to Negligible (direct - short term - temporary)	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				Signage will be put in place to inform people where, when and for how long temporary dust generating works are taking place. Dust trackout and dispersal will be managed via: ■ Project speed limits to be established and complied with by all Project vehicles; ■ Night-time driving will be prohibited unless specifically authorised; and ■ Off-road driving will be prohibited. As part of the development of borrow pits: ■ a pre-construction survey will identify and map receptors within 500 m of proposed borrow pit locations. These receptors will be considered as part of site selection and risk assessment processes. ■ NEMA, DCCs and relevant local stakeholders will be engaged to inform and consult on assets which could be		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				affected by deposited dust during the development and operation of borrow pits. Grievances will be monitored and remediated through the Grievance Management Procedure. Any complaints will be investigated and followed up.		

7.1.9.6 Operational Phase

The impact classification process focuses on potential significant impacts. As such some potential impacts have insufficient linkage between the source of impact and receptors, or where the magnitude of this impact would be not significant when taking account of incorporated environmental measures.

The following bullets provide a qualitative evaluation of impacts which are not considered for further impact classification:

- There are no operational Project emissions which will impact on areas of known rare or sensitive species of vegetation and therefore potential impacts on biodiversity are considered to be **Negligible**.
- All PAP which are outside of the 24-hour $PM_{2.5}$. contour area (PC greater than 25% of the AQS) shown in Figure 7.1-2 will have limited exposure to pollutants, excluding 24-hour $PM_{2.5}$ (which is carried forward for further assessment). Therefore, the impact magnitude will be low and the significance of the impact will be **Minor**. There is no mitigation to be applied and therefore there will be no further impact classification.
- Transient receptors will have limited exposure to all emissions to air quality pollutants excluding 24-hour $PM_{2.5}$. Therefore, the impact magnitude will be low and the significance of the impact will be **Minor**. There is no mitigation to be applied and therefore there will be no further impact classification.
- The impact magnitude for NO_x, NO_2 and SO_2 is low (with a resulting **minor** significance). Therefore, potential impacts on plant species in the vicinity of the Project from eutrophication and nitrogen and acid deposition are predicted to be low, with a resulting **minor** significance. There is no mitigation to be applied and therefore there will be no further impact classification.

Results for air quality within the Project fence-line will be considered separately in the context of occupational health and will be managed through the Worker Health and Safety Plan.

Any PAP directly within the Project footprint will be relocated prior to construction (Section 7.9). These PAP have therefore not been considered in this section.

7.1.9.6.1 Point Source Emissions

For the assessment of operational emissions from the Project infrastructure, a quantitative Air Dispersion Modelling Assessment has been undertaken using Breeze AERMOD software (version 9.2.0.4 Pro). The model input data is presented in Annex I.

Emissions have been considered from the following scenarios:

- Normal operations scenario including the operation of the WHRUs on the GTGs (supplementary firing with gas) plus wellpad operations and IWMF incinerator.
  - 3 x SGT-700 Gas turbines (and WHRUs);
  - 1 x fired heater;
  - IWMF incinerator; and
  - Well test operations at 3 wellpads[4] (including one diesel generator per wellpad).
- Abnormal operations scenario including the operation of the WHRUs on the GTGs (with no supplementary firing with gas) plus wellpad operations and IWMF incinerator. As this is an abnormal operating scenario

[4] Although three wellpads were included in the assessment, there are very limited cumulative emissions from the wellpad drilling activities, therefore more units could operate simultaneously providing the wellpads are not adjacent.

and will not operate for periods of greater than 12 hours (per event) (see Section 7.1.8.1), only the one-hour AQS are considered for the impact assessment. The following sources are associated with this scenario

- 3 x SGT-700 Gas turbines;
- 4 x fired heaters;
- IWMF incinerator; and
- Well test operations at 3 wellpads (including one diesel generator per wellpad).

Modelled emissions include:

- NO_x;
- NO_2;
- SO_2;
- fine particulates (PM_{10} and $PM_{2.5}$) and
- carbon monoxide (CO).

A standard ADM assumption has been adopted in the assessment, which is that 70% of NO_x is converted to NO_2 in the long-term and 35% in the short-term. Meteorological data used in the assessment is MMIF modelled data for the Site and the windrose is presented in Figure 7.1-1. Five years of data are used to account for inter-annual variability in the data and the highest predicted results have been reported and used in this assessment. Terrain data has also been incorporated into the assessment. Emission rates used in the assessment are detailed in Annex I.

The ADM uses the emissions source data and the meteorological data to predict the potential effect of emissions on air quality across the modelled domain. A receptor grid has been included, centred on the CFA and oilfields, from which contour plots of predicted concentrations and high impact magnitude areas have been generated.

The ADM predicts the contribution from the site, known as the Process Contribution (PC), to ambient air quality as a ground level concentration attributable to the modelled Project source. For the assessment of each pollutant considered, the PC is added to the existing background concentration (detailed in Section 6.2), to calculate the Predicted Environmental Concentration (PEC), which is the contribution from the site plus the existing baseline air quality environment. The PEC is then compared to the adopted AQS for the Project. The AQS indicates the degree of environmental effect that can be considered acceptable for the pollutant of concern at a receptor.

7.1.9.6.2 Emissions from Normal Operations

Outside of the CFA fenceline NO_x, NO_2, SO_2 and CO PECs for all relevant averaging periods are predicted to be above the existing baseline but below the Project AQS and therefore a low impact magnitude. The resulting impact significance on all impacted receptors (permanent PAP, transient PAP and vegetation) is **Minor** (permanent PAP, transient PAP) to **Negligible** (vegetation). There is no mitigation to be applied and therefore there will be no further impact classification.

PM_{10} and $PM_{2.5}$ background monitoring values for 24-hour and annual averaging periods are greater than the Project AQS resulting in the PEC always exceeding the AQS. The PCs from the facility are only a small proportion of the AQS and therefore the exceedance is considered to be driven by the existing high background levels. Elevated particle concentrations (PM_{10} and $PM_{2.5}$) could relate to specific meteorological events, such as periods of high wind speeds or dry periods. Monitoring was undertaken over 24-hour periods and it may be that these coincided with periods of higher-than -average levels of particulates.

Outside of the CFA fenceline, the PM_{10} 24-hour and annual average PEC and $PM_{2.5}$ annual average PEC is above the AQS but the PC is below 25% of the AQS (maximum of approximately 6%, 4% and 17% of the AQS respectively). Therefore, this results in a low to medium impact magnitude and **Minor to Moderate** impact significance. Elevated concentrations of PM_{10} and $PM_{2.5}$ are common in ASAL; over 80% of Kenya's land area including Turkana and some of the AoI including the Project footprint, are classified as ASAL with 85 to 100% aridity (see Section 6.12).

Prior to construction, additional 24-hour duration monitoring (once a month for a period of 6 months) will be undertaken at the CFA location to further characterise the background levels of particulates. This was planned to be undertaken during March 2021 but had to be delayed due to COVID related travel restrictions. No further mitigation is proposed as the significance is driven by the existing background data and additional mitigation will not reduce the impact (as it is not dependent on the Project activities).

The $PM_{2.5}$ 24-hour average PC is above 25% of the AQS for a small area around the CFA (Figure 7.1-2). No homesteads or households were identified as being located in this area during the 2021 social survey (See Section 6.12), therefore PAP at homesteads are not considered further. For impacts on transient receptors, there is a resulting high impact magnitude on high importance receptors and **Major** impact significance.

In order to mitigate this impact, further air dispersion modelling will be carried out during the detailed design process. The fenceline will then incorporate any areas where the Process Contribution (emissions from the Project) is predicted to exceed 25% of the air quality standards to ensure that public access will be restricted. The application of this mitigation will result in a **Minor** residual impact significance.

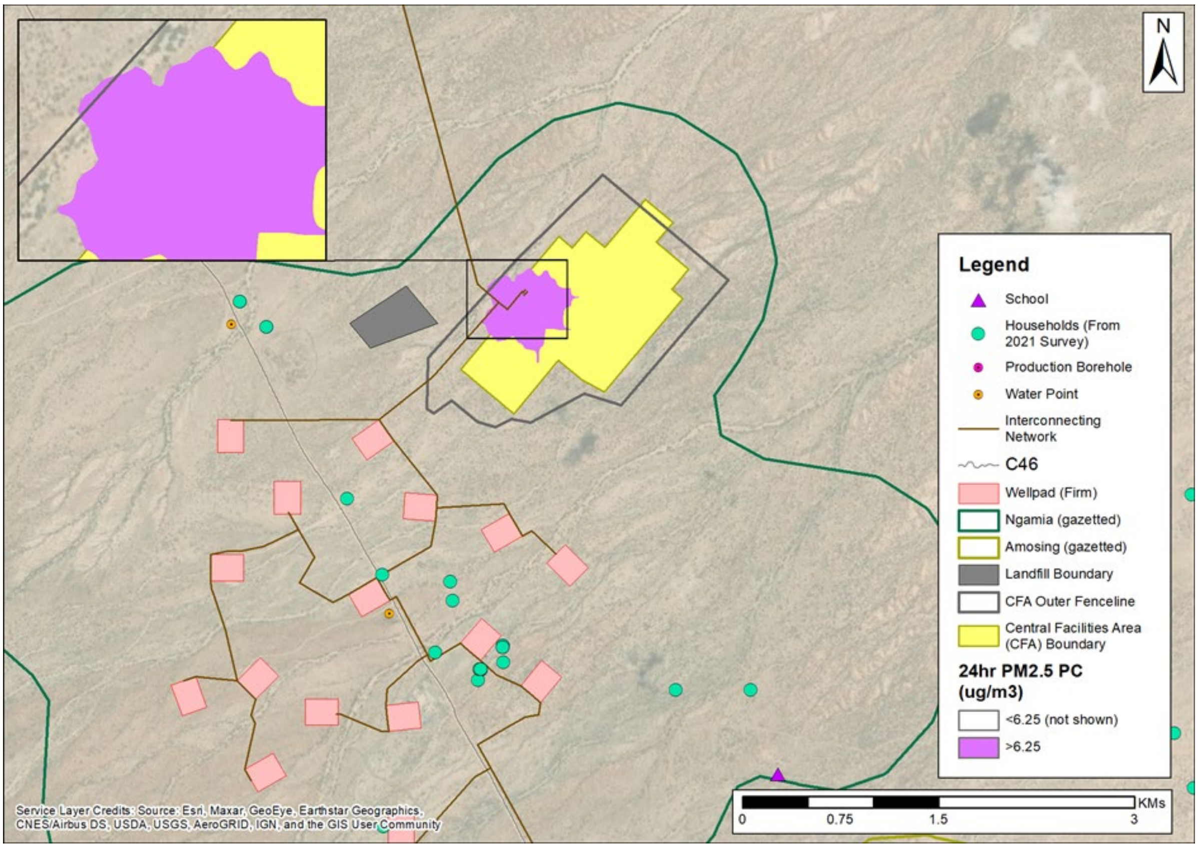


Figure 7.1-2: Scenario 1 24-hour $PM_{2.5}$ area where PC is greater than 25% of the AQS and locations of Homesteads identified in the 2021 Social Survey

7.1.9.6.3 Emissions from Abnormal Operations

NO_2 and SO_2 are the only pollutants with AQS with one-hour averaging periods or less (all other averaging periods are not applicable to this assessment (see Section 7.1.8.1). The PECs for the applicable AQS are predicted to be above the existing baseline but below the Project AQS and therefore a low impact magnitude. Therefore, the resulting impact significance on all impacted receptors (permanent PAP, transient PAP and vegetation) is **Minor** (permanent PAP, transient PAP) to **Negligible** (vegetation). There is no additional mitigation to be applied and therefore there will be no further impact classification.

7.1.9.6.4 Odour

Odour is a mixture of many chemicals which interact and generate what we detect as a smell. Odour is subjective, meaning the perception of odour (is it acceptable, objectionable, or offensive) is dependent on the individual. The perception of the impact of odour involves not just the strength of the odour but also the frequency, intensity, duration and offensiveness of the odour at a particular receptor location (IAQM, 2014). For an odour to cause an effect, there has to be a source, pathway and receptor linkage.

The duration of an odour can be either continuous (e.g., the result of constant fugitive emissions or intentional gas flaring) or temporary (e.g., odours emitted during temporary operations such as truck loading or an equipment outage). The pathway/ transport of odour emissions is determined primarily by the wind speed and wind direction which determines the likely dispersal area from the site. Atmospheric stability and precipitation can also impact the dispersion (and dilution) of odours. Receptors will include both PAP and transient receptors which are located or have access to the land surrounding the Project infrastructure. Potential odour sources associated with the Project have been defined in 7.1.7.2.

With a dominant north-easterly to south south-easterly wind direction (see Figure 7.1-1), it is considered likely that any PAP and transient receptors located downwind (to the north-west to south-west) of the Project infrastructure with potential odour sources are most likely to be affected by odours. The duration of any impacts is likely to be medium term for PAP due to their more permanent presence as receptors and short- term for pastoralists and transient receptors, to reflect the shorter time period they will be present in the area.

The IWMF will incorporate odour control design measures (Section 7.1.8.1) and will be operated in accordance with best practice (Section 7.1.8.2). Due to the odorous nature of the materials being handled at the IWMF, there is potential for odour to be generated, even with the application of the design measures and best practice. There is likely to be an increase in baseline odour particularly close to the IWMF and therefore a low magnitude impact is predicted on high sensitivity receptors (permanent and transient PAP) resulting in a **Minor** significance. The closest receptor to the CFA fenceline in a downwind direction identified during the 2021 social survey was approximately 900 m, which is approximately 1,300 m from the IWMF boundary. The distance between the IWMF and the CFA fenceline will aid the dilution and dispersion of any odours and reduce the effectiveness of any migration pathway. There is no additional mitigation to be applied and there will be no further impact classification.

The inert wastes and the hazardous wastes disposed to landfill will not contain any degradable content and should therefore produce negligible gas. The waste disposed of in the non-hazardous cells will be pre-treated so that the majority of the degradable content is removed prior to disposal. Due to the lack of biodegradable waste and associated gas generation, landfill odours are likely to be of negligible magnitude (as no change from current conditions is anticipated) on high sensitivity receptors (permanent and transient PAP) resulting in a **Negligible** significance. The closest receptor to the landfill in a downwind direction identified during the 2021 social survey was approximately 600 m. There is no additional mitigation to be applied and there will be no further impact classification.

As identified above, there are a number of odour sources associated with the wellpads. The primary sources of odour are focussed on the wellpad locations and include the following:

- Drilling Mud Systems;
- Storage Tanks / Storage Tank Vent Stacks;
- Well Head;
- Storage Areas;
- Site Sewage Tank;
- Wireline Equipment;
- Waste Skips and Waste Receptacles;
- Diesel Generators and fuel storage; and
- Spillages.

Due to the high number of potential odour sources and the potentially low distance between the wellpads and receptors (the closest receptor to a wellpad in a downwind direction identified during the 2021 social survey was approximately 30 m), odours from wellpads incorporating the design and best practice measures (Section 7.1.8) are likely to be of low magnitude on high sensitivity receptors resulting in a **Minor** significance. Daily odour 'sniff' monitoring around the perimeter of the wellpads. Additional monitoring will also be undertaken in response to any complaints. The monitoring will include the following:

- Date, time, and locations of monitoring;
- Weather conditions;
- Intensity and description of the odour including duration e.g.. constant or intermittent;
- Odour source, if identified including location and activity;
- Any remedial odour control measures which are implemented;
- A record will be kept of all routine monitoring; and
- Records of monitoring in response to complaints will be undertaken including any investigative and remedial actions.

The monitoring will not reduce the residual odour impacts but it will identify any odour issues and allow a prompt response and further management e.g. expedited removal of wastes or drilling muds if required.

7.1.9.7 Greenhouse Gas

As part of the GHG Assessment (see Annex I), the GHG emissions anticipated to be generated during operations have been quantified and are presented in Table 7.1-8 below for the maximum year of emissions (emissions will rise and fall during the operations phase related, amongst others, to production rates, and the amount of water that requires heating prior to injection into the reservoir).

Table 7.1-8: Approximate Predicted Annual CO_2e from Maximum Year of Emissions (Year 8)

GHG Emission	Gas Turbines ktpa CO_2e	Gas Fired Heaters & WHRU Supplementary Firing ktpa CO_2e	Main Flare (purge and pilot) ktpa CO_2e	Crude Storage ktpa CO_2e	Fugitive Emissions ktpa CO_2e	Grid Power ktpa CO_2e
CO_2e	387.7	169.6	4.3	<0.1	<0.1	27.7
% of Total	65.8	28.8	0.7	<0.1	<0.1	4.7
Total Annual CO_2e (kt)	589.3					

The most significant Project related emissions are the Scope 1 emissions resulting from GTG and gas fired heater (with WHRU supplementary firing) use. The assessment has estimated that up to 589.3 ktpa of CO_2e will be emitted annually by the Project (including Scope 1 and Scope 2 emissions). This is approximately 3.0% of the 2019 Kenyan total annual emissions (19,800 ktpa CO_2) (last year of publicly available data) and less than 0.001% of global GHG emissions in 2016[5].

Consideration of the Project's GHG emissions has been central to Project planning and strategy and will continue to inform decisions throughout the lifecycle of the Project. The Project has undertaken significant work to minimise the emission of greenhouse gases related to the production of crude oil. This has related to management of produced gas and minimisation of GHG emissions.

Annual CO_2e is predicted to be above the IFC PS3 reporting threshold[6] of 25,000 tpa. On an annual basis, the Operator will undertake a review of additional performance improvement options defined in Annex I.

7.1.9.7.1 VOC Emissions

Emissions of VOCs associated with construction activities are anticipated to be low due to the minimisation of flaring and venting and the reinjection of excess gas. Any VOC emissions will be short- term and intermittent and these will be minimised through regular planned maintenance of valves, flanges, pipework etc. VOC emission may increase above the background levels (which are only ≤0.5% of the AQS as detailed in Chapter 6.5) and therefore a low magnitude impact is anticipated on a high sensitivity receptor resulting in a **Minor** impact significance. The AQS has a 24-hour averaging period and therefore VOC emission would need to occur consistently over a 24-hour period for the averaging period to be applicable. There is no additional mitigation to be applied and therefore there will be no further impact classification.

7.1.9.7.2 O_3 Emissions

Ground level ozone is formed primarily from photochemical reactions between nitrogen oxides (NOx) and VOCs). NO_x emissions predicted to arise as a result of normal operations from point source emissions are low (Section 7.1.9.6.2) and VOC emissions are anticipated to be low, short- term and intermittent (Section 7.1.9.7.1). Therefore, the impact of ozone is anticipated to be of a low magnitude on a high sensitivity receptor, resulting

[5] World Total GHG emissions of 49358030 ktpa (Greenhouse gas emissions - Our World in Data)

[6] Reporting to IFC is not mandatory, so as a minimum the Operator must keep sufficient auditable records on energy usage, fuel usage and waste generation and disposal to allow actual emissions to be calculated annually, if required or requested.

in a **Minor** impact significance. There is no additional mitigation to be applied and therefore there will be no further impact classification.

Table 7.1-9: Operational Phase Impact Assessment.

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Transient Receptors – PAP in the medium impact magnitude area defined in Figure 7.1-2.	Emissions of $PM_{2.5}$ for 24-hour averaging period associated with Scenario 1.	Medium Direct – medium term – temporary	Major	Further air dispersion modelling will be carried out during the detailed design process. The fenceline will then incorporate any areas where the Process Contribution (emissions from the Project) is predicted to exceed 25% of the air quality standards to ensure that public access will be restricted.	Low Direct – medium term – temporary	Minor
PAP and transient receptors located downwind (see Figure 7.1-1) of the wellpads (high).	Change in odour levels associated with wellpad operations	Low Direct - medium term (residential), short term (transient) - temporary	Minor	Daily odour 'sniff' monitoring around the perimeter of the wellpads will be undertaken using the procedure defined in the Environmental Performance Plan. Additional monitoring will also be undertaken in response to any complaints. The monitoring will include the following: ■ Date, time, and locations of monitoring; ■ Weather conditions; ■ Intensity and description of the odour including duration e.g. constant or intermittent;	Low Direct - medium term (residential), short term (transient) - temporary	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				■ Odour source, if identified including location and activity; ■ Any remedial odour control measures which are implemented; and ■ A record will be kept of all routine monitoring. Records of monitoring in response to complaints will be undertaken including any investigative and remedial actions.		

7.1.9.8 Decommissioning

The Project has an operational design life of 25 years. At this stage it is not possible to anticipate the situation at that time. However, should any ground disturbance, demolition or waste management be required which will result in deposited dust or odour, the mitigation measures implemented during the construction phase (or GIP) will be applied during decommissioning. No sources of emissions to air are anticipated in addition to those already assessed.

7.1.10 Summary of Mitigation

The following mitigation measures are proposed for the Project:

- Local stakeholders will be informed of the construction activity dates through the procedure defined in the Stakeholder Engagement Plan.
- The Stakeholder Engagement Plan will include a procedure for informing local stakeholders of the construction schedule which will take account of any identified culturally sensitive days.
- The Operator's Environmental Performance Plan will include a procedure for daily visual dust monitoring which will be undertaken by the Environmental Supervisor. If high levels of dust are observed causing a nuisance to local receptors any appropriate changes to working practices will be undertaken to limit the dispersion of dust.
- Signage will be put in place to inform people where, when and for how long temporary dust generating works are taking place.
- The Operator's Environmental Performance Plan will define a procedure for consideration of dust in the development of borrow pits.
- Further air dispersion modelling will be carried out during detailed design process. The fenceline will then incorporate any areas where the Process Contribution (emissions from the Project) is predicted to exceed 25% of the air quality standards to ensure that public access will be restricted.
- Daily odour 'sniff' monitoring around the perimeter of the wellpads will be undertaken using the procedure defined in the Operator's Environmental Performance Plan. Additional monitoring will also be undertaken in response to any complaints.
- The Operator will undertake an annual review of GHG emissions performance improvement options.

7.1.11 Summary of Residual Impacts

The Project has the potential to impact the air environment in the following ways:

- Through the generation of dust and increased levels of deposited dust relating to the construction phase; and
- By changing local air quality from exhaust emissions of equipment located at the CFA and wellpads.

The residual impact significance that results from the combination of receptor importance and predicted impact magnitude is classified as no greater than **Minor**.

7.2 Noise and Vibration

7.2.1 Introduction

This section considers the potential impacts within the noise and vibration AoI arising from noise and vibration sources associated with the Project. Specifically, environmental noise impacts relevant to human receptors are assessed. Where potential impacts have been identified, these are considered in turn and mitigations are set out where necessary to ensure that any potential impacts are reduced as far as practicable.

7.2.2 Area of Influence

The noise and vibration AoI comprise the areas within 3 km of the CFA, wellpads, IWMF, and all associated infrastructure. This incorporates the areas beyond where it is expected that noise and vibration from Project sources will attenuate to a level below the ambient noise level or below a detectable vibration level. This area is encompassed by the Project AoI as defined in Chapter 3.0.

7.2.3 Receptor Importance

In order to identify the importance of the receptors, the scale of relative importance presented in Table 7.2-1 has been used with reference to the information collated in the baseline to classify the selected receptors.

Table 7.2-1: Criteria for Determining Importance of Receptors

Receptor Importance	Example Receptor Types
Very high	■ Noise or vibration sensitive receptors with a high quality and rarity, regional or national scale and limited potential for substitution/replacement (not applicable to this Chapter).
High	■ Human health of permanent (residential) or transient noise and vibration sensitive receptor; ■ Noise or vibration sensitive receptor with a high quality, local scale and limited potential for substitution/replacement; and/or ■ Noise or vibration sensitive receptor with a medium quality and rarity, regional or national scale and limited potential for substitution/replacement.
Medium	■ Noise or vibration sensitive receptor with a medium quality and rarity, local scale and limited potential for substitution/replacement; ■ Noise or vibration sensitive receptor with a low quality and rarity, regional or national scale and limited potential for substitution/replacement; and/or ■ Permanent or transient residential structure.
Low	■ Noise or vibration sensitive receptors of local, limited or no known importance; and/or ■ Noise or vibration sensitive receptor with a low quality and rarity, local scale.

7.2.4 Magnitude of Impact

The characterisation of the magnitude of the impact considers the description of Project processes and how the Project could result in a change at each of the receptors. The potential for an impact to occur at a receptor has been determined using the understanding of the baseline environment and consideration of whether there is a feasible linkage between a source of the potential impact and each receptor. The magnitude of each potential impact has then been classified between 'negligible' and 'high', as described in Table 7.2-2.

The magnitude effects criteria have been developed in accordance with the key guidelines discussed in Section 7.2.5, as well as general guidance provided from various directives for noise and vibration assessments[7]. The following are other criteria considered when assessing the potential overall impact of the Project on noise and vibration.

Each potential impact can be either adverse or beneficial (although beneficial is not applicable to noise and vibration) to the receptor of interest and vary in its duration (i.e. can be long term, medium or short term and either permanent or temporary). For the purposes of this assessment the following durations apply:

- A short-term impact is defined as up to 66 months (the maximum anticipated construction period). The CFA/CPF will be constructed within the first 36 months;
- A medium-term impact is defined as between 66 months and 25 years (anticipated duration of operations); and
- A long-term impact is defined as one that is predicted to last beyond the end of operational life of the project (>25 years).

A permanent impact is defined as a change to the baseline that would not reverse itself naturally. A temporary impact is defined as a change to the baseline conditions that would reverse naturally once the source of the impact is exhausted or has stopped.

Potential impacts are also assigned descriptors to identify whether the impact is direct or indirect. For the purposes of this assessment, a direct impact is one that occurs as a direct result of the Project and is likely to occur at the Project itself. Indirect impacts (or secondary/tertiary impacts) are those where a direct impact on one receptor has another knock-on impact on one or more other related receptor(s). Indirect impacts are likely to occur away from the Project.

Table 7.2-2: Criteria for Assessing Magnitude of Impact

Magnitude of Impact	Description Criteria [1]	
	Noise	Vibration
High	Project related change in daytime and/or night-time equivalent noise level >10 dB above baseline or exceeds applicable noise limit at permanent sensitive receptors	Project related ground vibration level of > 10.0 mm/s for ground vibration (level of human perception) and air overpressure >150 decibels linear (dBL) at permanent sensitive receptors. May influence related design decisions regardless of any possible mitigation
Medium	Project related change in daytime and/or night-time equivalent noise level >5 dB and ≤10 dB and meets applicable noise limit at permanent sensitive receptors	Project related ground vibration level >5 and ≤10 mm/s and air overpressure >117 and ≤150 dBL at permanent sensitive receptors. Should influence decisions on Project design unless mitigated. An impact or benefit which is sufficiently important to require management

[7] For noise assessment, the 3 dB, 5 dB and 10 dB intervals are informed by Bies and Hansen (2009)

Magnitude of Impact	Description Criteria [1]	
	Noise	Vibration
Low	Project related change in daytime and/or night-time equivalent noise level >3 dB and ≤5 dB and meets applicable noise limit at permanent sensitive receptors	Project related ground vibration level >0.5 and ≤5 mm/s and air overpressure >90 and ≤117 dBL at permanent sensitive receptors and meets the Project guidelines. Impacts with little real effect and which should not have an influence on or require modification of the Project design or alternative mitigation
Negligible	Project related change in daytime and/or night-time equivalent noise level ≤3 dB and meets applicable noise limit at permanent sensitive receptors	Project related ground vibration level ≤0.5 mm/s (level of human perception) and air overpressure ≤90 dBL at permanent sensitive receptors.

7.2.5 Key Guidance and Standards

7.2.5.1 Noise

The Kenyan policy and legislation documents presented in Section 2.2 and the international guidance and standards presented in Section 2.3 are relevant to this assessment. The following are of particular relevance:

- Kenyan Government EMCA (1999) and Amendments, 2018;
- *Kenya Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations* dated 2009 (Kenya Noise Regulations);
- IFC Performance Standards, 2012; and
- WBG EHS Guidelines, 2007.

As part of the EOPS Phase II ESIA (Ref. 1654017.718), Golder carried out a review of WBG EHS Guidelines and Kenya Noise Regulations, recommending the use of WBG EHS Guidelines for operations Project Standards (Golder tech memo 1654017.511 provided in Annex I). This approach was confirmed with NEMA in a minuted meeting and has been adopted for this Project also.

Permanent noise-sensitive receptors identified for the noise impact assessment are best categorised as "*residential; institutional; educational*" under the WBG EHS Guidelines, with noise level limits as presented in Table 7.2-3.

Table 7.2-3: WBG EHS Guidelines Noise Limits for Operation

Receptor Type	Noise Limit	Reference Period
Residential; institutional; educational	55 dBA; LAeq,1hr or a maximum increase in background levels of 3 dB at the nearest receptor location off-site.	Daytime (07:00 to 22:00)
	45 dBA; LAeq,1hr or a maximum increase in background levels of 3 dB at the nearest receptor location off-site.	Night-time (22:00 to 07:00)

LAeq = A-weighted, equivalent continuous sound level

The Project standards (also in Annex I) adopt the noise level limits presented in Table 7.2-3 at off-site permanent receptor locations during Project operations and considers these as the applicable noise level limits for the magnitude criteria for the impact assessment presented in Section 7.2.4.

The WBG EHS Guidelines do not explicitly provide construction noise level limits and therefore the construction limits (measurements taken within the facility) provided in the Kenya Noise Regulations (Table 7.2-4) have been taken to assess the construction phase. *Section 13 (1)*, *Section 14 (1)* and *Second Schedule – Maximum Permissible Noise Levels for Construction Sites* in the Kenya Noise Regulations present the applicable daytime and night-time sound level limits for construction. It is acknowledged that there may be an opportunity to allow Project construction to operate above these limits under specific conditions (i.e., apply for license), in discussion with NEMA. For the purposes of this assessment, even in instances where baseline levels may already exceed these limits, the Kenya Noise Regulations have been used as the applicable noise level limits for the magnitude criteria for the impact assessment at permanent receptors presented in Section 7.2.4. Using these limits when baseline levels already exceed the limits is expected to result in a conservative assessment.

Table 7.2-4: Kenya Noise Regulations Noise Limits for Construction (measurements taken within the facility)

Receptor Type	Noise Limit [a] (dBA; L_{Aeq}, daytime/night-time)	Reference Period
Health facilities, educational institutions, residential	60	Daytime (06:00 – 18:00)
	35	Night-time (18:00 – 06:00)

a) Section 13 (1), Section 14 (1) and Second Schedule-Maximum Permissible Noise Levels for Construction Sites in the Kenya Noise Regulations present the applicable daytime and night-time sound level limits for construction.

Note that the definition of daytime and night-time for the construction limits in the Kenya Noise Regulations differs from the daytime and night-time definition in the WBG EHS Guidelines.

There are no noise guidelines applicable to transient human receptors, and therefore the criteria for assessing magnitude of noise impacts at transient human receptors will rely solely on the change from baseline noise level according to the criteria presented in Table 7.2-2.

7.2.5.2 Vibration

The Kenya Noise Regulations is the relevant regulation that provides guidance in managing ground vibration levels at specific locations. Peak Particle Velocity (PPV) is considered the best measure of the impact of vibrations on residential structures.

The receptors identified for the vibration impact assessment are best categorised as "*residential*". The Kenyan Noise Regulations contain ground and air vibration limits for residential receptors which are adopted in this assessment for off-site permanent receptor locations/homesteads. These limits are presented in Table 7.2-5.

Table 7.2-5: Kenya Vibration Guidelines for Residential Vibration Limits

Receptor Type	Ground Vibration Limit(mm/s) [(a)]	Air Vibration Limit(dBL)
Residential	5 mm/s [8]	117 [9]

a) The Kenya Noise Regulations require that vibration levels do not exceed 0.5 centimetres per second beyond any source property boundary or 30 metres from any moving source.

7.2.6 Receptors of Interest and Importance

Noise and vibration receptors within the AoI have been identified and the importance of the receptor has been defined. Receptors of higher importance are considered to be noise and vibration sensitive locations where people live or spend long periods of time (i.e. permanent) or where people have access (for example, for the purposes of grazing) but do not spend long periods of time (i.e. transient and less than one year). Receptors for the noise and vibration assessment are presented in Table 7.2-6 and Table 7.2-7 respectively.

Table 7.2-6: Noise Receptors and Importance

Receptor	Importance	Comment
Homesteads which are indicative of PAP	High	Noise impacts on human receptors at permanent noise sensitive receptors/homesteads.
Transient Human Receptors	High	Noise impacts on human receptors at non-permanent locations (including livestock[10]).

Table 7.2-7: Vibration Receptors and Importance

Receptor	Importance	Comment
Permanent and Transient Residential Structures	Medium	Vibration impacts on residential structures (i.e., residential homesteads).

7.2.7 Sources of Impacts

Potential sources of impact of a range of magnitudes will occur throughout the life of the Project and are set out below by Project phase.

7.2.7.1 Construction Phase

7.2.7.1.1 Noise

Based on the Project Description and the understanding of the baseline noise conditions, potential sources of noise that could cause impacts during construction are as follows:

- The use of heavy equipment such as dozers, backhoes, excavators, graders, side boom tractors, cranes, and ancillary equipment such as generators, pumps, air compressors and welders in the construction or upgrades of the CFA, wellpads, infield flowlines and landfill;

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[8] Ground vibration is an elastic effect measured in units of peak particle velocity and is defined as the speed of excitation of particles within the ground resulting from vibratory motion. For the purposes of this assessment, ground vibration is measured in mm/s. For context, humans perceive vibrations below the levels required to impact residential structures. The level of human perception for impulsive vibration, such as blasting, is 0.5 mm/s.

[9] Air vibration is a pressure wave travelling through the air, produced by the direct action of an explosive on air or the indirect action of a confining material subjected to explosive loading. For the purposes of this assessment, air vibration is expressed in a logarithmic scale as decibels in the Linear or Unweighted mode (dBL). Air vibrations from surface blasting operations differ from noise in that they consist primarily of acoustic energy below a frequency of 20 Hz, where human hearing is less acute (Siskind et al., 1980). Alternatively, noise consists primarily of acoustic energy within the audible range from 20 to 20000 Hz.

[10] Noise can affect livestock in various ways, including feeding patterns, reproduction and development, metabolism, cardiovascular health, cognition and sleep, hearing and the immune system (Kight & Swaddle, 2011). Livestock are senstive to noise impacts and as such are considered alongside the impacts on transient human receptors, as they will be associated with pastoralists movements.

- The use of drilling equipment at the wellpads and well testing activities;
- Flights at the Kapese airstrip, which includes approximately four return flights a day; and
- Infield traffic
- Construction transport.

7.2.7.1.2 Vibration

Potential sources of vibration associated with the Project include road traffic, construction activities and well drilling which have the potential to cause continuous vibration which propagates over comparatively small distances, in the order of tens of metres.

7.2.7.2 Operational Phase

7.2.7.2.1 Noise

Based on the Project Description and the understanding of the baseline noise conditions, potential sources of noise that could cause impacts during operations are as follows:

- Routine operation of the CFA, which includes the following sources of noise:
  - CPF (compressors, air coolers, fired heaters, pumps, power generation units and valves);
  - IWMF (incinerator and pumps); and
  - LEF (pumps).
- Operation of the wellpads, which includes sources of noise such as pumps and flow reduction valves/ multi-stage restriction orifices;
- Project operations at the Kapese airstrip, which includes approximately two return flights a week per week.
- Delivery and maintenance of waste at the landfill, which includes the use of a vibratory roller and trucks delivering waste from the IWMF; and
- Infield traffic.

7.2.7.2.2 Vibration

No impacts are expected during the operational phase.

7.2.7.3 Climate Change

Climate change is not considered relevant to this section of the ESIA as changes in climate will not impact noise and Project noise will not impact climate.

7.2.8 Incorporated Environmental Measures

The Project has been designed and planned to incorporate a range of incorporated environmental measures to avoid potential impacts or reduce their magnitude, prior to the impact analysis being completed.

The measures presented in this section either relate to design measures or are widely accepted GIP.

7.2.8.1 Design Measures

The following measures are part of the Project design and reduce the potential impact of the Project on noise and/or vibration:

- Infield flowlines will be buried, therefore mitigating operational noise;

- Construction activities will be sequentially staggered and will not take place concurrently at the same location;
- Use of a ground flare (for emergency operation only) at the CFA rather than an elevated flare;
- Installation of a 10 m tall noise barrier to the north of the power generation units during operation;
- Installation of a 4.5 m tall noise barrier to the north of the excess gas injection compressor during operation; and
- Locating the IWMF close to the western side of the CPF to maximise the distance between the IWMF and permanent noise-sensitive receptors.

7.2.8.2 Good Industry Practice

7.2.8.2.1 Construction Measures

Environmental measures that were considered in the impact during both the construction and operations phases:

- Where practical, Project equipment will be selected or designed such that they will not be the source of tonal or impulsive noise;
- Regular schedule of vehicle maintenance to ensure optimal emissions performance, including noise abatement equipment (i.e. mufflers) as provided by the manufacturer or required by the Project; 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.

7.2.9 Impact Classification

Taking into account the baseline noise setting (Section 6.3), the potential sources of impact (Section 7.2.7) determined from the Project description, and the relevant incorporated environmental measures (Section 7.2.8), the potential source-pathway-receptor impact linkages for the construction and the operational phases are presented in this section.

A discussion regarding feasible impact linkages during each Project phase is presented in the sub-sections below. Each discussion is followed by a table where the potential sources of impact and relevant additional mitigation applicable to each receptor are summarised.

For the purposes of the noise assessment:

- a semi-quantitative noise assessment has been conducted for the Project activities associated with construction of the CFA, wellpads, infield flowlines and landfill.
- A quantitative noise assessment has been undertaken for drilling at the wellpads during the construction phase, as well as the operation of the CFA, wellpads and landfill.
- A qualitative noise screening and assessment was undertaken (where required) for the operation of the Kapese airstrip and truck traffic on the transport route during construction and operation.

The quantitative noise assessment of drilling at the wellpads during construction and the operation of the CFA and wellpads was developed based on the results of noise modelling carried out as part of the FEED Worley Parsons Noise Study for wellpad operation (summarised in Golder memo 1433956.648.A0, Annex I)[11] and

[11] Only 'Scenario A1', 'Scenario B' and 'Scenario C' of the model scenarios detailed in Golder memo 1433956.648.A0, (Annex I) are relevant to the Project Oil Kenya - Upstream ESIA. The other two model scenarios detailed ('Scenario A' and 'Scenario D') were not considered.

Xodus Noise Study for CFA operation (Annex I). Golder has not independently verified the data used in the assessment. Where possible, Golder has adopted the outputs of the assessment completed by a recognised competent consultancy, with the assumption QA checks were completed by Worley Parsons and Xodus. The Noise Study represents the final proposed design of these Project components, including noise mitigation. The modelled equipment is representative of the most significant noise sources relating to the Project.

The semi-quantitative and quantitative noise assessments and noise prediction modelling was undertaken using data contained within the FEED Worley Parsons noise model and the Computer Aided Noise Attenuation (CadnaA) noise modelling software, applying the modelling algorithms based on International Organization for Standardization (*ISO) 9613 Acoustics: Attenuation of Sound during Propagation Outdoors (International Organization for Standardization 1993 and 1996)* [ISO 1993 and 1996]. 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. The ground surrounding the different Project components was observed to be generally flat between the noise sources and receptor locations, therefore no localised shielding from topography was considered in the noise prediction modelling.

7.2.9.1 Construction - Noise

Noise levels are expected to increase, on occasion, due to construction activities, but construction noise will be temporary, intermittent, and limited to the vicinity of the construction activities, within the defined AoI. The range in increased noise levels associated with construction activities will depend primarily on the number and type of noise sources and their proximity to receptors (i.e. the Project noise levels in the environment generally decrease as the distance between the receptor and construction activities increases).

The Kenya Noise Regulations set out construction average noise level limits of 60 dBA during the daytime and 35 dBA during the night-time at health facilities, educational institutions, and residential type receptors. Project construction activities will need to meet this noise level limit at homesteads (2021 household survey being used as indicative of PAPs) and where transient receptors could be present, unless the EPC contractor or the Operator acquire a NEMA issued licence to allow the limit to be temporarily exceeded.

7.2.9.1.1 Infield Traffic

The estimated maximum number of truck movements per year during the construction period is approximately 34,000, which equates to an AADT volume of 93 with the assumption it is equally distributed across the year.

A recent 2021 baseline traffic survey was completed by the Operator along the C46 and A1. The survey details and results are detailed in Table 7.2-8.

With the additional 93 vehicles per day (equivalent to approximately 25% of the traffic on the least travelled road), the increase on the least travelled road, at a given distance from the road, results in an expected noise level increase of less than 3 dB (Note: for a given traffic distribution, at a given distance from the road, the road traffic noise is expected to increase by 3 dB with a doubling of traffic. An increase in traffic volume of approximately 25% is expected to result in an increase in noise levels less than 3 dB). Additional infield truck movements during construction are predicted to be of negligible magnitude (due to a ≤3 dB change) on a high sensitivity receptor, resulting in a **Negligible** impact significance and are therefore do not require the application of specific mitigation measures and are not considered further in this assessment.

Table 7.2-8: 2021 Traffic Survey data

Survey Location	Survey Date	Survey Duration	Number of Light Goods Vehicles[1]	Number of Heavy Goods Vehicles[2]	Total Vehicles	Approximate AADT equivalent[3]
C46	14/04/21	13 hours (6am to 7pm)	215	15	230	425
A1 North of Lokichar	15/04/21	12 hours (6am to 6pm)	331	211	542	1,084
A1 South of Lokichar	15/04/21	12 hours (6am to 6pm)	509	133	642	1,284

a) *Includes motorcycles and light vehicles*
b) *Includes buses, commercial vehicles, tractors, farm vehicles, articulate trucks and construction trucks*
c) *Calculated by (Total (HGV + LGV) / survey duration) *24*

7.2.9.1.2 Construction Transport Route Emissions

The estimated number of truck journeys per year associated with the movement of cargo and construction materials from Mombasa to the Project Site in the construction period is approximately 75 AADT, which for conservatism has been assumed to be doubled to 150 AADT to account for outbound and inbound traffic movements. No changes are anticipated to the alignment of the public roads, and it is not anticipated that there will be any increases to the speed limit on public roads.

A recent 2021 baseline traffic survey was completed by the Operator along the C46 and A1. The survey details and results are detailed in Table 7.2-8. A historical baseline traffic survey was also undertaken in 2016 as part of the ESIA for the EOPS project, with traffic counts undertaken during daytime hours at nine locations along the likely route from Mombasa to the Project Site. The two-way traffic flows ranged from 638 on the A1 near the Marich Pass to 40,724 on the A1 near Kitale.

Based on the screening criteria, with the additional 150 vehicles per day (equivalent to approximately 24% of the traffic on the least travelled road), the increase at a given distance from the road, results in an expected noise level increase of less than 3 dB (Note: for a given traffic distribution, at a given distance from the road, the road traffic noise is expected to increase by 3 dB with a doubling of traffic. An increase in traffic volume of approximately 25% is expected to result in an increase in noise levels less than 3 dB). Additional truck movements along the construction transport route are predicted to be of negligible magnitude (due to a ≤3 dB change) on a high sensitivity receptor, resulting in a **Negligible** impact significance and are therefore do not require the application of specific mitigation measures and are not considered further in this assessment.

7.2.9.1.3 Kapese Airstrip

Up to four return flights a day are planned from Wilson Airport Nairobi to the Kapese Airstrip in Lokichar during the construction phase. Noise levels are expected to increase, on occasion, due to the arriving and departing flights, but the noise will be temporary, intermittent, and short in duration.

Due to the limited information regarding the aircraft activity, types of aircraft and flight schedule, it has been assumed that noise levels from the future aircrafts will be at the same level as previous aircraft movements during EOPS Phase II. Project activities are expected to be similar to historic activities resulting in a negligible increase over historic activities. Based on the negligible significance, no further assessment is required and no mitigation is proposed.

7.2.9.1.4 Construction of Project Components - CFA, Wellpads, Infield Flowlines and Landfill.

Detailed construction information, such as a list of planned equipment and schedule, is not yet defined. Therefore, a semi-quantitative assessment based on assumptions has been completed through noise modelling to predict the potential noise levels in the AoI as a result of construction phase emissions. Predictions were undertaken to assess the potential noise levels resulting from the operation of assumed typical construction equipment. The noise prediction modelling was carried out with CadnaA applying the modelling algorithm ISO 9613.

The following key assumptions were applied for construction of the different Project components:

- The sound pressure level considered to represent a single unit of typical construction equipment was 85 dBA at 15 m when operating at full power; this is representative of large off-road equipment such as dozers, excavators, graders, cranes, or generators;
- An acoustical usage factor of 40% was considered. This is representative of equipment operating for 24 minutes per hour at full power with noise levels for the remaining time considered not significant, or acoustically equivalent; and
- No night-time construction works will be undertaken, except for within the CFA fence-line where night-time construction may occur.

It was assumed that five units of construction equipment would be operating at a location in a given 12-hour period.

The modelling predicts that there will be high and medium magnitude impact zones surrounding infrastructure during construction, which result in a **Major** or **Moderate** impact significance. Some analysis was completed to ascertain if a 5 m noise barrier could reduce the size of the high and medium impact zones.

Table 7.2-9 presents the results of the modelling, and describes:

- The average baseline noise level
- The minimum noise level from construction activities that would result in a high or a medium magnitude impact
- The distance in metres from the project component noise source to a potential receptor, within which there would be a medium or high magnitude impact. This has been modelled both with and without mitigation (5 m high noise barrier [12]).
- The final column shows the nearest identified PAP (during the 2021 social survey) to the source.

[12] N.B such a noise barrier must be located a maximum distance of 10 m from the construction equipment and block the line of site between the construction equipment and the receptor

Table 7.2-9: Predicted Noise Impacts for Construction of Project Components

Project Component	Location	Average Baseline Noise Level (dBA)		Minimum Predicted Construction Noise Level Resulting in a High Magnitude (dBA) (a), (b)		Minimum Predicted Construction Noise Level Resulting in a Medium Magnitude (dBA) (a), (b)		Unmitigated Scenario – Approximate Distance Resulting in a High Magnitude (m)		Mitigated Scenario d – Approximate Distance Resulting in a High Magnitude (m)		Unmitigated Scenario – Approximate Distance Resulting in a Medium Magnitude (m)		Mitigated Scenario d – Approximate Distance Resulting in a Medium Magnitude (m)		Approximate Distance to Closest Receptor (m) identified during 2021 household survey
		Day	Night	Day	Night	Day	Night	Day	Night(f)	Day	Night(f)	Day	Night(f)	Day	Night(f)	
CFA	Ngamia	60.5	42.0	60.0	35.0	- (e)	- (e)	210	1,930	100	1,670	- (e)	- (e)	- (e)	- (e)	1,300
Wellpad/Infield Flowlines	Ngamia	60.5	- (f)	60.0	- (f)	- (e)	- (f)	210	- (f)	100	- (f)	- (e)	- (f)	- (e)	- (f)	<5
	Amosing	44.1	- (f)	53.6 (c)	- (f)	47.4 (c)	- (f)	395	- (f)	250	- (f)	710	- (f)	550	- (f)	30
	Twiga	36.5	- (f)	46.0 (c)	- (f)	39.8 (c)	- (f)	800	- (f)	630	- (f)	1,340	- (f)	1,130	- (f)	400
	Ekales	55.2	- (f)	60.0	- (f)	58.5 (c)	- (f)	210	- (f)	n/a	- (f)	240	- (f)	n/a	- (f)	380
	Agete(g)	55.2	- (f)	60.0	- (f)	58.5 (c)	- (f)	210	- (f)	n/a	- (f)	240	- (f)	n/a	- (f)	880
	Etom	51.2	- (f)	60.0	- (f)	54.5 (c)	- (f)	210	- (f)	n/a	- (f)	360	- (f)	n/a	- (f)	90
Landfill	Ngamia	60.5	- (f)	60.0	- (f)	- (e)	- (f)	210	- (f)	100	- (f)	- (e)	- (f)	- (e)	- (f)	650

a) Minimum of Kenya Noise Regulations construction noise limit 60 dBA (daytime) or 35 dBA (night-time) and change in baseline noise level > 10 dB (high magnitude) or > 5 dB (medium magnitude).
b) Construction scenario in Section 7.2.9.1assessed.
c) Change in baseline noise level (i.e., change >10 dB or >5 dB) influencing predicted construction noise level resulting in a high or medium magnitude, not the Kenya Noise Regulations construction limit.
d) Implementation of a 5 m high noise barrier within 10 m from the construction equipment and blocking the line of site between the construction equipment and the receptor, or acoustically equivalent. As additional mitigation would still be required and due to the costs and practicalities associated with a noise barrier during construction, the 5 m noise barrier has not been taken forward into the final mitigation.
e) Due to elevated baseline noise levels, if the predicted noise level is below the Kenya Noise Regulations construction limits, the impact will be negligible (i.e., change from baseline is less than 3 dB).
f) Night-time working is not anticipated outside of the CFA
g) No baseline noise data is available for Agete so Ekales has been used as a proxy due to its location and higher baseline noise levels (compared to Twiga and Etom which are also located nearby)

The colour coding in the mitigated columns of Table 7.2-9 shows whether the 5 m barrier could be effective at reducing the high magnitude at the receptor. Green text implies an improvement that would lead to a reduction in magnitude classification, and blue implies no improvement.

Therefore, with the implementation of a 5 m high noise barrier, there are still high magnitude impacts (**Major** significance) predicted for construction during the daytime at the CFA, wellpads in Ngamia and Twiga and during the night-time for construction of the CFA. While a 5 m barrier may improve the situation close to the landfill and the Kapese airstrip during the daytime, PAP within the areas subject to high magnitude noise impacts would still need mitigation to manage the impact during construction. As additional mitigation would still be required and due to the costs and practicalities associated with a noise barrier during construction, the 5 m noise barrier has not been taken forward into the final mitigation.

The **Major** significance is triggered by a combination of the difference between baseline and the predicted noise levels and exceedance of the Kenya Noise Regulations construction limit, depending on location. The Kenyan daytime construction noise limit of 60 dBA is the equivalent noise to "*normal speech conversation*" according to the EU 2008. At locations where construction noise will temporarily exceed statutory limits, NEMA will be notified.

The Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders where, when and for how long temporary noise generating works are taking place and describe any measures adopted to minimise exposure such as limited work hours and phasing of work to limit the impact of noise. As a minimum the following needs to be communicated:

- Within 0 to 75 m from the perimeter of the following, noise levels may lead to hearing impairment if exposure occurs for a 24-hour period according to the WHO Guidelines for Community Noise, 1999.
  - The wellpads;
  - The infield flowlines RoW;
  - The CFA; and
  - The landfill.
- In the area directly outside this perimeter, noise will change due to the Project up to that similar to an elevated conversation at 1 m but should not lead to any hearing impairment through sustained exposure.

These areas defined above are located within the gazetted areas and will be demarcated as areas to be avoided. Local stakeholders will be informed of the demarcated areas and signage will be installed prior to construction to inform people not to remain in the area for periods greater than 24 hours during construction.

The Environmental Performance Plan will include a procedure for weekly visual monitoring (by the Environmental Supervisor) of any homestead structures which are developed within the demarcated areas. If homestead structures are observed the Project will work with local chiefs and DCCs to assist with the movement of the structures and people to outside of the demarcated areas.

Successful implementation of this mitigation would result in a residual significance of **Moderate** within 0 to 75 m from the perimeter of the wellpads, infield flowlines RoW, CFA and landfill and **Minor** outside of that perimeter.

Monitoring over a 24-hour period will be undertaken 75 m from the perimeter of the first construction works in an area e.g. wellpads, CFA, flowlines, landfill, etc, using an appropriately calibrated and maintained Class 1 Sound Level Meter. Monitoring will be carried out by trained personnel to confirm noise levels are within the Project Standard (Kenyan Construction Noise Guidelines) and to confirm and inform the demarcation distances for future construction tranches.

The Operator will monitor grievances and improvements through the Grievance Management Procedure. Any complaints will be investigated and followed up to ensure a form of remediation (e.g., improved engagement, sound barriers or equipment maintenance) is in place to prevent recurrence.

7.2.9.1.5 Drilling of Wells

The quantitative assessment of wellpad drilling during the construction phase once the other equipment at the wellpads is installed has been undertaken using CadnaA. Drilling is expected to operate continuously for 24 hours per day and therefore only the night-time criteria have been considered as it is more stringent.

The assessment considers four drill rigs which will be operating concurrently at up to four separate wellpads at a given time. The locations and sequencing of the drill rigs at the different wellpads will be defined during detailed design phase. A single point source with an overall sound power level of 105 dBA is assumed to represent the entire drilling operations at a single wellpad, specifically each drill rig operating continuously, in the centre of each wellpad fence-line.

Table 7.2.10 below shows the predicted noise levels associated with well drilling and summarises the distance at which high and medium magnitude impacts are predicted to occur at wellpads in each of the oilfields. It has been assumed that no two wellpads in the Amosing, Twiga, Ekales, Agete or Etom oilfields will be drilled at the same time and no neighbouring wellpads will be drilled simultaneously in any of the oilfields. If during detailed design it is determined that concurrent drilling at adjacent wellpads is required, or other acoustically significant factors change, additional noise modelling will be completed and the proposed mitigation review and amended, as required. Note that for night-time impacts, as shown in Table 7.2-10 below, a high magnitude occurs when noise levels are above 35.0 dBA at any of the wellpad locations, and a medium magnitude impact occurs at Amosing above 32.6 dBA and Twiga above 31.2 dBA. Note that due to elevated baseline noise levels in Ngamia, Ekales and Agete and Etom, there is no medium magnitude as ambient levels are not expected to increase over baseline before exceeding the applicable noise limit (i.e. impacts are expected to be either; 'negligible' or 'high').

Figure 7.2-1 to Figure 7.2-6 present the high and medium magnitude areas (where applicable) for well drilling on an example wellpad in each of the oilfields. The wellpad presented is the one in each oilfield with the closest household identified in the 2021 social survey (where applicable).

Table 7.2-10: Predicted noise levels associated with well drilling

Wellpad Location	Average Night-time Baseline Noise Level (dBA)	Noise Level (dBA) at which a high magnitude is predicted during Night-time[b]	Noise Level (dBA) at which a medium magnitude is predicted during Night-time[b]	Approximate distance (m) from wellpad centre to high magnitude[a]	Approximate distance (m) from wellpad centre to medium magnitude[a]	Approximate Distance to Closest Receptor (m) identified during 2021 household survey
Twiga	27.9	35	31.2 [c]	355	546	400
Amosing	29.3	35	32.6 [c]	355	472	30
Ngamia	42.0 [d]	35	-	355	-	30

Wellpad Location	Average Night-time Baseline Noise Level (dBA)	Noise Level (dBA) at which a high magnitude is predicted during Night-time[b]	Noise Level (dBA) at which a medium magnitude is predicted during Night-time[b]	Approximate distance (m) from wellpad centre to high magnitude[a]	Approximate distance (m) from wellpad centre to medium magnitude[a]	Approximate Distance to Closest Receptor (m) identified during 2021 household survey
Ekales & Agete[f]	38.7[d]	35	-	355	-	370 (Ekales) 890 (Agete)
Etom	34.2	35	-	355	-	90

a) *Distance from the centre of wellpad*
b) *Minimum of Kenya Noise Regulations construction noise limit 60 dBA (daytime) or 35 dBA (night-time) and change in baseline noise level > 10 dB (high magnitude) or > 5 dB (medium magnitude).*
c) *Change in baseline noise level (i.e., change >10 dB or >5 dB) influencing predicted construction noise level resulting in a high or medium magnitude, not the Kenya Noise Regulations construction limit.*
d) *Baseline levels already exceed the applicable Kenya Noise Regulations construction noise limit*
e) *No baseline noise data is available for Agete so Ekales has been used as a proxy due to its location and higher baseline noise levels (compared to nearby Twiga and Etom)*

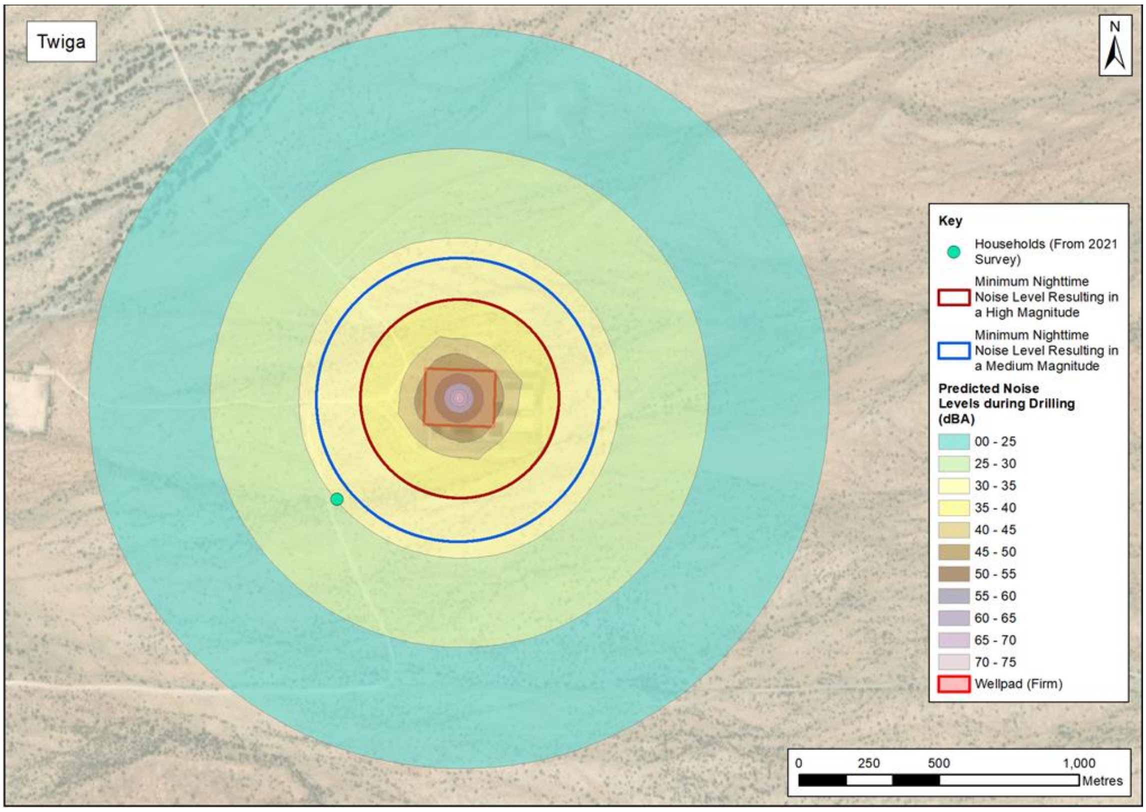

Figure 7.2-1: Indicative wellpad showing high and medium magnitude areas for night-time well drilling in Twiga

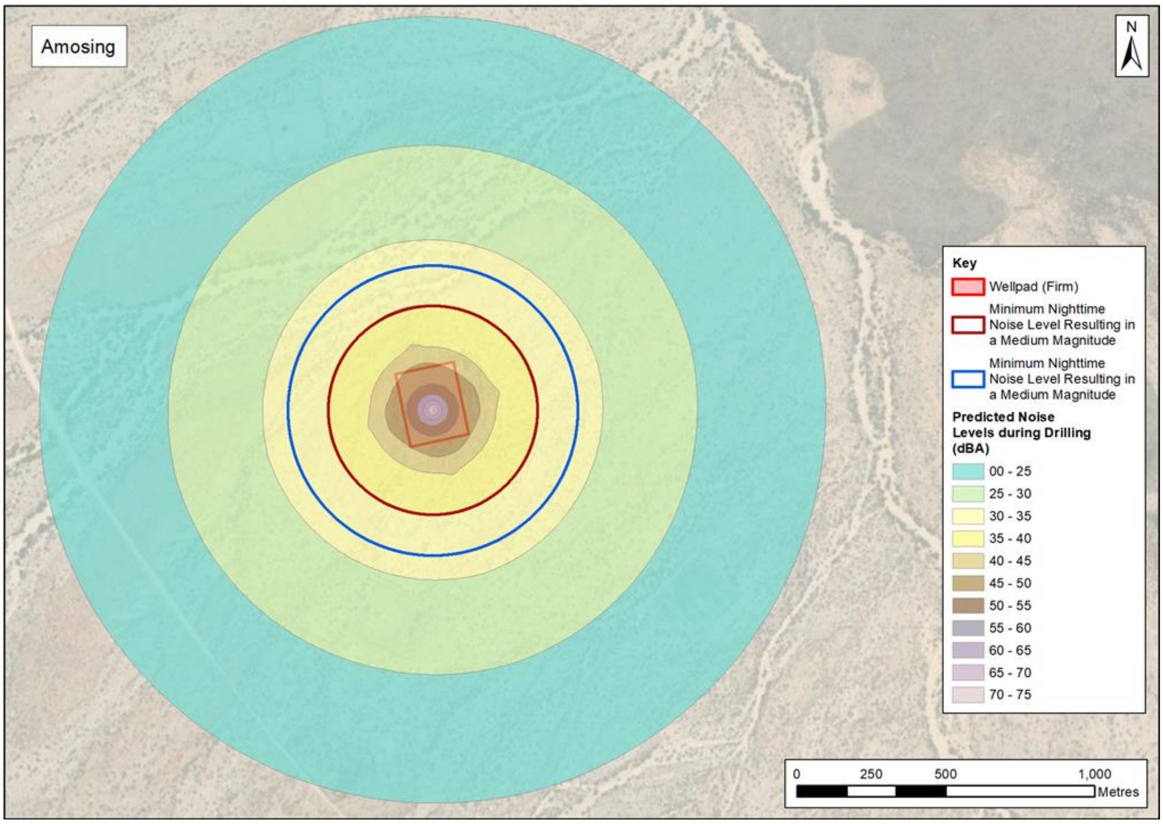

Figure 7.2-2: Indicative wellpad showing high and medium magnitude areas for night-time well drilling in Amosing

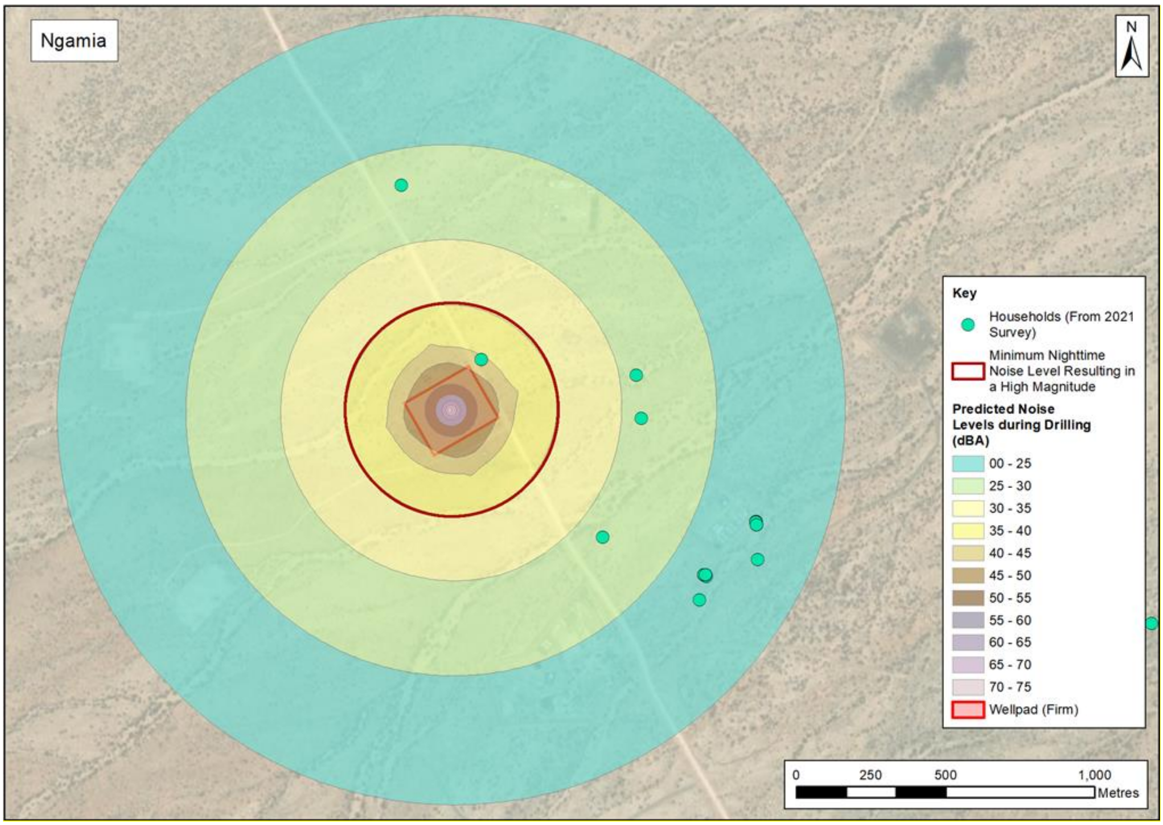

Figure 7.2-3: Indicative wellpad showing high magnitude areas for night-time well drilling in Ngamia

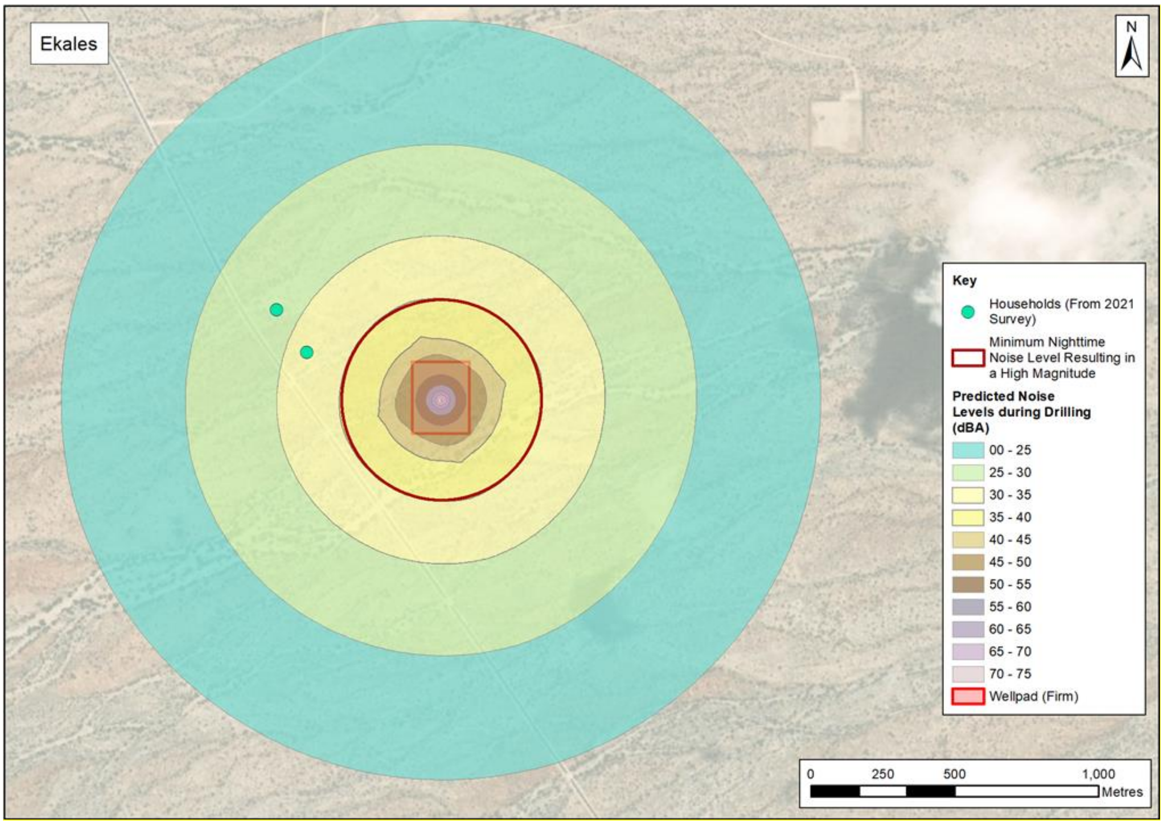

Figure 7.2-4: Indicative wellpad showing high magnitude areas for night-time well drilling in Ekales

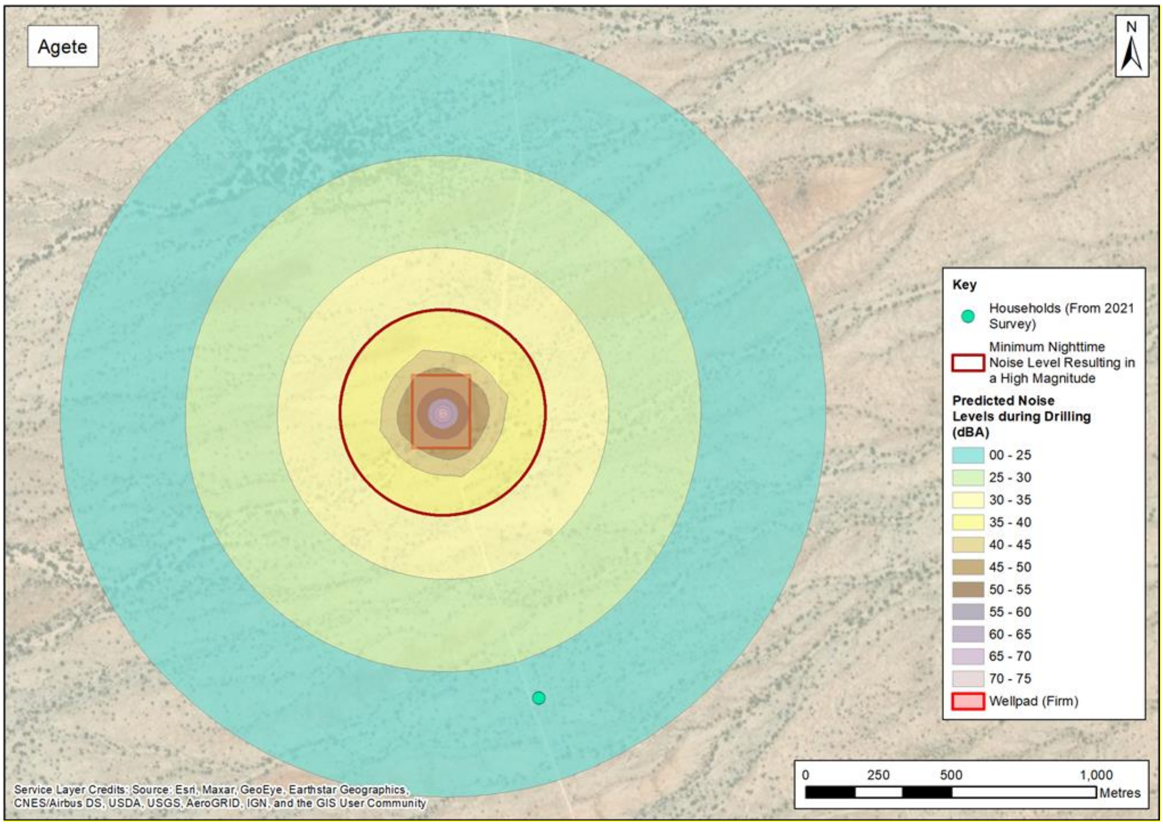

Figure 7.2-5: Indicative wellpad showing high magnitude areas for night-time well drilling in Agete

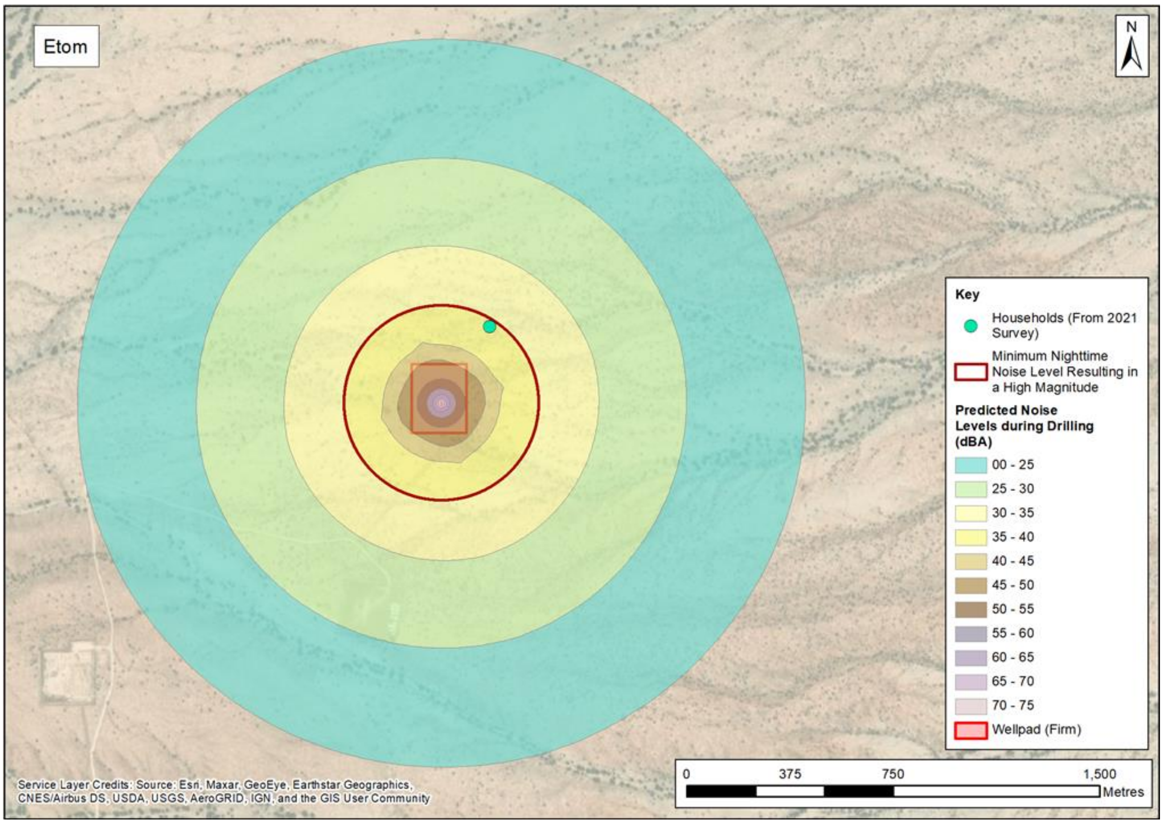

Figure 7.2-6: Indicative wellpad showing high magnitude areas for night-time well drilling in Etom

The modelling predicts up to a high magnitude rating during night-time drilling activities as the maximum predicted noise levels are above the Kenya Noise Regulations construction noise limit of 35 dBA, which would be a **Major** significance. The following measures will be undertaken to mitigate this:

The Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders of the drilling schedule and where, when and for how long temporary noise generating works are taking place. Measures adopted to minimise exposure such as limited work hours and phasing of work to limit the impact of noise will be discussed. The following will also be communicated:

- In the area surrounding the wellpad fence-line (during drilling) noise will change due to the Project to levels similar to a normal conversation at 1 m distance (or quieter) but should not lead to any hearing impairment through sustained exposure.
- Monitoring over a 24-hour period will be undertaken at the wellpad fenceline during the first drilling works, using an appropriately calibrated and maintained Class 1 Sound Level Meter. Monitoring will be carried out by trained personnel to confirm noise levels are within the Project Standard (Kenyan Construction Nosie Guidelines).
- The Environmental Performance Plan will define the actions to be taken and the timeframes in which those actions will be taken should exceedances of ambient noise guidelines be observed, e.g. review and maintenance of noise source equipment, review of noise abatement measures and implementation of demarcation areas.

Successful implementation of such mitigation would result in the significance being reduced to **Minor**.

7.2.9.2 Construction - Vibration

Vibration levels associated with continuous vibration activities identified in Section 7.2.7.1 are predicted to be of a Negligible impact magnitude (change no greater than the level of human perception) on a medium sensitivity receptor (permanent and transient residential structures) and therefore vibration impacts from the Project are predicted to be of **Negligible** significance and therefore no additional mitigation is proposed and this is not assessed further.

Table 7.2-11: Construction Phase Noise Impact Assessment

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
PAP (High) within the areas of predicted high magnitude defined in Table 7.2-9	Construction of Project Components	High – Short-Term – Temporary	Major	At locations where construction noise will temporarily exceed statutory limits, NEMA will be notified. The Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders where, when and for how long temporary noise generating works are taking place and describe any measures adopted to minimise exposure such as limited work hours and phasing of work to limit the impact of noise. The following will also be communicated: Within 0 to 75 m from the perimeter of the following, noise levels may lead to hearing impairment if exposure occurs for a 24-hour period, according to the WHO Guidelines for Community Noise, 1999. ■ The wellpads; ■ The infield flowlines RoW; ■ The CFA; and ■ The landfill. In the area directly outside this perimeter, noise will change due to the Project up to that similar to an elevated conversation at 1 m but should not	Low – Short-Term – Temporary	Moderate
PAP (High) within the areas of predicted medium magnitude defined in Table 7.2-9	Construction of Project Components	Medium – Short-Term – Temporary	Moderate		Low – Short-Term – Temporary	Minor
Transient Human Receptor (High) within the areas of predicted high and medium magnitude defined in Table 7.2-9	Construction of Project Components	Medium – Short-Term – Temporary	Moderate		Low – Short-Term – Temporary	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				lead to any hearing impairment through sustained exposure. These areas (which are located within the gazetted areas) will be demarcated as areas to be avoided. Local stakeholders will be informed of the demarcated areas and signage will be installed to inform people not to remain in the area for periods greater than 24 hours during construction. The Environmental Performance Plan will include a procedure for weekly visual monitoring (by the Environmental Supervisor) of any homestead structures which are developed within the demarcated areas. If homestead structures are observed the Project will work with local chiefs and DCCs to assist with the movement of the structures and people to outside of the demarcated areas. Monitoring over a 24-hour period will be undertaken 75 m from the perimeter of the first construction works in an area e.g. wellpads, CFA, flowlines, landfill, etc, using an appropriately calibrated and maintained Class 1 Sound Level Meter. Monitoring will be carried out by trained personnel to confirm noise levels are within the Project Standard (Kenyan Construction Nosie		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				Guidelines) and to confirm and inform the demarcation distances for future construction tranches. There will be an investigation into potential additional monitoring and a review of further controls of receptor movement within the area 0 to 75 m from the perimeter subject to monitoring results The Operator will monitor grievances and improvements through the Grievance Management Procedure. Any complaints will be investigated and followed up to ensure a form of remediation (e.g., improved engagement, sound barriers or equipment maintenance) is in place to prevent recurrence.		
PAP (High) within the areas of predicted high magnitude defined in Table 7.2-10 and Figure 7.2-1 to Figure 7.2-6	Well Drilling	High – Short-Term – Temporary	Major	The Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders of the drilling schedule and where, when and for how long temporary noise generating works are taking place. Any measures adopted to minimise exposure such as limited work hours and phasing of work to limit the impact of noise will be	Low – Short-Term – Temporary	Minor

<table>
<tr><th>Receptor (Importance)</th><th>Source of Potential Impact</th><th>Impact classification (excluding mitigation)</th><th>Impact Significance</th><th>Mitigation</th><th>Residual Impact Classification (including mitigation)</th><th>Residual Impact Significance</th></tr>
<tr><td>PAP (High) within the areas of predicted medium magnitude defined in and Figure 7.2-1 to Figure 7.2-6</td><td>Well Drilling</td><td>Medium – Short-Term – Temporary</td><td>Moderate</td><td rowspan="2">discussed. The following will also be communicated:
▪ In the area surrounding the wellpad fence-line (during drilling) noise will change due to the Project to levels similar to a normal conversation at 1 m distance (or quieter) but should not lead to any hearing impairment through sustained exposure.

Monitoring over a 24-hour period will be undertaken at the wellpad fenceline during the first drilling works, using an appropriately calibrated and maintained Class 1 Sound Level Meter. Monitoring will be carried out by trained personnel to confirm noise levels are within the Project Standard (Kenyan Construction Nosie Guidelines).

The Environmental Performance Plan will define the actions to be taken and the timeframes in which those actions will be taken should exceedances of ambient noise guidelines be observed, e.g. review and maintenance of noise source equipment, review of noise abatement measures and implementation of demarcation areas (within the gazetted areas).</td><td>Medium – Short-Term – Temporary</td><td>Minor</td></tr>
<tr><td>Transient Human Receptor (High) within the areas of predicted high and medium magnitude defined in Table 7.2-10 and Figure 7.2-1 to Figure 7.2-6</td><td>Well Drilling</td><td>Medium – Short-Term – Temporary</td><td>Moderate</td><td>Medium – Short-Term – Temporary</td><td>Minor-</td></tr>
</table>

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				If during detailed design it is determined that concurrent drilling at adjacent wellpads is required, or other acoustically significant factors change, additional noise modelling will be completed and the proposed mitigation review and amended, as required.		

7.2.9.3 Operation - Noise

7.2.9.3.1 Infield traffic

The estimated maximum number of truck movements per year during the operation period is less than the truck movements expected during construction (negligible impact). Therefore, truck movements on the transport route during operations are expected to have a negligible impact on traffic noise levels and a negligible significance and therefore no further assessment or mitigation is required.

7.2.9.3.2 Kapese Airstrip

Two return flights a week are planned from Wilson Airport Nairobi to the Kapese Airstrip in Lokichar for operations personnel. Noise levels are expected to increase, on occasion, due to the arriving and departing flights, but the noise will be temporary, intermittent, and short in duration.

Due to the limited information regarding the aircraft activity, types of aircraft and flight schedule, it has been assumed that noise levels from the future aircrafts will be at the same level as previous aircraft movements during EOPS Phase II. Project activities are expected to be similar to, or less than historic activities resulting in a negligible increase over historic activities on high sensitivity receptors. Based on the negligible significance, no further assessment is required and no mitigation is proposed.

7.2.9.3.3 Project Operations - CFA, Wellpads and Landfill

The quantitative assessment of the operation of the CFA, wellpads and landfill was completed through noise prediction modelling to predict the potential noise levels in the AoI as a result of Project noise emissions. The Worley Parsons FEED noise modelling report in Annex I details the model inputs and sound power levels. The equipment was assumed to operate continuously for 24-hours per day. The noise prediction model for the noise assessment of the operation of the landfill was based on Project information.

As stated in Section 7.2.8, two noise barriers are included in the design of the Project and therefore the noise assessment. Within the CFA, the assessment included a 10 m tall barrier to the north of the power generation units and a 4.5 m tall barrier to the north of the excess gas injection compressor.

The operational phase impact assessment with respect to noise from the CFA is presented in Table 7.2-12.

7.2.9.3.4 CFA Operations

This scenario considers predicted noise levels from CFA operations. Predicted noise results are presented in Figure 7.2-7. As the CFA is anticipated to operate continuously for 24 hours per day, only the night-time criteria has been considered as it is more stringent. The measured average baseline noise level during the night-time period representative of Ngamia and the CFA was 42.0 dBA. Therefore, for PAP a low magnitude occurs when the Project produces a noise level greater than 42.0 dBA (i.e., greater than 3 dB increase in baseline noise level [13]). A high magnitude occurs when the Project produces a noise level greater than 45 dBA, the night-time WBG EHS Guidelines limit.

For transient receptors (where the WBG EHS Guidelines are not applicable), a low magnitude occurs when the Project produces a noise level greater than 42.0 dBA, a medium magnitude occurs when the Project produces a noise level greater than 45.3 dBA (i.e., greater than 5 dB increase in baseline noise level), and a high magnitude occurs when the Project produces a noise level greater than 51.5 dBA (i.e., greater than 10 dB increase in baseline noise level).

The results presented in Figure 7.2-7 show that there were no permanent homesteads (according to the 2021 survey) within the high or medium magnitude contour bands. The results indicate that the highest predicted

[13] The combination of baseline noise (42.0 dBA) and Project produced noise (>42.0 dBA) result in an increase in overall noise level that is greater than 3 dB above baseline (i.e. baseline noise (42 dBA) + Project noise (>42 dBA) = >45 dBA).

noise level at the nearest permanent homestead (according to the 2021 survey) to the CFA is less than 35.0 dBA, resulting in a low magnitude and minor significance.

For transient receptors, the area where a high magnitude and **Major** significance is predicted (i.e., Project noise levels greater than 51.5 dBA) extends approximately 70 m outside of the north- western boundary of the CFA when the high magnitude is rounded down to the nearest 5 dBA (50 dBA) for conservatism due to the format of the modelling outputs. The area where a medium magnitude and **Moderate** significance is predicted (i.e., Project noise levels greater than 45.3 dBA) extends approximately 475 m to the north-western of the CFA fence-line. Figure 7.2-7 presents the area within which a medium magnitude is expected rounded down to the nearest 5 dBA (45 dBA) for conservatism due to the format of the modelling outputs.

In order to mitigate these impacts, the Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders of the following information:

- In the area surrounding the CFA noise will change due to the Project up to levels similar to a normal conversation at 1 m distance (or quieter) but should not lead to any hearing impairment through sustained exposure.

On a quarterly basis, and in response to noise complaints, 24- hour duration noise monitoring will be undertaken at the medium magnitude contour line defined in Figure 7.2-7, using an appropriately calibrated and maintained Class 1 Sound Level Meter. Monitoring will be carried out by trained personnel to confirm noise levels are within the Project Standard (WBG EHS Guidelines). The Environmental Performance Plan will define the actions to be taken and the timeframes in which those actions will be taken e.g. review and maintenance of noise source equipment and review of noise abatement measures, should exceedances of the Project Standard (WBG EHS Guidelines) be observed.

Communication of this change in noise level during operations in specific areas to local stakeholders will empower them to make informed decisions and deter them from using impacted areas. This combined with quarterly monitoring of the impacted noise levels, to enable the Operator to review monitoring and communication with local stakeholders throughout operations, will reduce the Moderate significance to a **Minor** residual impact significance.

Noise impacts on camp locations are considered from the perspective of occupational exposure and will be addressed within the Occupational Health and Safety Procedures.

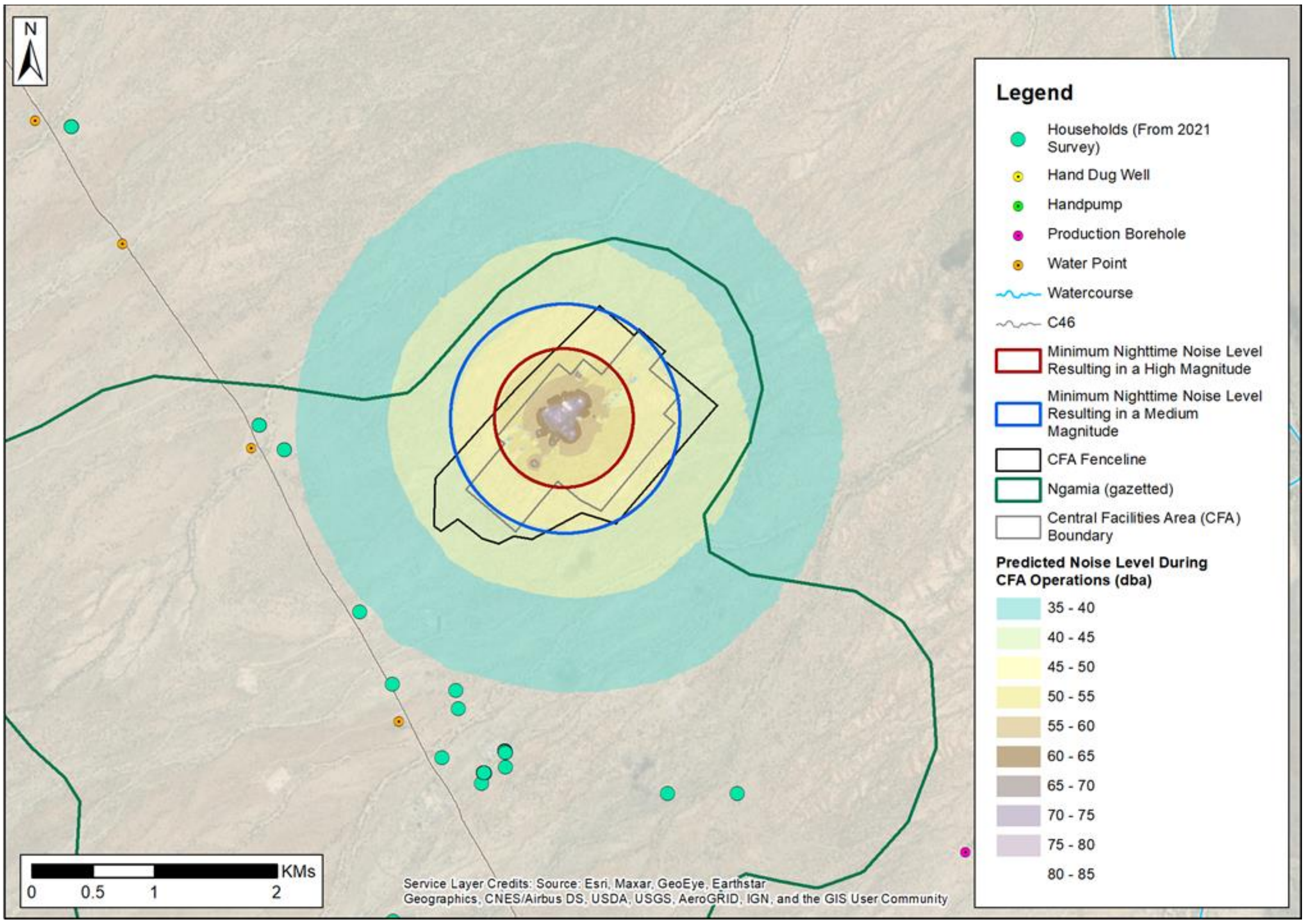

Figure 7.2-7: Predicted Noise Levels during CFA Operations

7.2.9.3.5 Wellpad Operations

This scenario considers wellpad operation. Wellpads are expected to operate continuously for 24 hours per day and therefore only the night-time criteria have been considered as it is more stringent.

As indicated in Figure 7.2-8 to Figure 7.2-12, the maximum predicted noise level outside of the fence-line of a wellpad with a jump-over line[14] (AM-01, NG-20, NG-23, EM-03, ET-09, TW-07, AG-03, EK-07) is approximately 41.0 dBA. This results in a negligible magnitude for transient receptors in Ngamia. However, the impact magnitude is high for transient receptors up to approximately 18 m of the Amosing and Twiga wellpad fencelines (i.e., greater than 10 dB change from baseline noise level) and medium for transient receptors up to approximately 16 m of the Agete, Ekales and Etom wellpad fencelines and up to approximately 47 m of the Amosing and Twiga wellpad fencelines. This results in a **Major** or **Moderate** significance within approximately 18 m or 47 m of the fence-lines, respectively, and a low impact magnitude and **Minor** significance beyond 47 m from the fence-line.

As indicated in Figure 7.2-8 to Figure 7.2-12, the maximum Project noise level outside of the fenceline of a wellpad without a jump-over line is 36.5 dBA. This results in a negligible magnitude for transient receptors in Ngamia, Agete, Ekales and Etom. However, the impact magnitude is medium for transient receptors up to approximately 10 m of the Amosing and Twiga wellpad fence-lines, resulting in a moderate significance. Beyond 10 m of the fenceline, the magnitude of the impact is low and the significance is minor.

[14] Jump- over lines are required on the defined wellpads to enable flushing of the trunklines

In order to mitigate impacts of wellpad operations, the Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders of the following information:

- In the area surrounding wellpads noise will change due to the Project up to that similar to a normal conversation at 1 m distance (or quieter) but should not lead to any hearing impairment through sustained exposure.

Communication of this change in noise level during operations in specific areas to local stakeholders will empower them to make informed decisions and deter them from using impacted areas. This combined with quarterly monitoring of the impacted noise levels, to enable the Operator to review monitoring and communication with local stakeholders throughout operations, will reduce the Major and Moderate significance to a **Minor** residual impact significance.

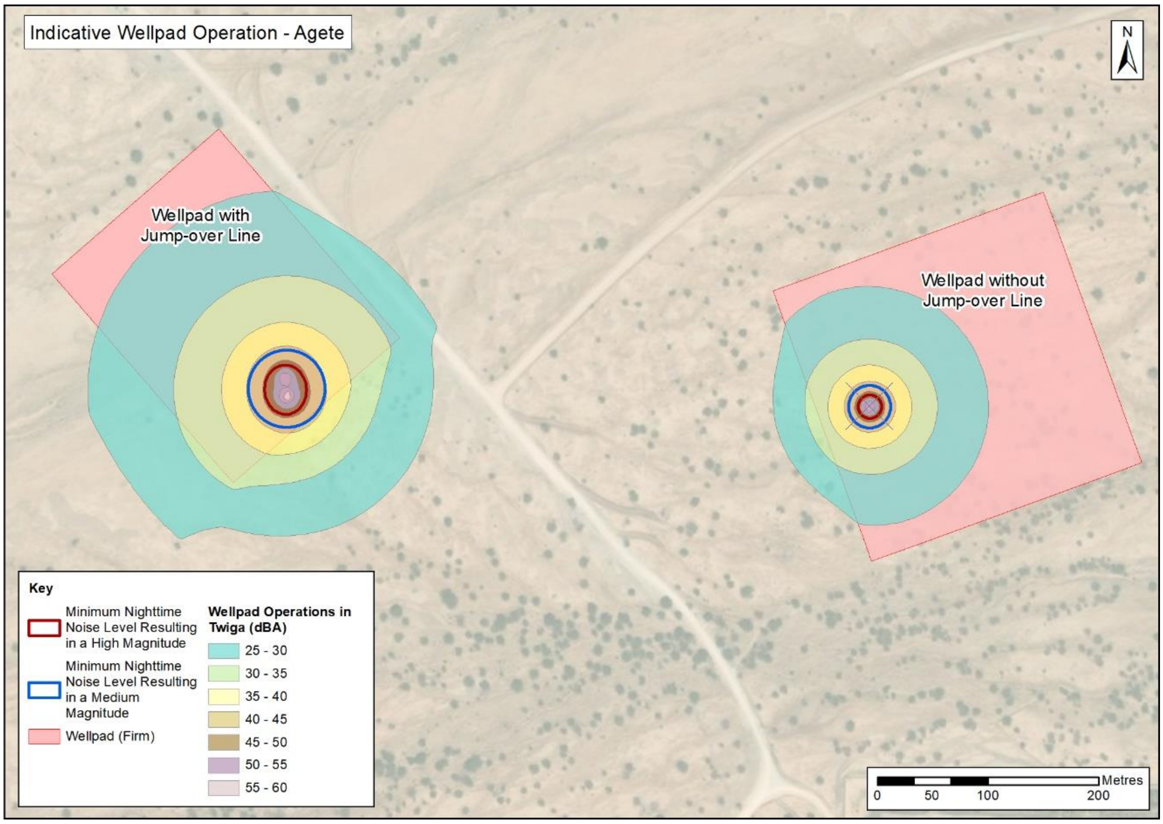

Figure 7.2-8: Indicative wellpad showing high magnitude areas for night-time wellpad operation in Agete

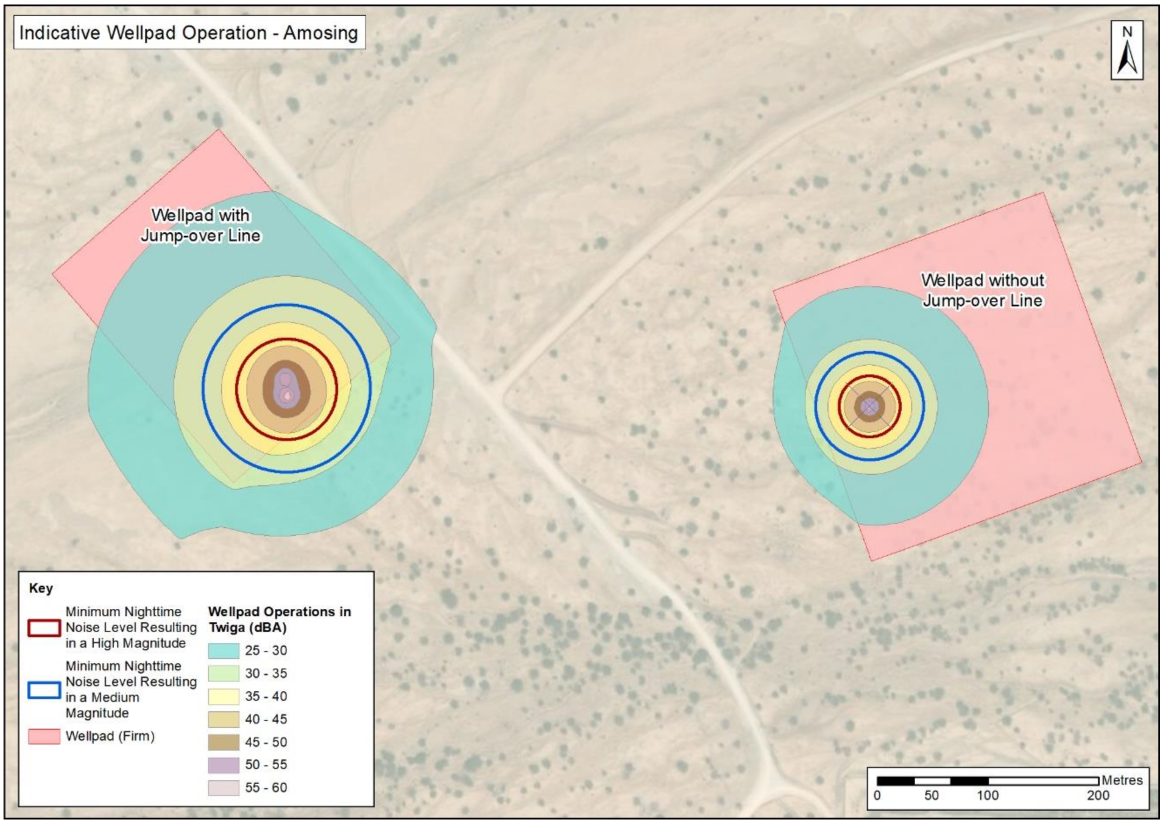

Figure 7.2-9: Indicative wellpad showing high magnitude areas for night-time wellpad operation in Amosing

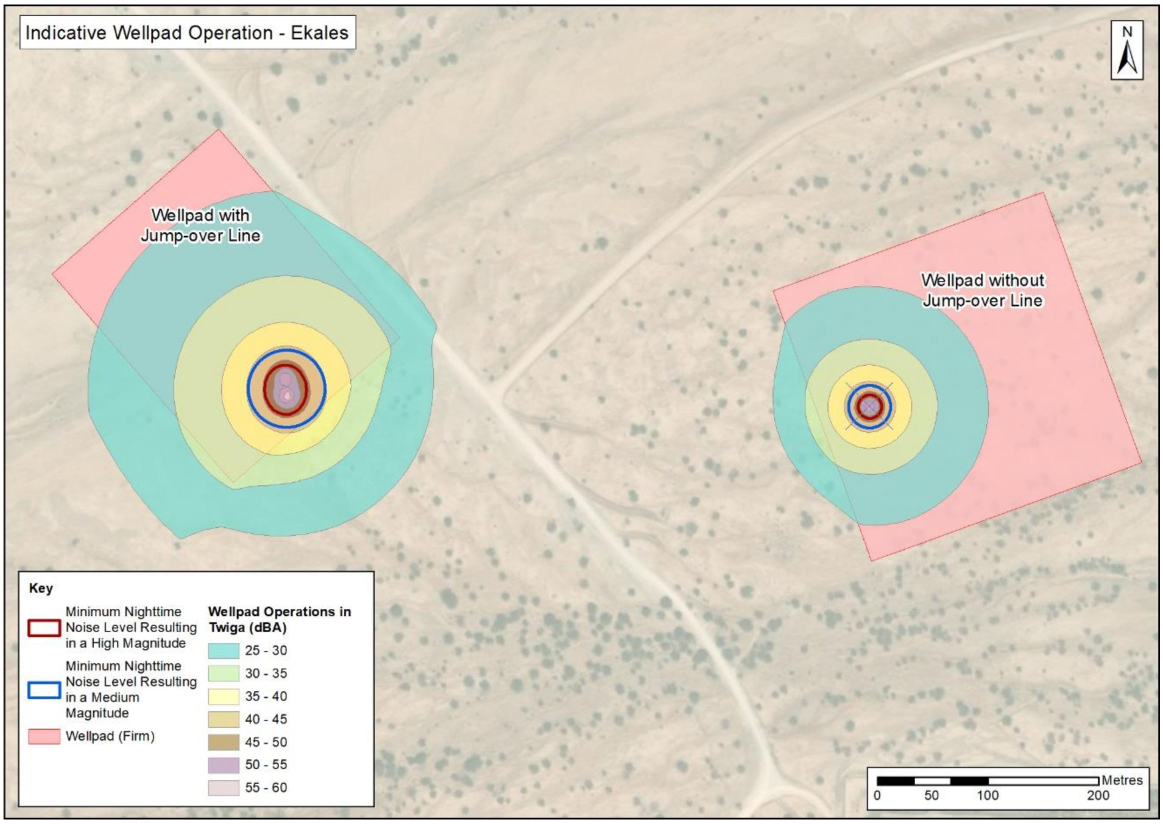

Figure 7.2-10: Indicative wellpad showing high magnitude areas for night-time wellpad operation in Ekales

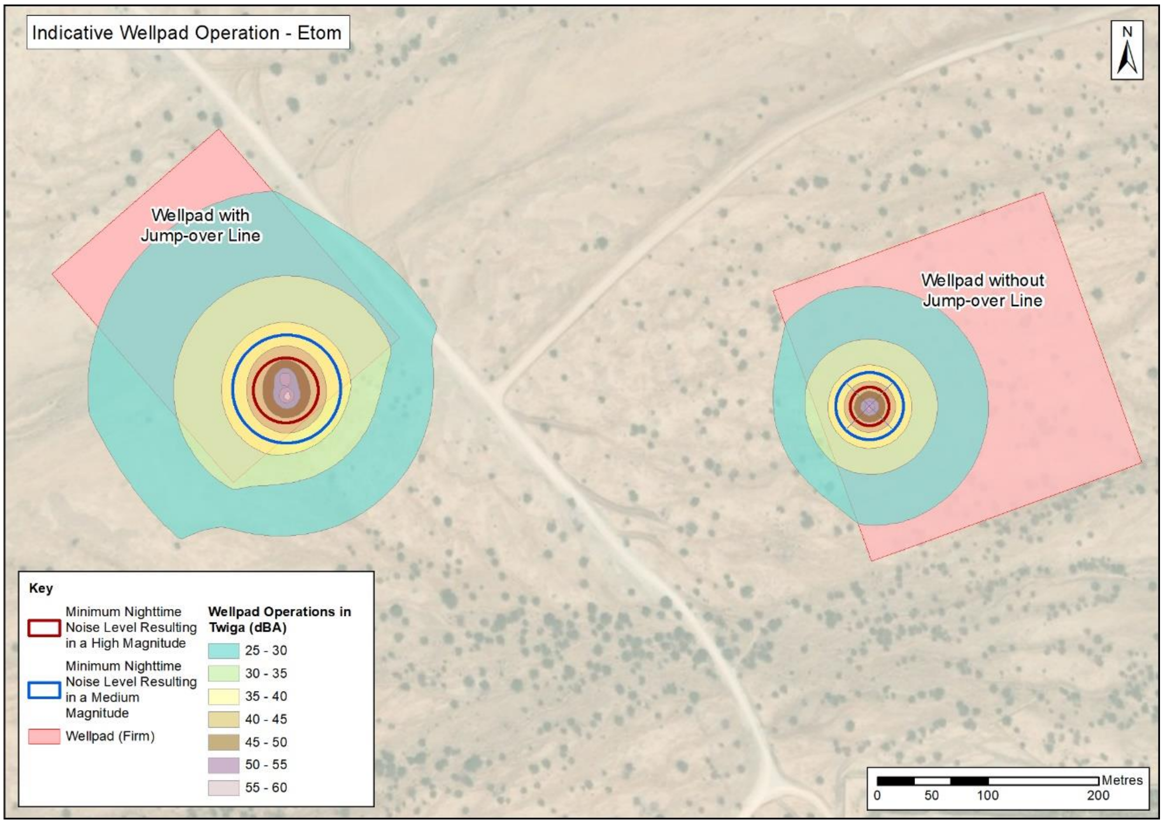

Figure 7.2-11: Indicative wellpad showing high magnitude areas for night-time wellpad operation in Etom

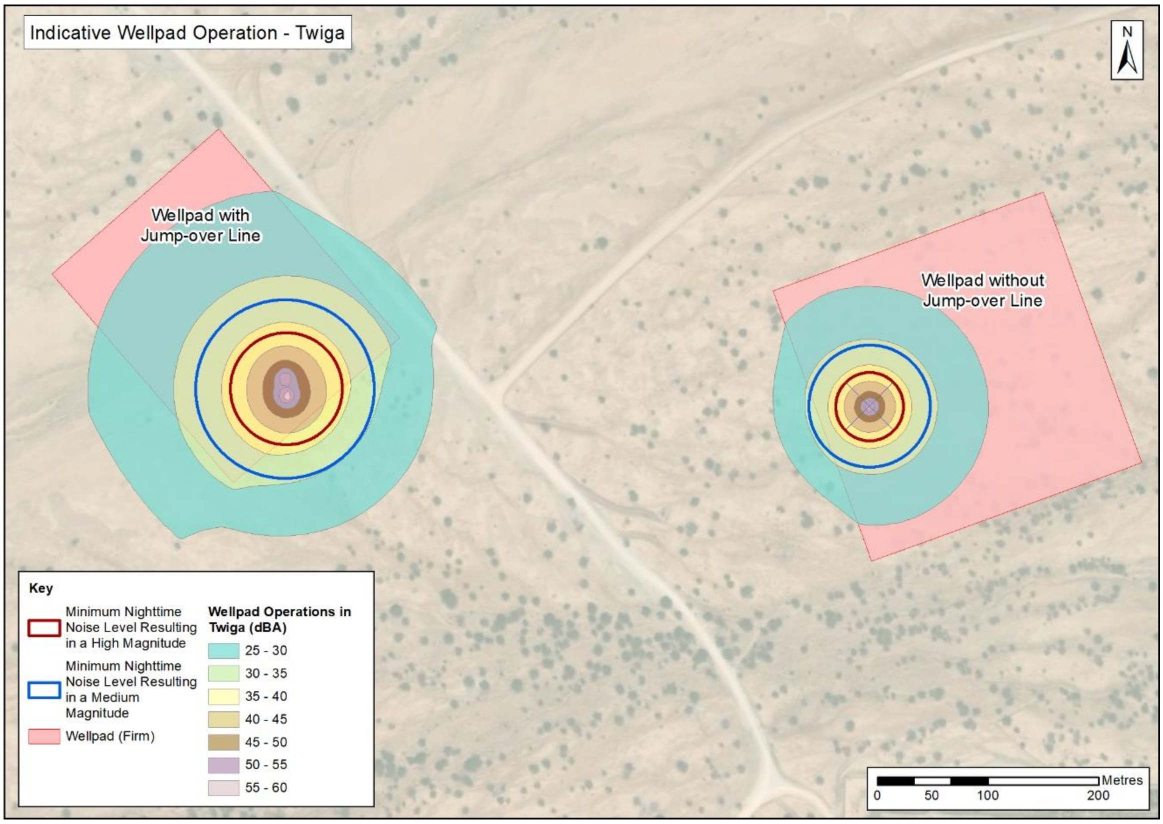

Figure 7.2-12: Indicative wellpad showing high magnitude areas for night-time wellpad operation in Twiga

7.2.9.3.6 Landfill Operations

This scenario considers noise levels from landfill operations, with the results presented in Figure 7.2-13. As the landfill is expected to operate continuously for 24 hours per day, only the night-time criteria has been considered as it provides a more stringent limit. The measured average baseline noise level during the night-time period in Ngamia was 42.0 dBA.

The predicted noise level at the nearest PAP to the landfill is 25 to 30 dBA, which is an impact of negligible magnitude. The maximum predicted noise level outside of the landfill fence-line is 51.0 dBA, which would be a medium magnitude for transient receptors, and therefore a **Moderate** significance. A low magnitude and a minor significance is achieved when the predicted Project noise level is less than 45.3 dBA, which occurs more than approximately 36 m away from the landfill fence-line. Figure 7.2-13 presents the area within which a medium magnitude is expected.

In order to mitigate these impacts, the Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders of the following information:

- In the area surrounding the landfill noise will change due to the Project up to levels similar to a normal conversation at 1 m distance (or quieter) but should not lead to any hearing impairment through sustained exposure.

Communication of this change in noise level during operations in specific areas to local stakeholders will empower them to make informed decisions and deter them from using impacted areas. This combined with quarterly monitoring of the impacted noise levels, to enable the Operator to review monitoring and communication with local stakeholders throughout operations, will reduce the Moderate impact significance to a **Minor** residual impact significance.

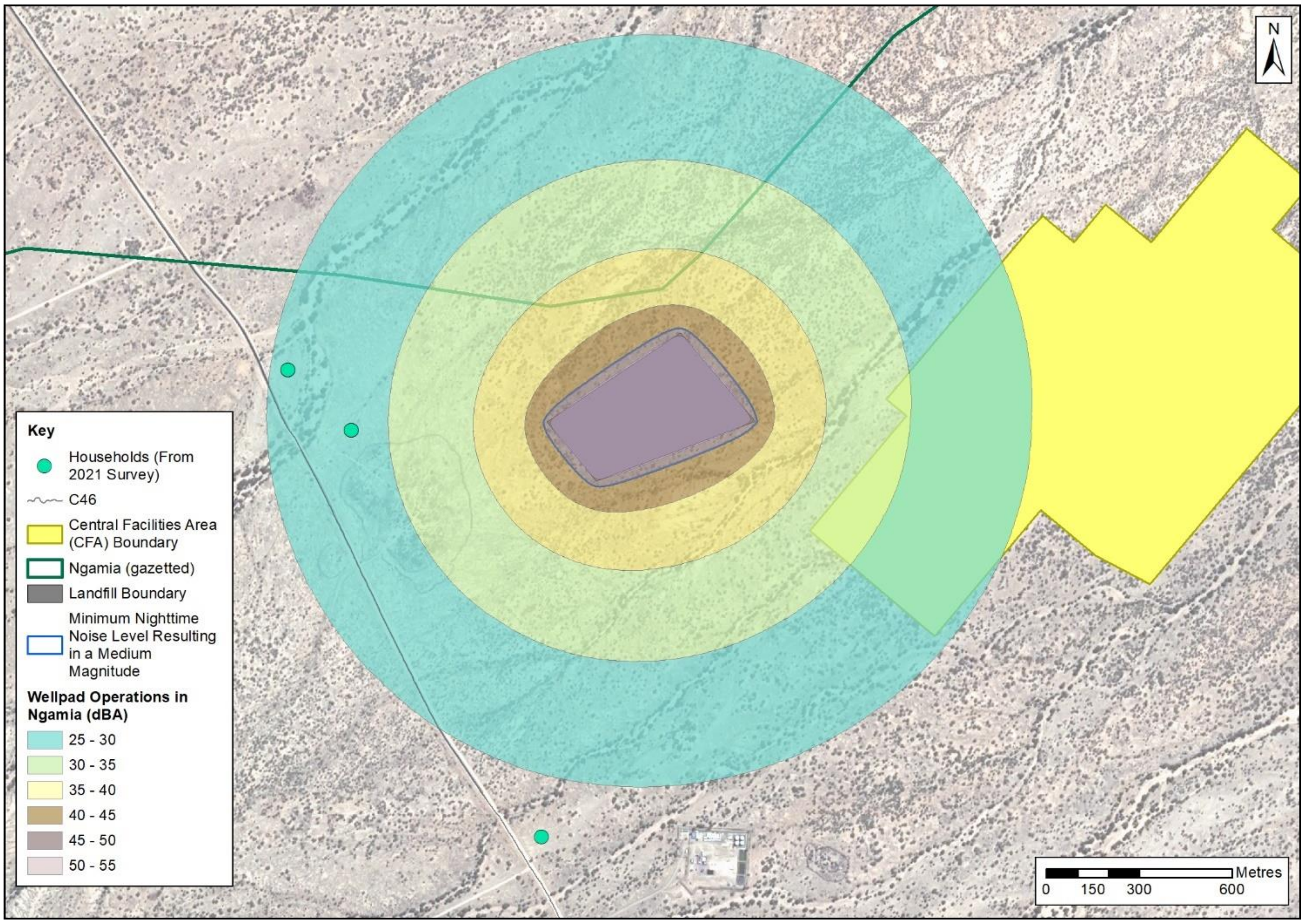

Figure 7.2-13: Predicted Noise Levels During Landfill Operations

Table 7.2-12: Operational Phase Impact Assessment

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Transient Human Receptor (high) within high and medium magnitude area defined in Figure 7.2-7	CFA Operations	Medium – Medium-Term – Temporary	Moderate	The Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders of the following information: ■ In the area surrounding the CFA, wellpads and landfill noise will change due to the Project up to levels similar to a normal conversation at 1 m distance (or quieter) but should not lead to any hearing impairment through sustained exposure. On a quarterly basis, and in response to noise complaints, 24-hour duration noise monitoring will be undertaken at the medium magnitude contour line defined in Figure 7.2-13, using an appropriately calibrated and maintained Class 1 Sound Level Meter. Monitoring will be carried out by trained personnel to confirm noise levels are within the Project Standard (WBG EHS Guidelines). The Environmental Performance Plan will define the actions to be taken and the timeframes in which those actions will be taken e.g review and maintenance of noise source equipment and review of noise abatement measures, should	Low – Medium-Term – Temporary	Minor
Transient Human Receptor (high) within high magnitude area defined in Figure 7.2-8 to Figure 7.2-12	Wellpads in Amosing or Twiga with jump-over lines (AM-01, NG-20, NG-23, EM-03, ET-09, TW-07, AG-03, EK-07)	High – Medium-Term – Temporary	Major		Low – Medium-Term – Temporary	Minor
Transient Human Receptor (high) within medium magnitude area defined in Figure 7.2-8 to Figure 7.2-12	Wellpads in Amosing or Twiga without jump-over lines	Medium – Medium-Term – Temporary	Moderate		Low – Medium-Term – Temporary	Minor
Transient Human Receptor (high) in medium magnitude area	Landfill Operations	Medium – Medium-Term – Temporary	Moderate		Low – Medium-Term – Temporary	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
defined in Figure 7.2-13				exceedances of the Project Standard (WBG EHS Guidelines) be observed.		

7.2.9.4 Decommissioning

The Project has an operational design life of 25 years. At this stage it is not possible to anticipate the situation at that time. However, should any ground disturbance or demolition be required which will result in noise and vibration at least equivalent mitigation measures implemented during the construction phase will be applied during decommissioning. No sources of emissions to noise are anticipated in addition to those already assessed.

7.2.10 Summary of Mitigation

7.2.10.1 Noise

The following additional mitigation was identified:

- The Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders where, when and for how long temporary and permanent noise generating works are taking place and describe any measures adopted to minimise exposure such as limited work hours and phasing of work to limit the impact of noise. Explanations will be provided of other sounds which the noise will be equivalent to e.g. speech, shouting etc.
- Areas to avoid (within the gazetted areas) will be demarcated. Local stakeholders will be informed of the demarcated areas and signage will be installed prior to construction and operations to inform people not to remain in the area for periods greater than 24 hours during construction or settle in the areas during operations. Weekly visual monitoring will be undertaken for the development of any homesteads in the demarcated areas.
- Monitoring will be undertaken during the construction and operational period.
- During construction, there will be an investigation into potential additional monitoring and a review of further controls of receptor movement within the area 0 to 75 m from the perimeter subject to monitoring results.
- Grievances will be recorded and followed-up.

7.2.10.2 Vibration

No mitigation is required for the Project to have a minor impact significance on vibration.

7.2.11 Summary of Residual Impacts

7.2.11.1 Noise

The residual impact significance that results from the combination of receptor importance and predicted impact magnitude is classified as minor to negligible for all impacts except for a moderate residual significance during construction for PAP within the areas of predicted high magnitude (0 to 75 m from the perimeter).

7.3 Water Quantity

7.3.1 Introduction

This section provides an assessment of the potential impacts of the Project on surface and groundwater quantity (i.e., flows, levels and availability to water users); and the potential risk to third parties as a result of changes to flood risk. Impacts have been determined using a qualitative assessment methodology presented in Section 3. Where potential impacts have been identified, these are considered in turn and mitigation are set out where necessary to ensure that any potential impacts are reduced as far as practicable.

7.3.2 Area of Influence

The AoI is presented in Section 3.13. Potential receptors located within the AoI were identified as part of the baseline studies. Receptors that have been carried forward into the assessment are presented in Section 7.3.6.

7.3.3 Receptor Importance

In order to identify the importance of the receptors, the scale of relative importance presented in Table 7.3-1 has been used with reference to the information collated in the baseline to classify the selected receptors.

Table 7.3-1: Criteria for Determining Importance of Receptors

Receptor Importance	Example Receptor Types
Very high	■ Water resources of international importance, high quality, regional or national scale and limited potential for substitution/replacement (not applicable for water resources considered in this ESIA)
High	■ Water resources recognised as being important at a national scale (e.g., strategically important for national water security); ■ Water resources with a high quality, used at a local scale as a water resource and limited potential for substitution/replacement; ■ Water resources with a medium quality and rarity, regional or national scale and limited potential for substitution/replacement; ■ Human water users in the AoI, specifically consumers of shallow groundwater supplies from hand dug wells in dry riverbeds; and/or ■ Humans living in areas at increased flood risk.
Medium	■ Water resources of regional importance; ■ Water resources with a medium quality and rarity, local scale and limited potential for substitution/replacement; and/or ■ Water resources with a low quality and rarity, regional or national scale and limited potential for substitution/replacement.
Low	■ Water resources with limited or no known importance; and/or ■ Water resources with a low quality and rarity.

7.3.4 Magnitude of Impact

The characterisation of the magnitude of the impact considers the description of Project processes and how the Project could result in a change at each of the receptors. The potential for an impact to occur at a receptor has been determined using the understanding of the baseline environment and consideration of whether there is a feasible linkage between a source of the potential impact and each receptor. The magnitude of each potential impact has then been classified between 'negligible' and 'high', as described in Table 7.3-2.

Each potential impact can be either adverse or beneficial to the receptor of interest and vary in its duration (i.e., can be long term, medium or short term and either permanent or temporary). For the purposes of this assessment the following durations apply:

- A short-term impact is defined as up to 66 months (the maximum anticipated construction period);
- A medium-term impact is defined as between 66 months and 25 years (anticipated duration of operations); and
- A long-term impact is defined as one that is predicted to last beyond the end of the operational life of the project (>25 years).

A permanent impact is defined as a change to the baseline that would not reverse itself naturally. A temporary impact is defined as a change to the baseline conditions that would reverse naturally once the source of the impact is exhausted or has stopped.

Potential impacts are also assigned descriptors to identify whether the impact is direct or indirect. For the purposes of this assessment, a direct impact is one that occurs as a direct result of the Project and is likely to occur at the Project itself. Indirect impacts (or secondary/tertiary impacts) are those where a direct impact on one receptor has another knock-on impact on one or more other related receptor(s). Indirect impacts are likely to occur away from the Project, which in the case of this assessment applies to downstream surface watercourses or water bodies and floodplains.

Table 7.3-2: Criteria for Assessing Magnitude of Impact

Magnitude of Impact	Description Criteria	
	Adverse	Beneficial
High	Loss of resource/receptor, loss of quality and integrity of the resource/receptor, severe damage to key characteristics, features or elements (e.g., to water flows, water levels, or the availability of a water resource to water users or to flood risk).	Large scale or major improvement to resource/receptor availability, extensive restoration or enhancement.
Medium	Partial loss of resource/receptor, but not adversely affecting the integrity, partial loss or damage to key characteristics, features or elements (e.g., to water flows, water levels, or the availability of a water resource to water users or to flood risk).	Some benefit to key characteristics, features or parameters describing resource/receptor availability.
Low	Some measurable change in/damage to attributes, quality or vulnerability (e.g., to water flows,	Minor benefit to, or addition of, one or more key characteristics, features

Magnitude of Impact	Description Criteria	
	Adverse	Beneficial
	water levels, or the availability of a water resource to water users or to flood risk). Minor loss of, or alteration to, key characteristics, features or elements.	or parameters describing resource/receptor availability.
Negligible	No, or very minor (immeasurable), change to characteristics, features or parameters describing resource/receptor quality (e.g., water flows, water levels, or the availability of a water resource or to flood risk).	

The definitions applied to resulting negative significance categories for the purposes of this assessment are summarised as follows:

- Major: If adverse, impacts with this significance represent key factors in the decision-making process or the feasibility of the Project. They are generally, but not exclusively, associated with human health or features of international or national importance and/or resources/features that are unique, which, if lost, cannot be replaced or relocated.
- Moderate: If adverse, impacts with this significance may contribute to the decision-making process. These impacts are generally, but not exclusively, expected to be important at a regional or local scale.
- Minor: These impacts may be raised as local issues but are unlikely to be of importance in the decision-making process. Nevertheless, they are of relevance in the detailed design of the Project.
- Negligible: Impacts that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

All beneficial impacts, from minor to major, may contribute to the decision-making process.

7.3.5 Key Guidance and Standards

The Kenyan policy and legislation and the international guidance and standards presented in Section 2.0 are relevant to this assessment. The following are of particular relevance:

- The National Water Policy (2012);
- National Water Masterplan 2030 (2014);
- The Water Act (2016) and subsidiary legislation;
- Climate Change Act (2016);
- The Turkana County Water Act (2019);
- WBG EHS Guidelines (2007);
- WBG EHS Guidelines: Water and Sanitation (2007);
- IFC PS 1 (2012); and
- IFC PS 3 (2012).

7.3.6 Receptors of Interest and Importance

The focus of this assessment is on changes to the quantity of water within the AoI. Baseline environmental information indicates the importance and scarcity of water in the AoI. This emphasis is reflected in the Water Act and other legislation[14].

Using the Project Description and the baseline water environment information presented in Section 6 of this ESIA, the following water environment receptors have been identified as being susceptible to changes in quantity (levels and flows, and therefore availability):

- Surface water in reservoirs, seasonal rivers and the extensive network of ephemeral streams and drainage luggas[15]; and
- Groundwater in shallow aquifers predominantly located along river valleys and the edge of the volcanic deposits and deeper aquifers.

In addition to the receptors that could be impacted by changes in water quantity/availability, this assessment also considers the potential for changes in the water environment to increase erosion and change flood risk that could have an impact on human receptors. Specific water environment receptors that fall within these general categories, and that will be considered in this assessment are presented in Table 7.3-3.

Table 7.3-3: Receptors and Importance

Receptor	Importance	Comment
Kalabata River (Project infrastructure, including wellpads and CFA, located within catchment plus specific locations affected by abstraction during construction)	Medium	An ephemeral watercourse that is fed by direct precipitation, run-off and ephemeral flow from luggas. The Kalabata River feeds into the Kerio River, which ultimately flows into Lake Turkana. Shallow groundwater underlying the Kalabata is used for water supplies.
Seasonal rivers and ephemeral streams/drainage luggas (as identified in the baseline) (Project infrastructure, including wellpads, CFA and infield flow lines, located within seasonal water courses)	Medium	Surface flows in seasonal rivers and luggas are rarely used as a water resource. Limited potential for substitution due to limited surface water resources in Kenya. Shallow groundwater associated with these systems is used for water supplies.
Turkwel Gorge Reservoir (Make-up water to be abstracted from reservoir)	High	Used for power generation through a hydroelectric scheme. Discharge from the turbines provide flow in the Turkwel River.
Shallow groundwater aquifers (Receptor underlies Project infrastructure and could be	High	Shallow groundwater near to the surface, including in river/stream/lugga bed sediments, as a water supply throughout the region with limited potential for substitution. Proximity to the surface and the potential for recharge through sandy soils and superficial

[14] The Water Act also enforces the requirement to have a permit to construct boreholes and wells, that abstraction amounts need to be reasonable, to reduce the potential for water losses and to prevent contamination/pollution of water.

[15] For the purposes of this work, permanent/perennial rivers are those where water is present above ground level all year round. Seasonal/ephemeral watercourses include seasonal rivers, seasonal streams and luggas. Seasonal rivers are the larger watercourses that have temporary flow above the ground surface only during the wet seasons. Seasonal streams also only have flow during the wet seasons but are more minor watercourses. Lugga is the term for the transitory network of drainage channels that direct surface water run-off during intense rainfall events towards the more defined channels. These are typically shallow, migratory and form a wide dendritic network. Seasonal rivers, seasonal stream and luggas may have water below the ground surface in the riverbeds in the dry season that can be exploited as water resources through dug wells in or adjacent to the riverbeds.

Receptor	Importance	Comment
affected by abstraction during construction)		deposits means there are likely to be pathways between activities at the surface and the water supplies provided by these receptors. Shallow groundwater is used as a water supply from hand dug wells in dry riverbeds.
Human water users	High	Local communities rely upon shallow groundwater supplies from hand dug wells in dry riverbeds for watering animals and for human consumption.
Homesteads (indicative of PAP)	High	Homesteads (indicative of PAP) located downstream of the Project infrastructure which could be subject to any changes in flood risk.
Deep groundwater (Receptor underlies Project infrastructure and could be affected by abstraction during construction)	Low	Existing deeper Project boreholes (screened at depths of up to 252 m below ground level); used for Project water and some of which are provided to local communities. Potential for importance as a water supply, but likely to have low quality due to high salinity and yields can be poor. Limited recharge potential from the surface.

Impacts on groundwater levels and changes to surface water flow regimes (including increases to flood risk) have the potential to impact water availability and areas that are habitable. Other receptors could be impacted because of changes in surface water or groundwater quantity/availability that are considered in this assessment include:

- Existing water users – non-human biota (i.e., riparian habitats), which are considered further in context with wider biodiversity issues in Section 7.7.

7.3.7 Sources of Impacts

Potential sources of impact of a range of magnitudes that will occur throughout the life of the Project are set out below by Project phase.

7.3.7.1 Construction Phase

Based on the Project Description and the understanding of the baseline water quantity conditions that has been developed, there are aspects of the Project that have been identified as having the potential to present sources of impact to water quantity (and therefore availability) during the construction phase. The potential sources of impact and routes by which they could impact water quantity are as follows:

- Construction of areas of hardstanding and buildings - potential changes to groundwater recharge.
- Construction activities within river catchments (e.g. vehicle movements, vegetation clearing, channel diversions, topsoil stripping, excavating and storage of excavated materials and construction of bunds/ditches/trenches) – potential changes to drainage patterns, recharge potential, run-off regimes, river flows, erosion patterns and flood risk.
- Construction activities within river channels (e.g. riparian vegetation removal, channel diversions and construction of trenches) – potential changes to channel morphology, surface water flows, erosion patterns and flood risk.

- Construction of subsurface features – potential passive dewatering and/or changes in local groundwater levels and flow patterns.
- Project water requirements – abstraction of early construction phase (months 1 to 22) groundwater will affect water availability for existing groundwater users (via availability of shallow groundwater, including in hand dug wells) and baseflow to luggas.
- Project water requirements – sourcing construction phase water from the Turkwel Gorge Reservoir (months 20 to 22 via bowser and months 22 to 36 via a water pipeline (permitted via a separate ESIA) has the potential to impact on water levels in the Turkwel Gorge Reservoir and other water users dependent on the Turkwel Gorge Reservoir.
- Discharges – discharges/drainage of water, treated effluent and hydrostatic test ('hydrotest') water have the potential to change baseline flows, erosion rates and downstream flood risk.

7.3.7.2 Operational Phase

Based on the Project Description and the understanding of the baseline water quantity conditions (i.e., flows, levels and availability), there are aspects of the Project that have been identified as having the potential to present sources of impact to water quantity during the operational phase. The potential sources of impact and routes by which they could impact water quantity are as follows:

- Project water requirements – sourcing operational water from the Turkwel Gorge Reservoir has the potential to impact on water levels in the Turkwel Gorge Reservoir and other water users dependent on the Turkwel Gorge Reservoir.
- Discharges – discharges/drainage of water or treated effluent during the operational phase have the potential to change baseline flows, erosion rates and downstream flood risk.

Those impacts that were identified as originating in the construction phase but have durations that are predicted to extend into the operation phase, are not re-assessed as part of this stage. Such impacts include the changes to the surface water or groundwater flow regimes or recharge to groundwater as a result of facility construction.

7.3.7.3 Climate Change

Climate change predictions with respect to rainfall, evaporation and flooding can be highly variable. The uncertainty in precipitation projections for Kenya arises from the wide disagreement of different climate models in the projected change in amplitude of future El Niño events. Most climate predictions suggest there will be an increase in temperature and rainfall, and of extreme weather events (i.e., rainfall intensity and droughts).

Temperature increases of up to 2.5˚C are predicted by 2060 (Ministry of Foreign Affairs of the Netherlands, 2018). Projections presented in the UNDP Climate Change Country Profile for Kenya consistently indicate an increase in total annual rainfall over Kenya. In addition, the proportion of rain falling in heavy rainfall events is predicted to increase (McSweeney C., New M. and Lizcano G. 2010). However, other studies predict a potential decrease in future rainfall in Kenya. Funk et al. (2010), for example, predict that large parts of Kenya will experience more than a 100 mm decline in long rains by 2025, linking the reduction in precipitation to changes in circulation patterns over the warming Indian Ocean. Generally, a wetter climate is predicted with more intense wet seasons, and increase in the number of extreme wet days, and less severe droughts during October-November-December and March-April-May.

It is likely that increased rainfall volumes and intensity will result in increased run-off, river flows, erosion and flooding. In the short term, climate change is likely to be less significant. However, climate change during operations has the potential to contribute to impacts on buried aspects of the Project through exposure and damage if the design has not considered climate change within the Project lifetime. This also has the potential for changes in run-off, erosion and flooding to impact facilities located near surface watercourses through erosion damage or inundation by flood waters.

There is uncertainty over predicted changes to river flows as a result of changes in weather patterns linked to forecast climate change. Some climate change models predict a 20% increase in Kenya's river flows by 2030 resulting from extreme runoff during intense rainfall events (Avery S. 2013). Increases in runoff rates would lead to more erosion and flooding.

Changes in the rainfall and run-off regimes could also impact reservoir water levels. Increased rainfall and run-off in the Turkwel Gorge Reservoir catchment could lead to increased water input and higher reservoir levels, but increased temperatures could increase evaporation, which would reduce water levels. If rainfall reduces due to climate change this could also result in reduced reservoir water levels. Water levels in the reservoir are currently around the optimum, but below the maximum, for power generation at the hydroelectric dam. The sides slopes of the reservoir are steep, so there are few other water users (e.g., fishing and water taken for human water supply). If water levels reduce, the power generation capacity would reduce, access could become more difficult if fishing or water extraction for supply is taking place, and Project water security could be affected.

Different groundwater systems are likely to react in different ways to climate change. Shallow aquifers recharged by rainfall and with short residence times will react more quickly to changes in recharge and are likely to be those most affected. If rainfall reduces due to climate change, or changes in rainfall patterns and intensity result in more run-off and less infiltration to ground, climate change could reduce recharge to aquifers and lead to reduced resource availability. This would not necessarily impact the Project because groundwater is only planned to be used in the short term. Deep groundwater is unlikely to be impacted by climate change directly because recharge is already negligible.

7.3.8 Incorporated Environmental Measures

The Project has been designed and planned to incorporate a range of incorporated environmental measures that provide measures to avoid potential impacts or reduce their magnitude, prior to the impact analysis being completed.

The measures presented in this section either relate to design measures or are widely accepted GIP.

7.3.8.1 Design Measures

The following measures are part of the Project design and reduce the potential impact of the Project on water quantity/availability:

- The abstraction point for Project water supply from the Turkwel Gorge Reservoir will be from upstream of the dam, in the reservoir itself. Hence there will be no abstraction from the flow already discharged through the turbines and into the Turkwel River. Therefore, compared to the baseline, will result in no change to the downstream flow regime in the Turkwel River.
- New roads will be designed to manage run-off at rates equivalent to pre-construction and in line with Kenyan water standards – this will mean there will be little change to run-off rate and the surface water flow regime.
- Facility locations and drainage will be designed to redirect surface water flows, including flood flows around wellpads where possible – localised redirection of surface water flows will maintain the water within the same catchment to result in reduced potential disturbance to baseline conditions.
- Uncontaminated surface water from wellpads will be discharged to nearby lugga, and drainage will be designed to minimise downstream flood risk – this will lead to the reduction in unnecessary water loss

through clean water becoming contaminated and the management of discharge rates will reduce the potential change in downstream flood risk.

- Selection of water sources - the initial source of water supply during construction will be from existing boreholes. This will mean no new boreholes will be installed; although abstraction rates at the boreholes will be greater than during baseline conditions. Between month 20 and month 22 during construction, estimated water demand will exceed the water production borehole yield of 1,560 m^3/day, at which point an alternative source will be required to meet the Project water demand prior to water being available from the Turkwel Gorge Reservoir at around month 22. Current indication is that water will be trucked-in from the Turkwel Gorge Reservoir. After 22 months from the start of construction, the water supply will be taken solely from the Turkwel Gorge Reservoir. This will reduce the long-term impacts on the groundwater environment that could result from the long-term abstraction of water from boreholes beyond the initial 22 months.
- Existing roads will be used where possible – avoiding the construction of new roads where existing ones can be used (with or without upgrade) reduces the requirement for unnecessary earth movement and, therefore, the potential to generate suspended solids that could pollute the surface water environment.
- There are no planned abstractions from luggas/streams – these smaller surface watercourses would be sensitive to abstractions. Avoiding taking water from these will mitigate changes to the baseline surface water flow regime in these watercourses.
- Work in ephemeral rivers, smaller streams/luggas will be planned to take place during the dry seasons when no or low flow is anticipated. If unavoidable, flow will be diverted and redirected into the same watercourse further downstream.

7.3.8.2 Good Industry Practice

In addition to the mitigation specified within the Project Description, this section presents accepted good practice that will also be implemented in order to remove or reduce the magnitude of potential impacts.

All Project Phases

- All abstractions from, or discharges to either groundwater or surface water will be within the volumes permitted under licence from NEMA.
- Abstraction and discharge monitoring will be undertaken as stated in the licence – licences will typically specify locations and limits of abstraction volumes or discharge rates. Therefore, by operating within the permitted limits of the licence, the impacts will be managed.

7.3.9 Impact Classification

Taking into account the baseline water environment setting (Section 6.4), the relevant incorporated environmental measures (Section 7.3.8), and the potential sources of impact (Section 7.3.7) determined from the Project Description, the potential source-pathway-receptor impact linkages for the construction and the operational phases are presented in this section.

A discussion regarding feasible impact linkages during each of the Project phases is presented in each of the sub-sections below. Each discussion is followed by a table where the potential sources of impact and relevant additional mitigation applicable to each receptor are summarised.

Where mitigation measures are repeated for different receptors, they are stated as a numbered “Repeated mitigation” in the initial instance and referred back to thereafter.

The determination of impact magnitude is supported by the findings presented in the following documents, all of which are presented in Annex I:

- The Flood Risk Assessment (Worley Parsons, Kenya South Lokichar Foundation Project Flood Risk Assessment, reference KSLFP-0000-EG-STU-0001, dated February 2019);
- Strategic Water Supply for Development, Technical Report 1.1. Sean Avery for Tullow Oil dated 8 October 2015;
- Strategic Water Supply for Development, Internal Paper 10 – Optimum Intake Location at Turkwel Dam, Richard Boak and Sean Avery, dated December 2016;
- Strategic Water Supply for Development – Turkwel Dam Option. The South Lokichar Development and Other Water Demands. An Objective Perspective and Way Forward, Sean Avery, dated October 2018;
- Strategic Water Supply for Development – Turkwel Dam Option. Turkwel Reservoir Hydrology, Sean Avery, dated August 2020; and
- Golder document 1433956.636 - Assessment of the predicted zones of influence of planned groundwater abstractions (Golder, 2019b).

The qualitative assessment of impacts uses the receptor importance (as assigned in 7.3.6), the magnitude of impact and the assessment matrix presented in Section 3.7 to evaluate the environmental impact significance. The direction and timescale of each impact linkage is assigned.

7.3.9.1 Construction Phase

The impact classification process focuses on the potential impacts to water quantity that could result in significant impacts. As such some potential impacts are not considered further in this assessment as there is insufficient linkage between the source of impact and receptors, or the magnitude of this impact would be negligible when taking account of incorporated environmental measures.

The following bullets provides qualitative evaluation of impacts which are not considered for further impact classification:

- The discharge of hydrotest water for the proposed water pipeline and the LLCOP, which has been identified as part of the water demand for the Project from the Turkwel Gorge Reservoir (Section 5), will be assessed under separate ESIAs (one for the water pipeline – pending and one for LLCOP – already completed). This ESIA will address water used in hydrotesting of the infield infrastructure only.
- Construction of areas of hardstanding and buildings could result in reduced infiltration to groundwater. The baseline environment work identified that recharge to deeper groundwater aquifers is limited in the Project area. The greatest recharge of groundwater typically occurs in the upper catchment. There will also be some recharge of shallow alluvial aquifers adjacent to rivers from surface water. The Project will reuse existing infrastructure where possible; thereby reducing the amount of new hardstanding. The area taken up with Project infrastructure is also small compared to the wider water catchment areas. The drainage is being designed to mimic baseline flow patterns and rates, and clean run-off is being kept separate from water affected by Project activities to reduce the amount of water that will be treated. Given this, it is predicted that the impact magnitude will be negligible and the significance of the impact on deep groundwater and shallow groundwater is **Negligible**.
- Construction of subsurface features (e.g., sumps, pits, buried pipelines, foundations and trenches) and the backfilling of features such as trenches once pipework has been laid, has the potential to change hydraulic properties, and groundwater levels and flow regimes. Such changes would be localised, and very small

scale given the proposed depth of excavations. It is predicted that the impact magnitude will be negligible and the significance of the impact on deep groundwater and shallow groundwater is **Negligible**.

- There is potential that changes to drainage regimes within catchments due to construction activities may result in the redistribution of water into different luggas when compared to baseline conditions. However, for localised drainage and luggas, maintaining the natural drainage patterns is part of the design measures. Predicted impact magnitude is therefore assessed as negligible and the impact significance on these receptors is **Negligible**.

The following potential sources of impact are, therefore, the focus of further impact classification:

- Discharges of water from drainage systems and sumps, from sanitation systems, from waste management areas and water from hydrotesting of infield lines, which cannot be discharged to evaporation ponds, could impact natural drainage patterns and increase erosion/flood risk.
- Changes to flood risk due to Project infrastructure and drainage changing flood flow mechanisms in luggas and in run-off regimes.
- Water abstractions from boreholes potentially impacting groundwater levels - water will be needed to supply construction camps, local community supplies and the Project during construction. Water will also be required for drilling, concrete production, dust suppression, and hydrotesting pipelines. The proportions required for each element will vary through the construction period. Initially, all construction phase water will come from existing abstraction boreholes, which already exist although they may not be currently operational (i.e., no new wells will be required). The number of operational boreholes and the volume abstracted will increase compared to baseline abstractions (i.e., existing boreholes that are currently not in use will be brought into use).
- Water abstraction from the Turkwel Gorge Reservoir potentially impacting surface water levels - from 22 months into the construction phase, from which point water supply for the Project will no longer come from groundwater boreholes; and
- Changes in flow regimes due to work in or near water courses - changes to drainage patterns and run-off regimes resulting in changes to which watercourses receive the run-off and the volumes of run-off to watercourses. Construction activities in watercourses themselves also have the potential to alter existing river flows, erosion patterns and flood risk through temporary works, diversion or damming.

The impact assessment is discussed in more detail in the sub-sections below. The construction phase impact classification is presented in Table 7.3-5. Any additional mitigation is also presented in that table.

7.3.9.1.1 Changes in Groundwater Levels Due to Water Abstractions from Wells

The conceptual understanding of groundwater in the AoI is that there can be groundwater in near surface aquifers (typically alluvial/colluvial deposits and near surface volcanics) and deep aquifers (typically in the igneous bedrock). During exploration activities, many wells in Plio-Holocene sediments and in the basaltic lava layers of the Auwerwer Volcanics were proven to bear little water. Most water was struck in the interflow sediments between the lavas (Avery, 2016). Strata in the Lokichar basin are known to be highly variable in thickness and extent, so the presence, lateral extent and thickness of aquifer units, and layers that might provide hydraulic barriers to flow, is difficult to predict.

The proposed Project abstraction wells have screens at various depths in order to target groundwater. Most have more than one screened section. Some screened sections are in an igneous unit that is over 75 m below ground level (bgl) and others are in more sandy deposits in the top 16 m to 40 m bgl. It is possible that the deeper groundwater is present in discrete lenses or units of varying areal extent. If these are hydraulically separate from each other, changes to water levels in one aquifer unit would not necessarily affect another (e.g., abstraction from a deeper aquifer might not result in changes in groundwater levels in a shallow aquifer in the same location, and vice versa).

The geological information available for some of the wells suggests that there is a 4 m to 10 m thick clayey layer present that could restrict vertical hydraulic connection between some water bearing strata at different depths in the same area. In addition, the water strikes when drilling the boreholes were often 50 m to 100 m or more bgl, but the resting water level in the installed well were much closer to the surface, which in combination with the conceptual understanding of the hydrogeology of the area suggests the deeper water bearing units may be confined. However, some boreholes such as East Lokichar and Ngamia East have one of their screened sections in nearer surface sandy deposits (i.e., top 20 m). The fact that descriptive drilling logs are not available for all boreholes, the fact the geology is highly variable, and the absence of near-surface monitoring wells means that it is not currently possible to conclusively state that the separate water bearing units at the abstraction wells are not hydraulically connected. On this basis, this assessment has been completed on the assumption that both deep and shallow aquifers could be hydraulically connected.

In order to identify areas where drawdown (i.e., lowering) of groundwater levels due to abstraction would impact groundwater availability (including the availability of shallow groundwater in seasonal dug wells) Golder has completed predictive work (Annex I – document 1433956.636) to estimate the potential distance from 18 months[16] of pumping at the proposed groundwater abstraction rates to show where groundwater lowering can be expected, i.e., the radius of influence. The results are presented in Table 7.3-4 and the predicted radii of influence are shown in Figure 7.3-1.

It is understood that the proposed water demand (1,560 m^3/day) from the wells is enough to cover the construction need and continue providing the volume already supplied to local water users (Figure 5.4-4). The modelling of 18-months of pumping[17] predicts that the indicative radius of influence for Nakukulas 9 and Nakukulas 10 is estimated to be between 2,500 m (specific yield of 0.1) and 5,600 m (specific yield of 0.02 – sensitivity analysis). The information known about the Ngamia East well suggests that similar hydrogeological conditions to the Kengomo wells are present; therefore, an indicative radius of influence between 500 m and 750 m is inferred. The impact is predicted to extend up to 1,150 m from the wells in the case of East Lokichar WBHC.

Abstraction for 18 months is predicted to lower groundwater levels at the wells themselves by up to 84 m; this then reduces to no drawdown at the maximum extent of the radius of influence, creating a cone of depression of the groundwater around the abstraction borehole.

Based on the calculations undertaken to determine the above impacts, it is considered likely that any abstractions within 200 m of any of the abstraction wells could be derogated as a result of abstraction from the Project wells. The most significant combination of drawdown and radius of influence is at Kengomo 1 where a drawdown of 5 m is estimated at a distance of 200 m by considering a logarithmic drawdown relationship between the estimated pumping well drawdown of 35 m and radius of influence of 460 m.

Whilst it is understood that it is likely that groundwater at depth will be present in discrete unit, there is insufficient data exist to indicate whether the targeted groundwaters form discrete aquifer units or act as one, and there is no information to confirm or reject the possibility that there could be hydraulic connection between groundwater in the screened strata and groundwater in the near surface. Therefore, is has been assumed that drawdown in water bearing units at depth would also be experienced at surface in response to pumping. Consequently,

[16] Groundwater abstraction will occur for 22 months, however the results presented here for 18 months of groundwater abstraction, are provided as indicative. As they lead to further hydrogeological characterisation as part of the mitigation, these studies have not been revisited since the groundwater abstraction period increased form 18 months to 22 months.

[17] Groundwater abstraction will occur for 22 months, however the results presented here for 18 months of groundwater abstraction, are provided as indicative. As they lead to further hydrogeological characterisation as part of the mitigation, these studies have not been revisited since the groundwater abstraction period increased form 18 months to 22 months.

surface watercourses in the radii of influence that are reliant on shallow groundwater for baseflow and surficial habitats reliant on shallow groundwater could be impacted by the groundwater abstraction if groundwater levels are drawn down to a level below which they can still provide input to surface water. This could also mean that water normally present in shallow groundwater in the riverbeds (even when the surface water is not flowing) might also be lowered, which could impact those who use water from shallow hand dug wells.

Table 7.3-4: Proposed Distribution of Abstraction Rates and Estimated Radius of Influence (based on 18 month abstraction).

Well Name	Proposed Average Abstraction Rate (m^3/d)	Estimated Radius of Influence (m) Based on Pumping Test Data	Sensitivity Analysis on Radius of Influence (m) Based on Literature Value of Specific Yield [(b)]
Kengomo 1	130	460	610
Kengomo 2	100	140	710
Nakukulas 9 [(a)]	200	No data available	
Kaeng'akalalio C	90	70	150
Nabolei	90	210	470
Ngamia East [(b)]	240	No data available (estimated to be greater than East Lokichar WBHC)	
Nakukulas 10 [(b)]	170	No data available (estimated to be greater than East Lokichar WBHC)	
East Lokichar WBHC	170	520	1,150
Ekunyuk	180	83	420
Ewoi	190	200	450
TOTAL	**1,560[(c)]**	**n/a**	**n/a**

a) For the three wells that pumping test data has not been available a qualitative methodology has been applied in order to provide an indicative radius of influence.
b) Due to lack of confidence in the specific yield value estimated using field data, conservative sensitivity analyses have been completed using literature values for specific yield
c) Total proposed average abstraction rate is 1,543 m^3/d (Section 5.4.6.1). Total provided here is the sum of estimated average from each well, presented here to provide an estimate of distribution of abstraction rates.

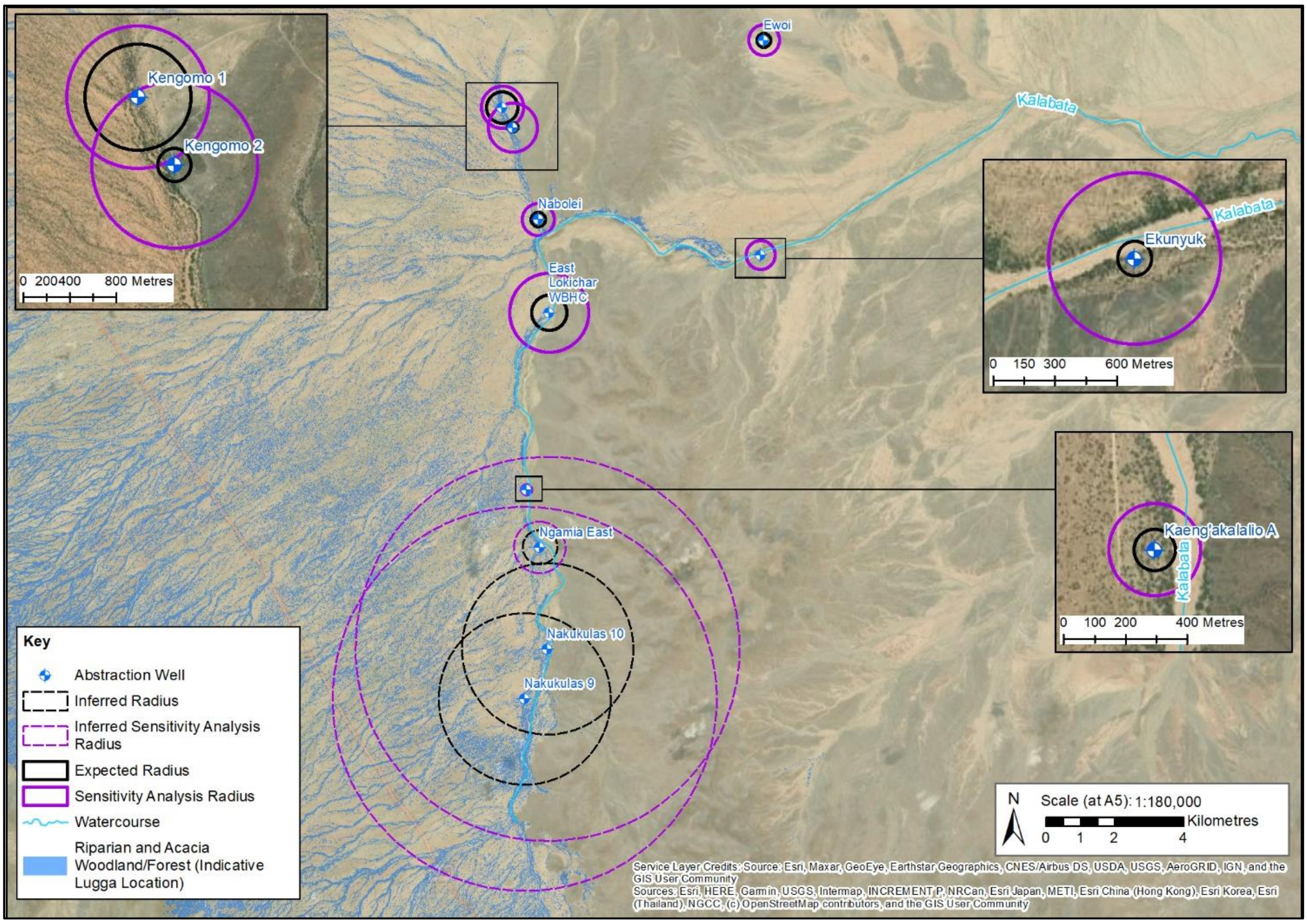

Figure 7.3-1: Indicative Radii of Influence After 18 Months Abstraction

Figure 7.3-1 presents indicative locations of luggas by mapping the riparian vegetation along the luggas. The figure shows that there is a network of luggas located within the radii of influence of the abstraction boreholes. The shallow groundwater provides a resource to riparian habitats (assessed further in Section 7.7) and human water users.

Homesteads identified during the 2018 survey (further described in the Land baseline in Section 6.9), and water users identified during the hydrocensus in April 2021, are shown in Figure 7.3-2. *Ad hoc* field observations in the field and the hydrocensus in 2021 indicate that hand dug wells tend to be dug in the larger luggas, as the shallow groundwater is more likely to be encountered there. Figure 7.3-2 shows the sections of the larger luggas (in orange) which will be potentially impacted by groundwater abstraction, within which hand dugs are most likely to be located. Three hand dug wells, identified during the hydrocensus in 2021, are located within areas where drawdown due to groundwater abstraction would lower shallow groundwater to a level likely to be inaccessible by hand dug wells:

- One hand dug well within the section potentially affected by abstraction from Nabolei;
- One hand dug well within the section potentially affected by the combined abstraction from Kaeng'akalalio A and Nakukulas 10; and
- One hand dug well within the section potentially affected by the combined abstraction from the Nakukulas 9 and Nakukulas 10.

Hand dug wells are temporary water resources, the observations during the hydrocensus in 2021 provide an indication for where hand dug wells will be located in the future, as does the proximity of households, identified in the 2021 survey (Figure 7.3-2), to the larger luggas affected by drawdown.

In addition, there were four hand pump water supplies (Figure 7.3-2) identified in the 2021 hydrocensus which are located adjacent to the larger luggas, which could have yields diminished or water supply temporarily removed due to groundwater abstraction.

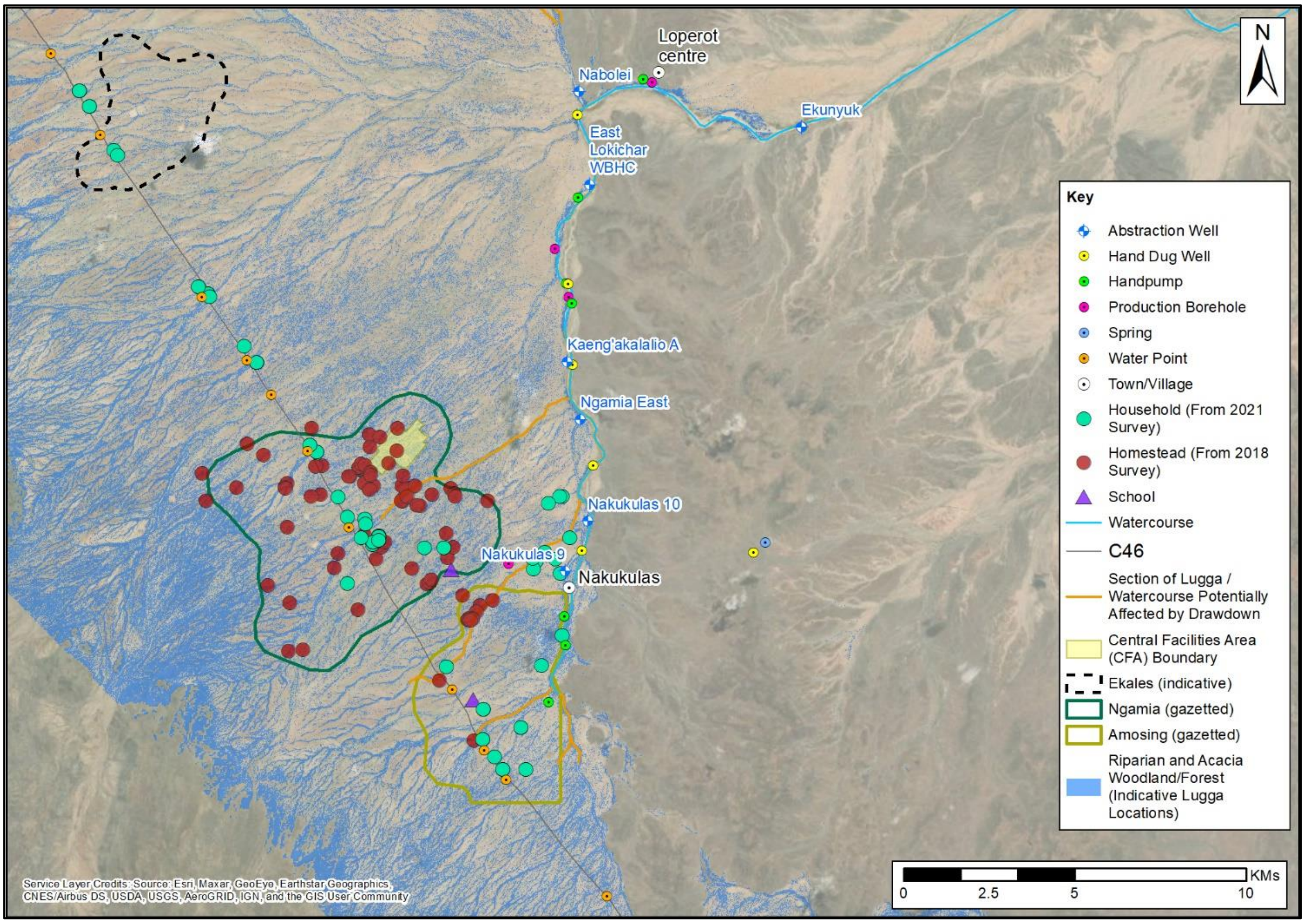

Figure 7.3-2: Potentially Impacted Sections of Watercourses and Major Luggas After a Simulated 18-Month Abstraction

Although local communities rely on water supplies provided by the Operator from community water points, people do also use shallow groundwater in hand dug wells as other water supply sources. These sources, and the users, have the potential to be impacted by a lowering of groundwater levels because water may become less available or inaccessible.

Without any mitigation, the estimated drawdown is predicted to be measurable and could result in full or partial loss of a resource within the radius of influence. Therefore, the impact magnitude is predicted to be high (adverse). The impact to groundwater will be direct and the impact to surface water will be indirect. The associated impact significance on surface water in seasonal rivers/ephemeral streams/luggas within the radius of influence is **Negligible** as all the watercourses are ephemeral and only flow during extreme events**.** The assessment assumes there is hydraulic connectivity between the shallow and deep aquifers, so that abstractions from strata at depth could impact water levels and availability in both deep and shallow aquifers. The impact significance on shallow groundwater is **Major**. The impact significance on users of the shallow groundwater (i.e., hand dug wells and potentially hand pump wells users is **Major**. This impact is a potential source of impact to habitats (discussed further in Section 7.7, including mitigation measures for sensitive receptors including Turkana toad and an undescribed beetle). The impact significance on deep groundwater is **Minor**. The impact will be temporary and short term because pumping for the Project will cease after 22 months, and groundwater levels should rebound over time.

7.3.9.1.2 Mitigation

The extent of the radius of influence could be reduced by reducing abstraction rates. In order to do this, a lower water demand or alternative supplies would be needed. However, the Project water requirement during the initial period of construction cannot be reduced. However, the Operator will seek to minimise construction-phase water demand as part of the FEED process and the Operator will ensure continuity of water supply to water users affected by the abstraction of groundwater during the construction phase, and for the duration of the effect. The Operator will implement an abstraction strategy to minimise the effect on sensitive natural receptors (i.e. critical habitat) and water users by prioritising the wells used to provide construction water supply.

This strategy would be informed by further investigation to characterise the hydrogeological system from which water will be abstracted and to identify the receptors which will be impacted. Therefore the Operator will develop a hydraulic testing plan and undertake a further hydrogeological investigation (**Repeated Mitigation – Water Quantity 01 - Further Hydrogeological Investigation)** to evaluate existing data for community and project abstraction wells within the potentially affected area prior to commencement of construction-phase water abstraction to understand if, and to what degree, hydraulic connectivity exists between the hydrogeological units used for Project water supply and the shallow aquifers used for community water supply. The hydrogeological investigation will include the following:

- Pump testing in abstraction wells which have not been previously tested (Ngamia East, Nakukulas 9, Nakukulas 10). Testing will comprise both constant rate tests and step-tests. Step tests should include a minimum of four steps, with each step lasting a least 100 minutes.
- Pump testing will be undertaken towards the end of a dry season and in accordance with the International Standard for Hydrometric Determinations – Pumping Tests for Water Wells (BSI, 2006).
- Full-scale constant rate pump tests (at 100% of abstraction volume) will be undertaken at Ngamia East, Nakukulas 9, Nakukulas 10, Kengomo 1 and Kengomo 2. Each well will be tested individually for a 24-hour period, and all wells will be tested in combination for a minimum of a 72-hour period.
- During pump testing, water quality (pH, temperature, EC, major ions, bacteria) will be monitored on a 12-hour basis to indicate any change which may be related to hydraulic stresses induced by pumping. Abstracted water will be discharged down-gradient of the abstraction point.

Thereafter, the Operator will develop a conceptual hydrogeological model for the section of the Kalabata catchment where the potential for groundwater draw-down impacts have been identified. Prior to construction, data will be evaluated to identify any evidence of hydraulic connectivity (draw-down and/or changes in water chemistry) between shallow aquifers used for community water supply and deep aquifers used for the supply of construction activities.

Prior to construction, The Operator will install a network of shallow groundwater monitoring wells (**Repeated Mitigation – Water Quantity 02 - Groundwater Level Monitoring**) to continuously monitor water levels. In addition to existing monitoring locations, water levels will be monitored in at least two monitoring boreholes within the identified potential radius of influence of each construction-phase abstraction well. Where no suitable existing well exists, new monitoring boreholes will be installed. Monitoring boreholes will be spaced at different distances from the abstraction well to allow characterisation of the cone of depression.

Water levels will be monitored throughout construction and for a period of at least 12 months after the later of i) water levels rising above the action level and ii) the cessation of groundwater abstraction for construction water supply by the Project. Water level data will be disclosed publicly.

Monitoring data and data from the hydrogeological investigations will be used to revise the conceptual hydrogeological model (**Repeated Mitigation – Water Quantity 03 - Conceptual Model and Trigger Levels**). The Operator Environmental Performance Plan will define the water levels (including consideration for natural seasonal fluctuations) below which detailed monitoring by the Project will be undertaken on a weekly basis to determine if water levels have reduced sufficiently to threaten continuity of supply (action level). The action levels will be determined such that action to provide alternative water supplies is undertaken prior to the supply of shallow water resources being affected. The objective is to ensure continuity of supply for local water users within the potentially affected area of the Kalabata catchment.

Following the hydrogeological investigations and re-evaluation of the radii of influence of groundwater abstraction, but prior to construction, in order to mitigate impacts to water users, the Operator will complete **Repeated Mitigation – Water Quantity 05 - Monitoring Shallow Groundwater Used by Humans**:

- Further hydrocensuses to establish hand dug well water users in areas predicted as impacted by groundwater abstraction;
- manual measurements at hand-dug wells within the radii of influence of each construction-phase abstraction well. A monthly photolog of the hand-dug wells used for monitoring will also be prepared.
- If water levels do fall below the action level (**Repeated Mitigation – Water Quantity 03 - Conceptual Model and Trigger Levels**), the Operator will then implement its contingency water supply plans to provide alternative water supplies for human water users for the duration of the impact.
- The Stakeholder Engagement Plan will provide detailed procedures for communicating to existing local water users within the predicted impacted area to identify alternative sources of water e.g., bowser from Turkwel Reservoir Dam, or from alternative water supply points and to help PAP understand that hand dug wells in luggas in the zones identified may not be able to be used during the period of the impact and alternative supplies may be needed.

In addition and relating to mitigation presented in more detail in Section 7.7, In parallel with groundwater monitoring, an additional biodiversity survey (**Repeated Mitigation – Water Quantity 04 - Biological Monitoring**) within the potentially affected area of the Kalabata catchment, will be undertaken (at least one June survey before construction) to identify the presence (or otherwise) of the Turkana toad and previously undescribed beetle. Based on that data, critical habitat mapping will be revised, future biological monitoring will be evaluated, and sensitivities related to groundwater levels will be evaluated and included in consideration of action levels and associated water supply mitigations to avoid long term stress of potential critical habitat, e.g., targeted irrigation during the impacted period.

7.3.9.1.3 Residual Impact

Taking into account the above mitigations, the predicted magnitude of residual impact to the water environment in the Kalabata catchment, water users and habitats in the area affected by the construction water abstraction, would be low, resulting in a **Minor** residual impact significance on seasonal rivers/ephemeral streams/luggas, shallow groundwater and water users.

7.3.9.1.4 Water Discharges

Without mitigation, discharges of water or treated effluent to existing watercourses (including that from pipeline hydrostatic testing) could result in changes to drainage regimes, erosion patterns and downstream flood risk; particularly to watercourses with little baseline flow, or long periods of no baseline flow (i.e., ephemeral streams and the local drainage lugga network). Hydrotesting of equipment and pipelines involves pressure testing with water to detect leaks and verify equipment and pipeline integrity. Hydrotesting typically occurs during pre-commissioning. Pipelines are filled with hydrotest water, which is then raised to greater than operating pressure, allowing infrastructure to be assessed in terms of its structural integrity.

The impact magnitude without mitigation is predicted to be direct medium (negative), short term, and temporary because they can be reversed if discharges cease. The impact significance to ephemeral streams and the lugga network is **Minor**.

7.3.9.1.5 Mitigation

The incorporated mitigation measures mean that discharge locations and rates will be controlled through GIP (i.e., undertaken under a valid effluent discharge license issued by NEMA).

In addition, the Operator Environmental Performance Plan will define all procedures relating to the management of hydrotest water, including:

- Procedures relating to abstraction, use, storage, and disposal of water used during hydrotest of pipelines and how water reuse will be maximised, including:
  - The same hydrotest water should be used for tests on multiple sections if practicable. Treatment/filtering may be required to make sure the test water is suitable for re-use in the next section of pipe.
  - Once the final testing has been completed, further water reuse should also be considered.
  - Re-use will be maximised. Before re-use, water should first be collected, tested and treated if required. Depending on the quality of the water, reuse could include grey water for toilets, floor washing water, vehicle washing, dust suppression, or cleaning of construction equipment.
  - Reuse, or storage before disposal, may require holding a facility (e.g., pond or tank). Losses (e.g., evaporation or leaks) from such facilities should be minimised.
- Evaporation will be used to dispose of hydrotest water. Evaporation ponds will be constructed using the following:
  - Lined with an impermeable liner;
  - Fenced to prevent intrusion by people, livestock and wildlife;
  - Constructed to prevent any failure during a flood event (up to 100-year return period);
  - Any evaporite remaining will be packaged up with the liner and disposed of as part of the Operator Waste Management Plan.
- However, although unplanned, in the event that discharge into the surrounding environment occurs, the following will be applied relating to water quantity (further consideration are in Section 7.4 relating to water quality):
  - Appropriate approval under the appropriate Kenyan permitting regime; any wastewater disposal should be undertaken with cognisance of Kenya legislation and the nature of the receiving environment;
  - Discharge location selection and rates should be managed to limit the potential for increased erosion or flooding (i.e., at a controlled rate and use of erosion control measures);

- Discharges will be monitored. A discharge method statement and monitoring programme will be developed.

7.3.9.1.6 Residual Impact

Including the incorporated and additional mitigation, the predicted impact magnitude on ephemeral streams and the lugga drainage network is considered to be reduced to negligible and the impact significance on these receptors is **Negligible**.

7.3.9.1.7 Changes to Flow Regimes Due to Work in or Near Water Courses

The upstream infrastructure and flowline development will involve construction across and within luggas. Flowlines and other infrastructure will be installed across luggas by trenching and backfilling. Figure 7.3-3 presents a representation of lugga locations in the Kalabata catchment and where main luggas will be affected directly by permanent project infrastructure (CFA and wellpads only) and therefore where mitigation will be required to ensure maintenance of surface water conveyance and recharge to shallow groundwater downstream of infrastructure.

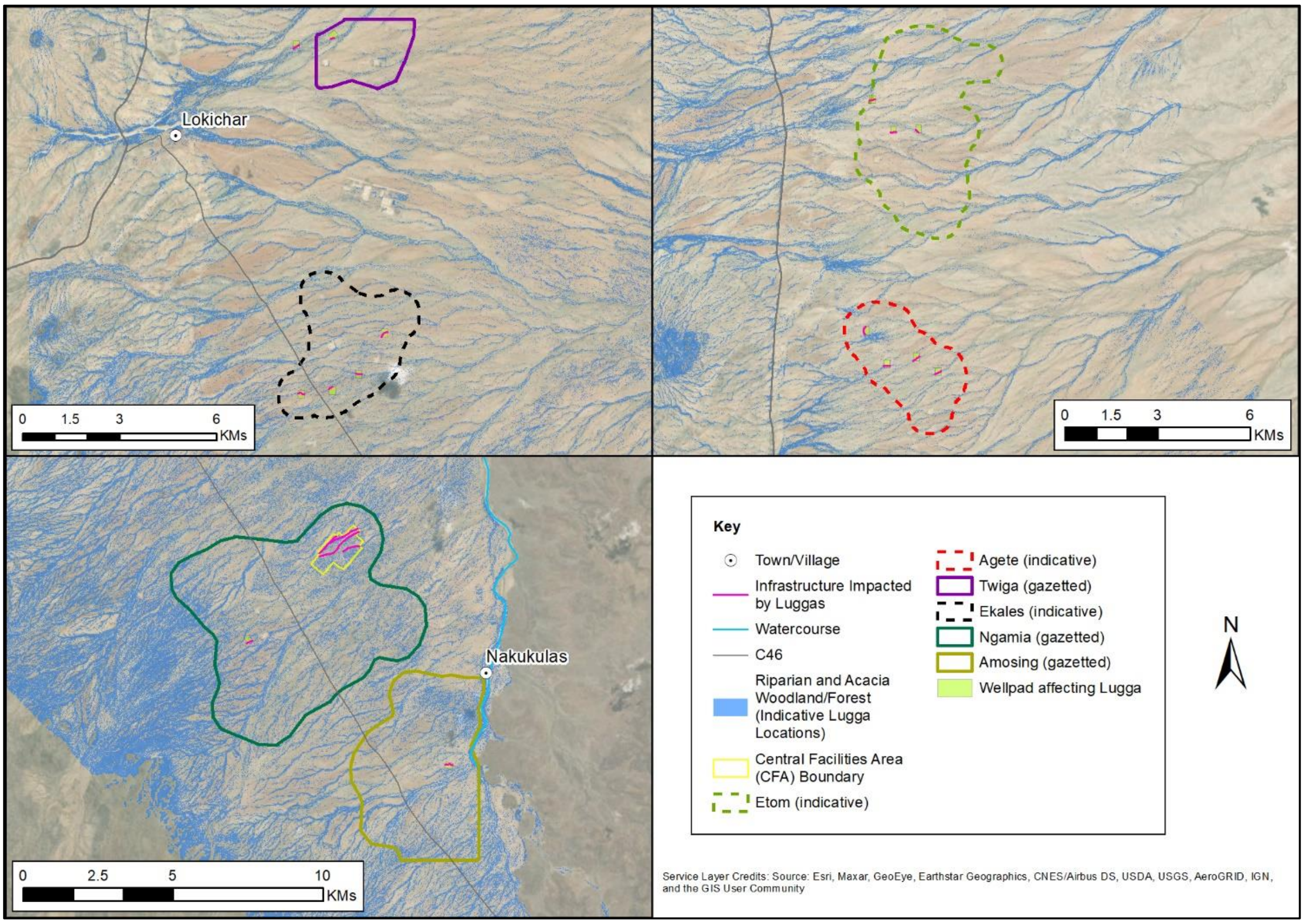

Figure 7.3-3: Project Infrastructure and Potential Direct Impacts on Luggas

Incorporated mitigation describes that work in ephemeral rivers, smaller streams/luggas and wetlands will be planned to take place during the dry seasons when no flow is anticipated to reduce the potential for changing the surface water flow regime in the channel. However, due to the length of construction time and the nature of construction, it is likely that some localised flows will be affected.

If flows are present in luggas during works, they could be affected by works to construct infrastructure and to install flowlines. Flows could be partially or completely blocked or diverted to different watercourses. Where infrastructure will remain in the luggas permanently, the function of the lugga may be lost, affecting flows downstream and reducing recharge to shallow aquifers downstream. Flowline pipework will be buried, and the working method is anticipated to be trenching and backfill. During trenching, flows could be partially or completely blocked or diverted to different watercourses. If the channel is not reinstated after the trenching is completed, the luggas would be permanently lost. The predicted impact magnitude for infrastructure and flowlines is considered to be direct medium (negative) and the impact significance on Seasonal rivers/streams is Minor and on shallow aquifers and downstream water users is **Moderate**.

7.3.9.1.8 Mitigation

The Operator Environmental Performance Plan will include procedures to prevent changes to flow regimes in watercourses due to construction activities.

The EPC contractor will complete pre-construction surveys to identify potential locations where construction activities could have an impact on lugga drainage patterns. In identified areas, drainage channels and ditches will be designed to limit changes to natural flow ranges and reduce the potential for flood risk.

Temporary erosion control measures will be installed in such a way that regulates flow in line with natural variation. The amount of time trenches or other excavations will be open will be minimised.

Work on ephemeral rivers, smaller streams/luggas will be planned to take place during the dry seasons when no flow is anticipated. If unavoidable, flow will be diverted and redirected into same watercourse further downstream. A dynamic risk assessment (completed within a reasonable period before works commence and updated regularly) will be completed by the EPC contractor, on an individual case basis.

Where the lugga will be lost due to the presence of Project infrastructure within the watercourse, a suitable e.g. (constructed to convey up to 100-year return period flows) permanent diversion will be put in place to redirect water further downstream in the same watercourse, or to another watercourse in the same catchment.

Monitoring (channel morphology) will be completed throughout construction and one year after construction with further inspections following any extreme rainfall/flood events (1 in 30-year return period flows). This will confirm whether sediment transport and erosion patterns have not been adversely altered. Maintenance activities and actions for management, if there are issues, will be outlined in the Operator Environmental Performance Plan.

In addition, measures will be taken to identify hand dug well users in the temporarily affected recharge zone downstream on lugga interventions, to monitor water levels and availability, and provide contingency water supply if required, which will be appropriately communicated to water users in affected areas (**Repeated Mitigation – Water Quantity 05 – Monitoring).**

7.3.9.1.9 Residual Impact

Taking into account the additional mitigation, the potential residual impact on water users downstream of proposed infrastructure, smaller seasonal rivers, streams and local drainage luggas due to construction of infrastructure and flowlines is predicted to be low, resulting in a **Minor** residual impact significance.

7.3.9.1.10 Changes in Flood Risk

The Worley Parsons Flood Risk Assessment (Annex I) focussed on flood risk to the Project infrastructure at Amosing and Ngamia, however the flood model outputs (1 in 100-year return period event) have also been used to assess the potential change in flood risk to third parties (homesteads). Figure 7.3-4 and Figure 7.3-5 present estimated flood depths with the Project infrastructure in place and incorporated flood mitigation applied.

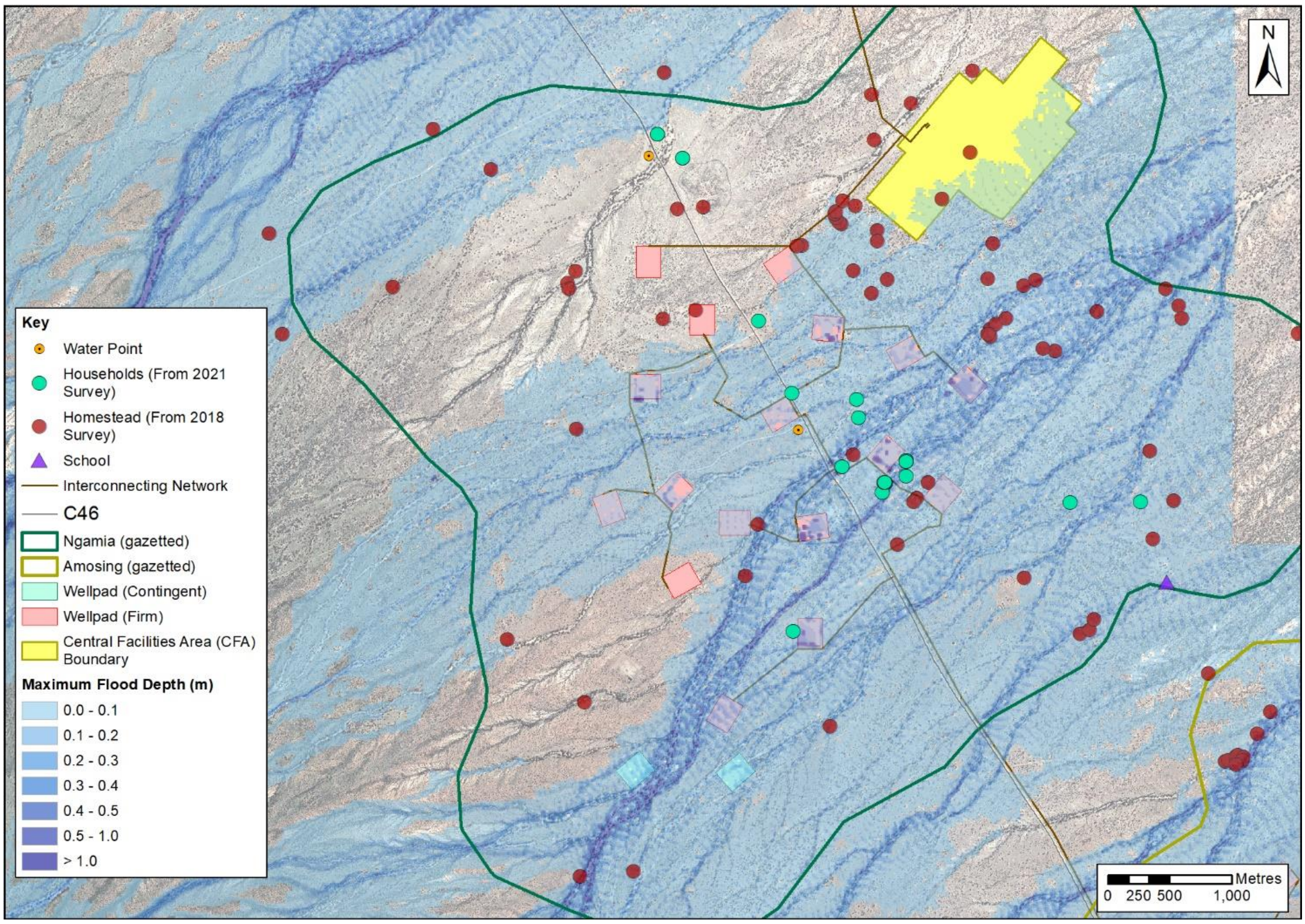

Figure 7.3-4: 1 in 100-Year Return Period Flood Model Output Around Ngamia and the CFA with Flood Mitigation for 2019 Layout Applied (Source: Worley Parsons, 2019)

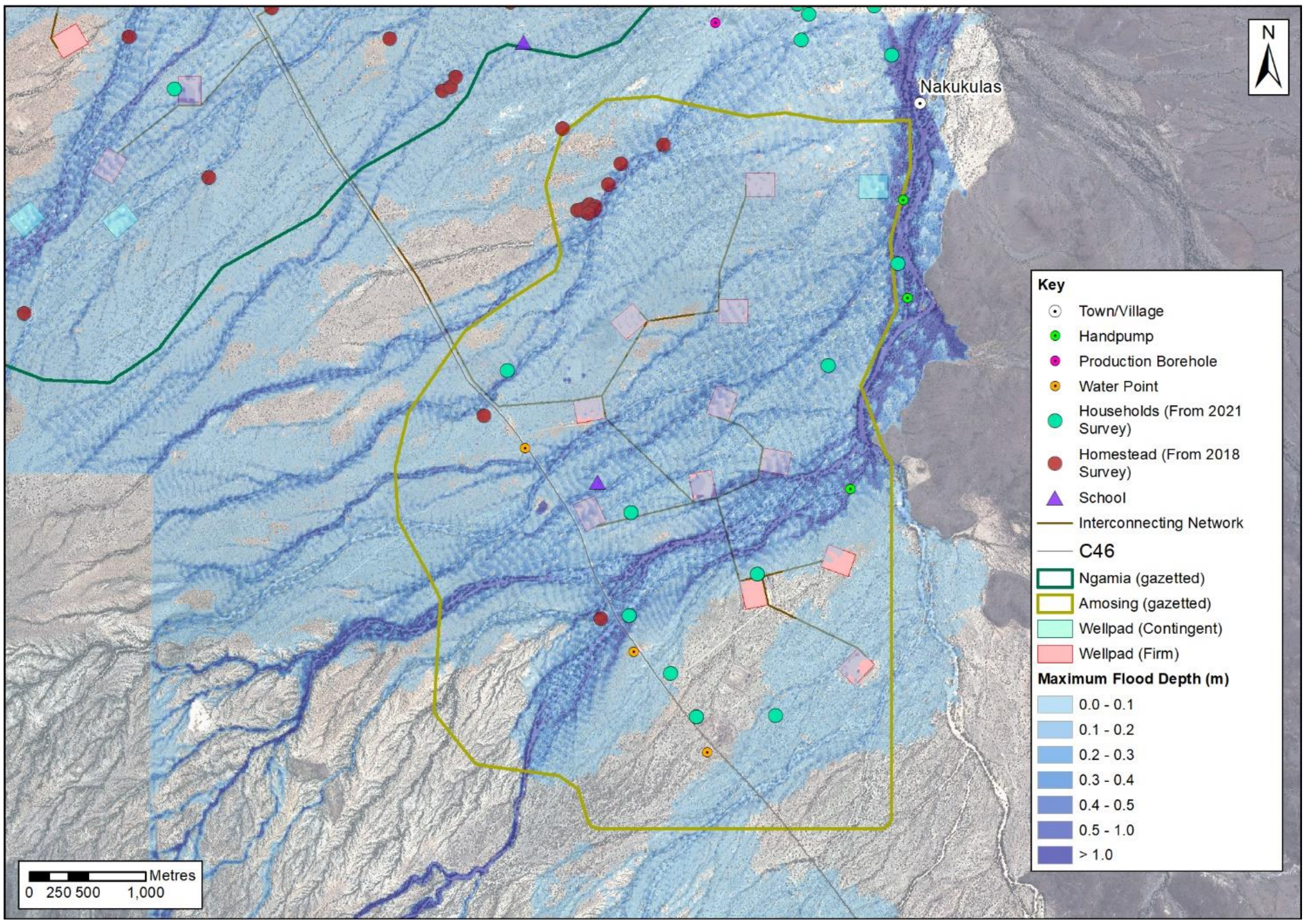

Figure 7.3-5: 1 in 100-Year Return Period Flood Model Output Around Amosing with Flood Mitigation for 2019 Layout Applied (Source: Worley Parsons, 2019)

The assessment of flood risk to third parties involves comparing the Project scenario (i.e., with the incorporated flood mitigation in place) to the baseline scenario. Figure 7.3-6 and Figure 7.3-7 present difference plots between these two scenarios, which show the increase or decrease in flood depths due to presence of the Project infrastructure and associated incorporated flood mitigation. The flood mitigation included in the study completed in 2019 is no longer valid and will need to be revisited. Nevertheless, the change in risk to third parties as a consequence of developing the Project is low. Figure 7.3-6 and Figure 7.3-7 show that there is a maximum increase of approximately 5 cm in areas outside of the luggas that are already predicted to be flooded to depths of between 0.1 to 1 m (see Figure 7.3-5 and Figure 7.3-6).

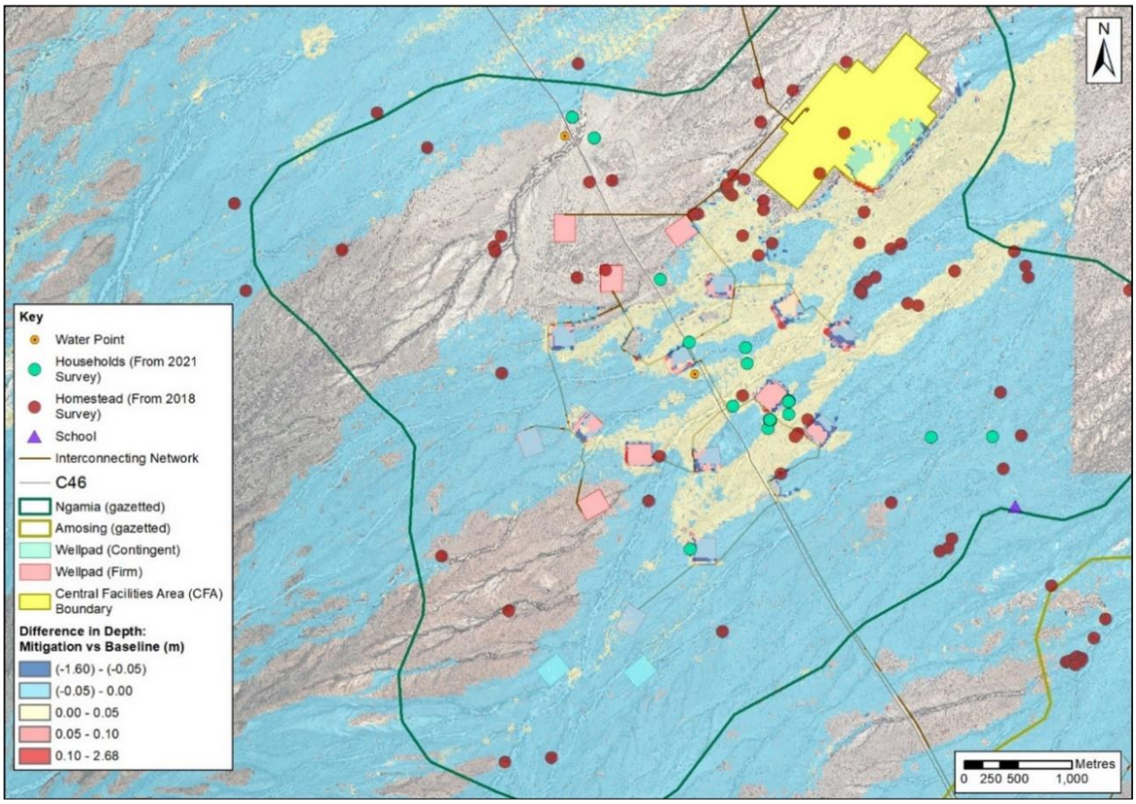

Figure 7.3-6: Difference Plot (Infrastructure and Mitigation vs. Baseline) Showing Change to Flood Risk for 2019 Layout During a 1 in 100-Year Return Period Event near Amosing

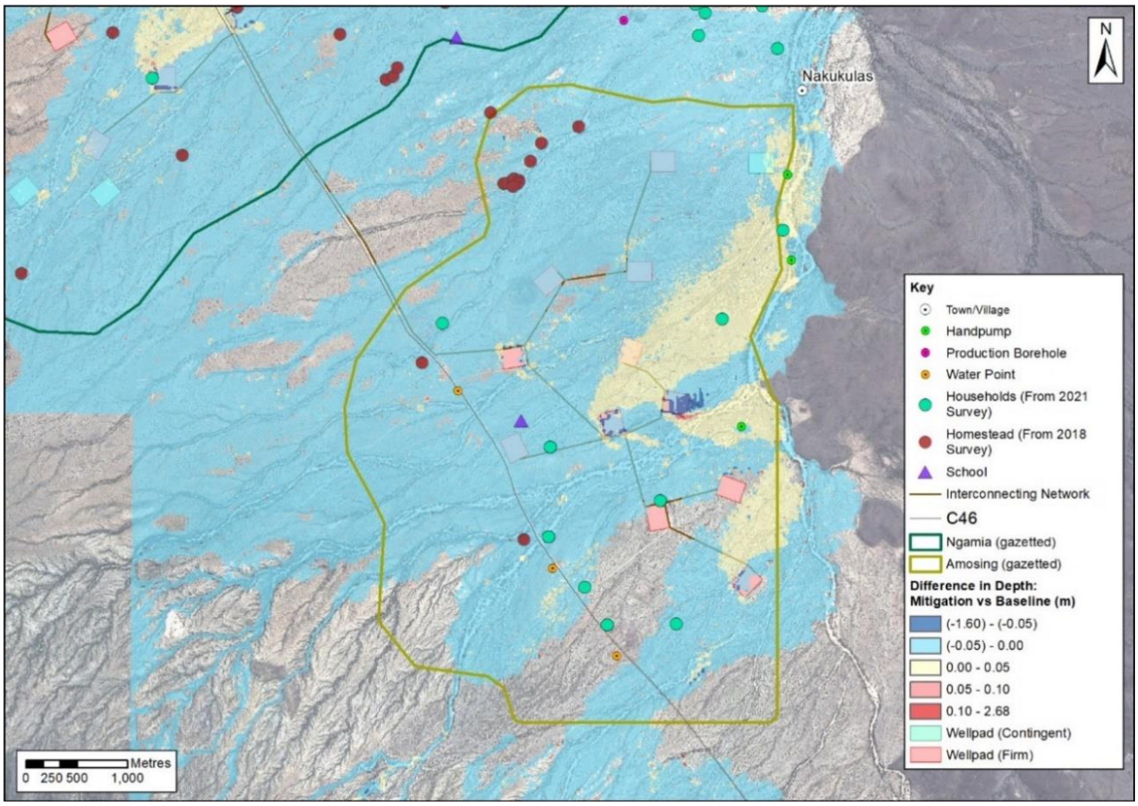

Figure 7.3-7: Difference Plot (Infrastructure and Mitigation vs. Baseline) Showing Change to Flood Risk for 2019 Layout During a 1 in 100-Year Return Period Event near Ngamia

The Flood risk analysis will need to be completed for the new project layout, prior to construction plans being finalised. However, the previous study gives enough of an indication that with incorporated flood mitigation in place, the increased flood risk to third parties leads to an impact magnitude of low (adverse). The impact significance on humans living downstream of the infrastructure is **Minor.** The impact will be medium term as it will extend beyond construction and last throughout operations**.**

7.3.9.1.11 Mitigation

Works in periods of extreme rainfall will be minimised, to limit the impact on flood risk. Temporary erosion control measures will be installed prior to earth-moving activities, and be maintained throughout construction activities, to attenuate flood flows up maintain the natural runoff regime for events up to 1 in 30-year return period. Following any extreme rainfall/flood events (greater than 1 in 30-year return period rainfall) all erosion control measures will be inspected and, if required, reinstated as soon as practicably possible after an event.

Where the lugga will be lost due to the presence of Project infrastructure within the watercourse, a suitable e.g. (constructed to convey up to 100 year return period flows) permanent diversion will be put in place to redirect water further downstream in the same watercourse, or to another watercourse in the same catchment.

Monitoring (channel morphology) will be completed throughout construction and one year after construction with further inspections following any extreme rainfall/flood events (1 in 30-year return period flows). This will confirm whether flood flow conveyance have not been adversely altered. Maintenance activities and actions for management, if there are issues, will be outlined in the Operator Environmental Performance Plan.

7.3.9.1.12 Residual Impact

The mitigation will not change the potential impact to humans living downstream. Therefore, the residual impact magnitude remains at low (adverse). The associated residual impact significance remains **Minor.**

7.3.9.1.13 Changes in Reservoir Levels Due to Water Abstraction During Construction

Water abstraction from the Turkwel Gorge Reservoir has the potential to impact surface water levels in the reservoir from month 22 to month 36 of the construction phase. Water abstraction required from the Turkwel Gorge Reservoir will average 1,550 m^3/day, peaking at 3,540 m^3/day (0.04 m^3/s) during construction in month 27 (Section 5).

The Operator has undertaken a range of assessments in order to select the most appropriate long-term source of make-up water, and, as part of that, the potential impacts on the source were considered. A list of key reference documents used in this assessment is presented in Section 7.3.9, the documents themselves are presented in Annex I. The main points from these reference documents which inform the impact assessment for construction can be summarised as follows:

- The average annual inflow to the Turkwel Gorge Reservoir from commissioning of the Dam (1996) to 2019 is 18 m^3/s. Average discharge via the turbines is 16 m^3/s and evaporative losses average 1.25 m^3/s;
- The best estimate of current reservoir water balance (Table 6.8-10) based on estimated average inputs and outputs between 1996 and 2019 shows that on average an estimated 0.8m^3/s was volume to storage during this period; and
- The maximum abstraction sought by the Operator (0.04 m^3/s) is equivalent to 0.2 % of the average inflow to the Turkwel Gorge Reservoir and approximately 5% of the volume to Storage between 1996 and 2019. Although no variation in inflows, discharges, evaporative losses, changes to water demand by other users are considered.

The predicted impact magnitude during construction is considered to be direct low (negative) and the impact significance on reservoir water levels is **Minor**.

7.3.9.1.14 Mitigation

The Operator Environmental Performance Plan will set out procedures to describe monitoring of abstraction volumes and reservoir levels and actions to maintain security of supply throughout the abstraction period.

Prior to construction, continuous monitoring of water levels in the Turkwel Gorge Reservoir will be established in coordination with KVDA. Water levels will be monitored throughout the abstraction period during construction and water level data will be disclosed publicly.

The Operator will develop a predictive water balance model for the Turkwel Gorge Reservoir, calibrated to historic data and using best predictions of inputs and outputs to the water balance for the entire abstraction period of the Project (**Repeated Mitigation – Water Quantity 06 - Predictive Water Balance for Turkwel Gorge Reservoir and Triggers)**. Climatic inputs will be adjusted to predict inputs throughout the abstraction period for Representative Concentration Pathway (RCP) 8.5 ('business as usual' scenario with continued high GHG emissions and an absence of climate change policies)[18] and one other less conservative scenario to provide a range of climate change predictions on which to define the water levels (including consideration for natural seasonal fluctuations) below which abstraction will become unsustainable (given other water users and electricity generation requirements) or affect security of water supply for the Project (action level). Action levels and appropriate contingencies will be established in coordination with KVDA.

7.3.9.1.15 Residual Impact

With the incorporated mitigation in place, the residual impact magnitude remains at low (adverse). The associated residual impact significance on the Turkwel Gorge Reservoir and users of the reservoir remains **Minor.**

[18] IPCC, 2014: Climate Change 2014: Synthesis Report.

Table 7.3-5: Construction Phase Impact Assessment

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Kalabata River within the area of influence of abstraction wells used for construction water, where critical habitat may be triggered (high)	Abstraction of groundwater for initial construction water requirements - reduction in baseflow due to lowered groundwater levels	High (indirect, temporary, short term, negative)	Major	The Operator will seek to minimise construction-phase water demand as part of the FEED process. **Repeated Mitigation – Water Quantity 01 - Further Hydrogeological Investigation:** The Operator will develop a hydraulic testing plan and undertake a further hydrogeological investigation to evaluate existing data for community and project abstraction wells within the potentially affected area prior to commencement of construction-phase water abstraction to understand if, and to what degree, hydraulic connectivity exists between the hydrogeological units used for Project water supply and the shallow aquifers used for community water supply. The hydrogeological investigation will include the following: ■ Pump testing in abstraction wells which have not been previously tested (Ngamia East, Nakukulas 9, Nakukulas 10). Testing will comprise both constant rate tests and step-tests. Step tests should include a minimum of four steps, with each step lasting a least 100 minutes. ■ Pump testing will be undertaken towards the end of a dry season and in accordance with the International Standard for Hydrometric	Low	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				Determinations – Pumping Tests for Water Wells (BSI, 2006). ▪ Full-scale constant rate pump tests (at 100% of abstraction volume) will be undertaken at Ngamia East, Nakukulas 9, Nakukulas 10, Kengomo 1 and Kengomo 2. Each well will be tested individually for a 24-hour period, and all wells will be tested in combination for a minimum of a 72-hour period. ▪ During pump testing, water quality (pH, temperature, EC, major ions, bacteria) will be monitored on a 12-hour basis to indicate any change which may be related to hydraulic stresses induced by pumping. Abstracted water will be discharged down-gradient of the abstraction point. **Repeated Mitigation – Water Quantity 02 - Groundwater Level Monitoring:** Prior to construction, the Operator will install a network of shallow groundwater monitoring wells to continuously monitor water levels. In addition to existing monitoring locations, water levels will be monitored in at least two monitoring boreholes within the identified potential radius of influence of each construction-phase abstraction well. Where no suitable existing well exists, new monitoring boreholes will be installed. Monitoring boreholes		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				will be spaced at different distances from the abstraction well to allow characterisation of the cone of depression. Water levels will be monitored throughout construction and for a period of at least 12 months after the later of i) water levels rising above the action level and ii) the cessation of groundwater abstraction for construction water supply by the Project. Water level data will be disclosed publicly. **Repeated Mitigation – Water Quantity 03 - Conceptual Model and Trigger Levels:** The Operator will develop a conceptual hydrogeological model for the section of the Kalabata catchment where the potential for groundwater draw-down impacts have been identified in the ESIA. Prior to construction, data will be evaluated to identify any evidence of hydraulic connectivity (draw-down and/or changes in water chemistry) between shallow aquifers used for community water supply and deep aquifers used for the supply of construction activities. Monitoring data and data from the hydrogeological investigations will be used to revise the conceptual hydrogeological model. The Operator Environmental Performance Plan will define the water levels (including consideration for natural seasonal fluctuations) below which detailed monitoring by the Project will be undertaken on a weekly basis to determine if water levels have reduced sufficiently to threaten continuity of supply (action level). The action levels will be		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				determined such that action to provide alternative water supplies is undertaken prior to the supply of shallow water resources being affected. The objective is to ensure continuity of supply for local water users within the potentially affected area of the Kalabata catchment. **Repeated Mitigation – Water Quantity 04 - Biological Monitoring:** In parallel with groundwater monitoring, an additional biodiversity survey within the potentially affected area of the Kalabata catchment, will be undertaken (at least one June survey before construction) to identify the presence (or otherwise) of the Turkana toad and previously undescribed beetle. Based on that data, critical habitat mapping will be revised, future biological monitoring will be evaluated, and sensitivities related to groundwater levels will be evaluated and included in consideration of action levels and associated water supply mitigations to avoid long term stress of potential critical habitat, e.g., targeted irrigation during the impacted period. The Operator will seek to minimise construction-phase water demand as part of the FEED process and the Operator will ensure continuity of water supply to water users affected by the abstraction of groundwater during the construction phase, and for the duration of the effect. The Operator will implement an abstraction strategy to minimise the effect on sensitive natural receptors (i.e. critical		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				habitat) and water users by prioritising the wells used to provide construction water supply.		
Water users of shallow hand dug wells in the dry riverbeds (high)	Abstraction of groundwater for initial construction water requirements - lowering groundwater levels below a level accessible by hand dug well	High (indirect, temporary, short term, negative)	Major	**Repeated Mitigation – Water Quantity 01 - Further Hydrogeological Investigation** **Repeated Mitigation – Water Quantity 02 - Groundwater Level Monitoring** **Repeated Mitigation – Water Quantity 03 - Conceptual Model and Trigger Levels** **Repeated Mitigation – Water Quantity 05 – Monitoring Shallow Groundwater Used by Humans:** Further hydrocensuses to establish hand dug well water users in areas predicted as impacted; Manual measurements at hand-dug wells within the radii of influence of each construction-phase abstraction well. A monthly photolog of the hand-dug wells used for monitoring will also be prepared. If water levels do fall below the action level (**Repeated Mitigation – Water Quantity 03 - Conceptual Model and Trigger Levels**), the Operator will then implement its contingency water supply plans to provide alternative water supplies	Low	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				for human water users for the duration of the impact. The Stakeholder Engagement Plan will provide detailed procedures for communicating to existing local water users within the predicted impacted area to identify alternative sources of water e.g., bowser from Turkwel Reservoir Dam, or from alternative water supply points and to help PAP understand that hand dug wells in luggas in the zones identified may not be able to be used during the period of the impact and alternative supplies may be needed.		
Seasonal rivers/streams and drainage luggas within the area of influence of abstraction wells used for construction water (medium)	Abstraction of groundwater for initial construction water requirements - reduction in baseflow due to lowered groundwater levels	High (indirect, temporary, short term, negative)	Moderate	The Operator will seek to minimise construction-phase water demand as part of the FEED process. **Repeated Mitigation – Water Quantity 01 - Further Hydrogeological Investigation** **Repeated Mitigation – Water Quantity 02 - Groundwater Level Monitoring** **Repeated Mitigation – Water Quantity 03- Conceptual Model and Trigger Levels** **Repeated Mitigation – Water Quantity 04 - Biological Monitoring**	Low	Minor
Groundwater - shallow aquifers within the area of influence of abstraction wells used for construction	Abstraction of groundwater for construction for initial construction water requirements - reduction in	High (direct, temporary, short term, negative)	Major	The Operator will seek to minimise construction-phase water demand as part of the FEED process and the Operator will ensure continuity of water supply to water users affected by the abstraction of groundwater during the construction phase, and	Low	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
water where groundwater sustains critical habitat (high)	groundwater levels.			for the duration of the effect. The Operator will implement an abstraction strategy to minimise the effect on sensitive natural receptors (i.e. critical habitat) and water users by prioritising the wells used to provide construction water supply. The Stakeholder Engagement Plan will provide detailed procedures for communicating to existing local water users within the predicted impacted area to identify alternative sources of water e.g., bowser from Turkwel Gorge Reservoir, or from alternative water supply points and to help PAP understand that hand dug wells in luggas in the zones identified may not be able to be used during the period of the impact and alternative supplies may be needed.		
Groundwater - deep aquifers within the area of influence of abstraction wells used for construction water (low)	Abstraction of groundwater for construction for initial construction water requirements - reduction in groundwater levels.	Medium (direct, temporary, short term, negative)	Minor		Low	Negligible

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Seasonal rivers/streams and drainage luggas throughout the project affected area (medium)	Unplanned, discharges from hydrotest water and other construction activities	Medium (direct, temporary, short term, negative)	Minor	■ The Operator Environmental Performance Plan will define all procedures relating to abstraction, use, storage, and disposal of water used during hydrotest of pipelines and how water reuse will be maximised. ■ Where possible, evaporation from fenced, lined ponds will be used to dispose of hydrotest water. Any evaporite remaining will be packaged up with the liner and disposed of as part of the Operator Waste Management Plan. ■ Should disposal of hydrotest water to the environment be required and evaporation is not a feasible option, the disposal location and method of disposal will be in line with Kenya legislation and details of permitting agreed with the Kenya regulator, and criteria for water quality monitoring of discharge will meet permitting requirements.	Negligible	Negligible
	Construction activities near or within watercourses - Infrastructure Development	Medium (direct, temporary to permanent, short term to long term, negative)	Minor	The Operator Environmental Performance Plan will include procedures to prevent changes to flow regimes in watercourses due to construction activities.	Low	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
	Construction activities near or within watercourses - Flowline Development	Medium (direct, temporary to permanent, short term to long term, negative)	Minor	The EPC contractor will complete pre-construction surveys to identify potential locations where construction activities could have an impact on lugga drainage patterns. In identified areas, drainage channels and ditches will be designed to limit changes to natural flow ranges and reduce the potential for flood risk. Temporary erosion control measures will be installed in such a way that regulates flow in line with natural variation. Work on ephemeral rivers, smaller streams/luggas will be planned to take place during the dry seasons when no flow is anticipated. If unavoidable, flow will be diverted and redirected into same watercourse further downstream. A dynamic risk assessment (completed within a reasonable period before works commence and updated regularly) will be completed by the EPC contractor, on an individual case basis. The amount of time trenches or other excavations will be open will be minimised. Where the lugga will be lost due to the presence of Project infrastructure within the watercourse, a suitable permanent diversion will be put in place to redirect water further downstream in the same watercourse, or to another watercourse in the same catchment. Monitoring (channel morphology) will be completed throughout construction and one year after construction with further inspections following any extreme rainfall/flood events (1 in 30-year return period flows). This will confirm	Low	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				whether sediment transport and erosion patterns have not been adversely altered. Maintenance activities and actions for management, if there are issues, will be outlined in the Operator Environmental Performance Plan.		
Shallow groundwater receiving recharge from surface water (high)	Construction activities near or within watercourses - Infrastructure Development and Flowline Development – reduction in recharge	High (indirect, temporary, short term, negative)	Major	Where the lugga will be lost due to the presence of Project infrastructure within the watercourse, a suitable permanent diversion will be put in place to redirect water further downstream in the same watercourse, or to another watercourse in the same catchment. **Repeated Mitigation – Water Quantity 05 – Monitoring Shallow Groundwater Used by Humans.**	Low	Minor
Water users of shallow hand dug wells in the dry riverbeds downstream of infrastructure (high)		High (indirect, temporary, short term, negative)	Major		Low	Minor
Turkwel Gorge Reservoir (high)	Abstraction of water for make-up water requirements during the latter stages of the	Low (direct, temporary, medium term, negative)	Minor	The Operator Environmental Performance Plan will set out procedures to describe monitoring of abstraction volumes and reservoir levels and actions to maintain security of supply throughout the abstraction period.	Low	Minor

	construction phase			Prior to construction, continuous monitoring of water levels in the Turkwel Gorge Reservoir will be established in coordination with KVDA. Water levels will be monitored throughout the abstraction period during construction and for a period of at least 12 months after the cessation of abstraction for water supply from the reservoir by the Project. Water level data will be disclosed publicly. **Repeated Mitigation – Water Quantity 06 - Predictive Water Balance for Turkwel Gorge Reservoir and Triggers**: The Operator will develop a predictive water balance model for the Turkwel Gorge Reservoir, calibrated to historic data and using best predictions of inputs and outputs to the water balance for the entire abstraction period of the Project. Climatic inputs will be adjusted to predict inputs throughout the abstraction period for RCP 8.5 ('business as usual' scenario with continued high GHG emissions and an absence of climate change policies)[19] and one other less conservative scenario to provide a range of climate change predictions on which to define the water levels (including consideration for natural seasonal fluctuations) below which abstraction will become unsustainable (given other water users and electricity generation requirements) or affect security of water supply for the Project (action level). Action levels and appropriate contingencies will be established in coordination with KVDA. The Operator Environmental Performance Plan will describe the action to be taken if the water level in the reservoir falls below the action level,		

[19] IPCC, 2014: Climate Change 2014: Synthesis Report.

				the Operator will implement contingency water supply plans for the Project.		
Human residences downgradient of project infrastructure (high)	Flood Risk downstream of infrastructure	Low (indirect, temporary, medium term, negative)	Minor	Works in periods of extreme rainfall will be minimised, to limit the impact on flood risk. Temporary erosion control measures will be installed prior to earth-moving activities, and be maintained throughout construction activities, to attenuate flood flows up maintain the natural runoff regime for events up to 1 in 30-year return period. Following any extreme rainfall/flood events (greater than 1 in 30-year return period rainfall) all erosion control measures will be inspected and, if required, reinstated as soon as practicably possible after an event. Monitoring (channel morphology) will be completed throughout construction and one year after construction with further inspections following any extreme rainfall/flood events (1 in 30-year return period flows). This will confirm whether flood flow conveyance have not been adversely altered. Maintenance activities and actions for management, if there are issues, will be outlined in the Operator Environmental Performance Plan. Where the lugga will be lost due to the presence of Project infrastructure within the watercourse, a	Low	Minor

				suitable e.g. (constructed to convey up to 100 year return period flows) permanent diversion will be put in place to redirect water further downstream in the same watercourse, or to another watercourse in the same catchment.		

7.3.9.2 Operational Phase

The main potential impacts to water quantity during the operational phase are:

- The ongoing water abstraction from the Turkwel Gorge Reservoir – make-up water that will be used to inject into the oil reservoir, plus supply communities and permanent operational facilities (including all accommodation facilities) will have some water requirements for welfare and maintenance.

During operations, water abstraction from the Turkwel Gorge Reservoir will peak at approximately 26,000 m^3/d (0.3 m^3/s) in year 4 of operations and thereafter decrease throughout the 25-year operation period. It is understood that the Operator is currently seeking a permit for abstraction of 40,000 m^3/day (0.46 m^3/s) (Avery, 2020). As the operational phase is anticipated to last 25 years, climate change could result in additional changes to water availability.

The Operator has undertaken a range of assessments in order to select the most appropriate long-term source of make-up water, and, as part of that, the potential impacts on the source were considered. These are listed in Section 7.3.9.1 and presented in Annex I:

The main points relating to operations from these pieces of work can be summarised as follows:

- The average annual inflow to the Turkwel Gorge Reservoir from commissioning of the Dam (1996) to 2019 is 18 m^3/s. Average discharge via the turbines is 16 m^3/s and evaporative losses average 1.25 m^3/s.
- The best estimate of current reservoir water balance (Table 6.8-10) based on estimated average inputs and outputs between 1996 and 2019 shows that on average an estimated 0.8 m^3/s was volume to storage during this period;
- Water Allocation Guidelines, issued by the WRA under the 2016 Water Act identify that reserve flows and existing water uses for domestic, industrial, irrigation, hydropower and inter-basin transfers are prioritised ahead of any new applications. The Guidelines require determination of the Reserve by adopting a holistic multidisciplinary methodology and public consultations. If these requirements are met, the dam's operation rules may be adjusted;
- The Turkwel Reservoir Dam turbines operate 12.5 hours / day and there is currently insufficient water to allow any increase to this power generation;
- The maximum abstraction sought by the Operator (0.3 m^3/s) is equivalent to 1.7% of the average inflow to the Turkwel Gorge Reservoir and approximately 38% of the volume to storage between 1996 and 2019. Although no variation in inflows, discharges, evaporative losses, changes to water demand by other users are considered;
- The Project may require an adjustment by KenGen to the power generation levels to secure a sustainable water supply for the Project;
- Sedimentation in the reservoir is in line with design expectations and the dam currently has a low flood risk.

The predicted direct medium (negative) impact magnitude will occur throughout operations, but in particular for the initial 7 years of operations (during which water demand exceeds 0.2 m^3/s or approximately 17,000 m^3/d). The duration is medium term. This results in a **Moderate** significance. The abstraction impacts were predicted to be temporary because they would reverse when the abstraction is ceased.

Given the potential for climate change to alter rainfall (in timing, duration, and intensity), temperature and evaporation, it is possible that the reservoir water resource available may change through the operational phase and change the magnitude of the impact.

7.3.9.2.1 Mitigation

The Operator Environmental Performance Plan will set out procedures to describe monitoring of abstraction volumes and reservoir levels throughout the abstraction period.

Continuous monitoring of water levels in the Turkwel Gorge Reservoir will be maintained throughout operations in coordination with KVDA. Water levels will be monitored throughout the abstraction period and for a period of at least 12 months after the cessation of abstraction for water supply from the reservoir by the Project. Water level data will be disclosed publicly.

As additional data becomes available, the Operator will maintain and calibrate (with new data) a predictive water balance model for the Turkwel Gorge Reservoir, using best predictions of inputs and outputs to the water balance for the entire abstraction period of the Project (**Repeated Mitigation – Water Quantity 06 - Predictive Water Balance for Turkwel Gorge Reservoir and Triggers)**. Climatic inputs will be adjusted to predict inputs throughout the abstraction period for RCP 8.5 ('business as usual' scenario with continued high GHG emissions and an absence of climate change policies) [20] and one other less conservative scenario to provide a range of climate change predictions on which to define the water levels (including consideration for natural seasonal fluctuations) below which abstraction will become unsustainable (given other water users and electricity generation requirements) or affect security of water supply for the Project (action level). Action levels and appropriate contingencies will be established in coordination with KVDA but should not compromise existing prioritised water demand by other users and should not be below the minimum operational level for power generation (1105 mASL).

The Operator will review the water balance model on a yearly basis and update adaptive management procedures for abstraction management including consideration of climate change predictions, in coordination with KVDA.

7.3.9.2.2 Residual Impact

With the incorporated mitigation in place, the residual impact magnitude is low (adverse). The associated residual impact significance on the Turkwel Gorge Reservoir and users of the reservoir is **Minor.**

The operational phase impact assessment with respect to water resources is presented in Table 7.3-6.

[20] IPCC, 2014: Climate Change 2014: Synthesis Report.

Table 7.3-6: Operational Phase Impact Assessment

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Turkwel Reservoir (high)	Continued abstraction for make-up water requirements for operation of the Project	Medium (direct, temporary, medium term, negative)	Moderate	The Operator Environmental Performance Plan will set out procedures to describe monitoring of abstraction volumes and reservoir levels throughout the abstraction period. Continuous monitoring of water levels in the Turkwel Gorge Reservoir will be maintained throughout operations in coordination with KVDA. Water levels will be monitored throughout the abstraction period and for a period of at least 12 months after the cessation of abstraction for water supply from the reservoir by the Project. Water level data will be disclosed publicly. **Repeated Mitigation – Water Quantity 06 - Predictive Water Balance for Turkwel Gorge Reservoir and Triggers.** The Operator will review the water balance model on a yearly basis and update adaptive management procedures for abstraction management including consideration of climate change predictions, in coordination with KVDA.	Low	Minor

7.3.9.3 Decommissioning Phase

The predicted sources of impact to water quantity at the decommissioning phase are considered to be limited beyond the abstraction of water from the Turkwel Gorge Reservoir. It is anticipated that water use during the decommissioning phase will be considerably less than earlier phases. Water use is anticipated to be limited to general housekeeping purposes, decommissioning camps supply and dust suppression. Therefore, there will be negligible impact on water levels as a result of abstractions at the decommissioning phase.

Five years prior to the planned 'End of Project', a Decommissioning Plan will be developed for agreement with the appropriate authorities.

7.3.10 Summary of Mitigation

In addition to the incorporated mitigation measures, the following additional mitigation and monitoring is recommended to reduce the predicted impact significance to minor or below:

- The Operator will develop a hydraulic testing plan and undertake a further hydrogeological investigation within the area of influence of abstraction wells used for construction water, including pump tests to review/confirm hydraulic parameters;
- Prior to construction, the Operator will install a network of shallow groundwater monitoring wells to continuously monitor water levels throughout construction and for an extended period thereafter;
- The Operator will develop a conceptual hydrogeological model for the section of the Kalabata catchment and prior to construction, re-evaluate hydraulic connectivity in local aquifers and revisit the impact classifications and mitigations. Action levels will be determined such that action to provide alternative water supplies is undertaken prior to the supply of shallow water resources being affected;
- Prior to construction, further hydrocensuses and A biodiversity survey will be completed within the potentially affected area of the Kalabata catchment;
- The Operator will implement an abstraction strategy to minimise the effect on sensitive natural receptors (i.e. critical habitat) and water users by prioritising the wells used to provide construction water supply;
- The Operator will provide detailed procedures for communicating to existing local water users within the predicted impacted area to identify alternative sources of water;
- The Operator will define all procedures relating to abstraction, use, storage, and disposal of water used during hydrotest of pipelines. Where possible, evaporation from fenced, lined ponds will be used to dispose of hydrotest water. Should unplanned disposal of hydrotest water to the environment be required and evaporation is not a feasible option. The disposal location and method of disposal will be in line with Kenya legislation;
- The Operator will complete pre- construction surveys to identify potential locations where construction activities could have an impact on lugga drainage patterns. Temporary erosion control measures will be installed in such a way that regulates flow in line with natural variation;
- Work on ephemeral rivers, smaller streams/luggas will be planned to take place during the dry seasons when no flow is anticipated. If unavoidable, flow will be diverted and redirected into same watercourse further downstream;
- Where the lugga will be lost due to the presence of Project infrastructure within the watercourse, a suitable permanent diversion will be put in place;

- The Operator will communicate to existing local water users within the predicted impacted area to identify alternative sources of water;
- Monitoring (channel morphology) will be completed throughout construction and for one year after construction is completed;
- The Operator will monitor abstraction volumes from the Turkwel Gorge Reservoir and reservoir levels and actions to maintain security of supply throughout the abstraction period. Prior to construction, continuous monitoring of water levels in the Turkwel Gorge Reservoir will be established in coordination with KVDA. Continuous monitoring will be maintained throughout operations in coordination with KVDA and for a period of at least 12 months after the cessation of abstraction for water supply from the reservoir by the Project;
- Water level data will be disclosed publicly;
- The Operator will develop a predictive water balance model for the Turkwel Gorge Reservoir, calibrated to historic data and using best predictions for the entire abstraction period of the Project, including a range of climate change predictions and consideration for natural seasonal fluctuations. Action levels and appropriate contingencies will be established in coordination with KVDA and if the water level in the reservoir falls below the action level, the Operator will implement contingency water supply plans for the Project;
- Throughout operations, the Operator will review the water balance model on a yearly basis and update adaptive management procedures for abstraction management including consideration of climate change predictions, in coordination with KVDA;
- Works in periods of extreme rainfall will be minimised, to limit the impact on flood risk;
- Where the lugga will be lost due to the presence of Project infrastructure within the watercourse, a suitable e.g. (constructed to convey up to 100-year return period flows) permanent diversion will be put in place to redirect water further downstream in the same watercourse, or to another watercourse in the same catchment; and
- Following any extreme rainfall/flood events all erosion control measures will be inspected and, if required, reinstated as soon as practicably possible after an event.

7.3.11 Summary of Residual Impacts

Major significance impacts were predicted (pre-mitigation) for the impact on the Kalabata, shallow groundwater and water users thereof during the abstraction of groundwater for construction. Moderate significance impacts (pre mitigation) were predicted for groundwater abstraction during construction and construction activities near or in seasonal rivers/streams and drainage luggas, plus for the impact on Turkwel Gorge Reservoir water levels during operations.

Taking account of the additional mitigation, the Moderate and Major significance impacts are predicted to be reduced to minor significance residual impacts. All residual impacts to water quantity are predicted to be **Minor** or **Negligible**.

7.4 Water Quality

7.4.1 Introduction

This section provides an assessment of the potential impacts of the Project on surface and groundwater quality. Potential impacts have been determined using a qualitative assessment methodology. Where potential impacts have been identified, these are considered in turn and mitigation is set out where these are considered necessary to ensure that any potential impacts are reduced as far as is practicable.

7.4.2 Area of Influence

The AoI is presented in Section 3.13. Potential receptors located within the AoI have been identified as part of the baseline studies. Receptors that have been carried forward into the assessment are presented in Section 7.4.6.

7.4.3 Receptor Importance

In order to identify the importance of the receptors, the scale of relative importance presented in Table 7.4-1 for water quantity is also relevant to this water quality section.

7.4.4 Magnitude of Impact

The characterisation of the duration and nature of the impact for water quality (i.e., temporary or permanent, and direct or indirect) is as described in Section 7.3.4. The assessment criteria for water quality impact magnitude are presented in Table 7.4-1.

Table 7.4-1: Criteria for Assessing Magnitude of Impact

Magnitude of Impact	Description Criteria	
	Adverse	Beneficial
High	Loss of resource/receptor, loss of quality and integrity of the resource/receptor, severe damage to key characteristics, features or elements. Water concentrations exceed baseline concentrations and water quality standards for parameters that could affect human health.	Large scale or major improvement to resource/ receptor quality, extensive restoration or enhancement.
Medium	Partial loss of resource/receptor, but not adversely affecting the integrity, partial loss or damage to key characteristics, features or elements. Water concentrations exceed baseline concentrations and water quality standards for parameters that are unlikely to affect human health.	Some benefit to key characteristics, features or parameters describing resource/receptor quality.
Low	Some measurable change in/damage to attributes, quality or vulnerability. Minor loss of, or alteration to, key characteristics, features or elements. Water concentrations exceed baseline concentrations but do not exceed water quality standards.	Minor benefit to, or addition of, one or more key characteristics, features or parameters describing resource/ receptor quality.
Negligible	No, or very minor (immeasurable), change to baseline characteristics, features or parameters describing resource/receptor quality.	

7.4.5 Key Guidance and Standards

In addition to the water policy and legislation documents highlighted in Section 7.3.5, the following are of particular relevance to water quality:

- Water Quality Regulations, 2006;
- The Environmental Management and Coordination (Water Quality) Regulations, 2006; and
- The Kenya Standard KS 459-1: 2007 (ISC 13.060.20) (Drinking Water – Specification. Part 1: The requirements for drinking water. Third Edition), which has been used to compile the Project standards for water quality and emissions.

7.4.6 Receptors of Interest and Importance

The focus of this assessment is on the quality of water within the AoI. Baseline environmental information indicates the importance and scarcity of water in the AoI. This emphasis is reflected in the Water Act and other legislation [21].

Using the Project Description and the baseline water environment information presented in Chapter 6.0, the same receptors have been identified as those presented for water quantity in Section 7.3.6 as being susceptible to changes in water quality.

7.4.7 Sources of Impacts

Potential sources of impact of a range of magnitudes that will occur throughout the life of the Project are set out below by Project phase.

7.4.7.1 Construction Phase

Based on the Project Description and the understanding of the baseline water quality conditions that has been developed, there are aspects of the Project that have been identified as having the potential to present sources of impact to water quality (and therefore usability) during the construction phase. The potential sources of impact and routes by which they could impact water quality are as follows:

- Construction activities near or within watercourses (e.g., vehicle movements, vegetation clearance, channel diversions, topsoil stripping, excavating and storage of excavated materials and construction of bunds/ditches/trenches) – ground disturbance could lead to changes in sediment transport/water quality.
- Accidental spills or releases of fuels, oils, drilling muds, chemicals or other contaminants, through perforation for rupture of storage tanks, evaporation ponds, sanitation tanks, pipework, flowlines or due to structural failure of plant or blow outs - leading discharge of contaminants to surface water or groundwater which would change water quality.
- Well casing/cement integrity failure during drilling interventions - leading discharge of contaminants in groundwater which would change water quality.
- Leaching from backfill materials – if non-inert materials are introduced to the subsurface whilst excavations are backfilled, these could leach and result in the introduction of potentially contaminative substances to groundwater.

[21] The objective of the Environmental Management and Co-Ordination (Water Quality) Regulations is to prevent pollution of water, prohibit the discharge of effluent to the environment that has a quality that contravenes the standards, and prevent abstraction without an environmental impact assessment license.

The Kenya Water Act also enforces the requirement to have permission to construct boreholes and wells, that abstraction amounts need to be reasonable, to reduce the potential for water losses, and to prevent contamination/pollution of water.

- Heat from well commissioning tests – potential changes to the temperature of the surrounding water environment, which can also induce changes in chemical reactions and bacterial growth, which can alter water quality.
- Concrete batching – potential to lead to contamination of the water environment through run-off with increased suspended solids, a more alkaline pH, and higher alkalinity.
- Pipeline flushing and hydraulic testing (hydrotesting) – the discharge of used water could introduce chemicals added to the water and any substances cleared from the inside of the pipework during flushing.

7.4.7.2 Operational Phase

Based on the Project Description and the understanding of the baseline water quality conditions that has been developed, there are aspects of the Project that have been identified as having the potential to present sources of impact to water quality during the operational phase. The potential sources of impact and routes by which they could impact water quality are as follows:

- Heat from the operational well heads and oil and hot water in the connecting pipelines – potential changes to the temperature of the surrounding water environment, which can also induce changes in chemical reactions and bacterial growth, which can alter water quality.
- Operational waste – leaching from stored operational waste (either locally to its generation or at the IWMF), or inappropriate disposal of the waste, could lead to a change in water quality in the receiving waterbody.
- Accidental spills or releases of fuels, oils, chemicals or other contaminants, through perforation for rupture of storage tanks, evaporation ponds, sanitation tanks, pipework, flowlines or due to structural failure of plant or blow outs - leading discharge of contaminants to surface water or groundwater which would change water quality.
- Well casing/cement integrity failure during production - leading discharge of contaminants in groundwater which would change water quality.

7.4.7.3 Climate Change

Climate change has more potential to directly affect water availability than water quality. A discussion of predicted climate change impacts on the water environment is presented in section 7.3.7. Climate change effects on water quality are more likely to be secondary as a result of changes in availability.

Changes in surface water flow regimes will result in changes to the volumes of water and the times when water flows are low and high. Higher flows would lead to greater erosion leading to suspended solid mobilisation and poorer water quality, but the greater volume of water during higher flows would also result in greater dilution.

Changes in the availability of groundwater as a resource (potentially as a combination of reduced recharge and greater demand from an increased population) could lead to poorer water resources having to be exploited. In the case of aquifers that have existing areas of poor water quality (e.g., high salinity at depth), over abstraction of these aquifers could lead to the poorer water being drawn towards the abstraction point and the abstracted water quality declining.

7.4.8 Incorporated Environmental Measures

The Project has been designed and planned to incorporate a range of incorporated environmental measures that provide measures to avoid potential impacts or reduce their magnitude, prior to the impact analysis being completed.

The measures presented in this section either relate to Project infrastructure (design measures) or are widely accepted GIP.

7.4.8.1 Design Measures

The following measures are part of the Project design and reduce the potential impact of the Project on water quality:

- The gathering network will be insulated to reduce heat loss (to maintain oil temperature, but also reduce transfer of heat to surrounding environment) - this will reduce the potential for changes to the temperature of surrounding or nearby groundwater and surface water.
- The pipework at, and between, wellpads will be buried and depths will be increase under roads and watercourses – this will reduce the possibility of damage (deliberate or accidental) that could otherwise lead to leaks and subsequent water contamination.
- Existing infrastructure has been identified for use where possible (e.g., existing roads instead of new ones) – this will reduce the need for the creation of new infrastructure, which will in turn result in less earth movement and reduced suspended solids creation that could pollute the water environment.
- Pits located at the wellpads and used for the collection of drilling wastes will be lined with HDPE – lining the pits with HDPE creates a barrier between the surface and the groundwater environment, which reduces the potential for any contaminants that might be present in the drilling waste to reach groundwater by infiltration.
- The cellars at the wellpads will be concrete or steel lined – lining the cellars creates a barrier between the surface and the groundwater environment, which reduces the potential for any contaminants that might be present in the drilling waste to reach groundwater by infiltration.
- The cellars will have sumps - the sumps will allow any fluid within the footprint of the wellpad itself will be captured and held before collection and treatment at IWMF.
- There will be oil interceptors in the wellpad drainage ditches - oil will be captured, removed and disposed of appropriately to Project waste facilities.
- Septic tanks will be managed – wastewater from camps and any other welfare facilities (i.e., toilets, wash areas) will be collected in septic tanks and the effluent will be treated at the STP in the IWMF.
- All substance storage (chemicals and fuels) will be bunded – all on-site hazardous materials storage will feature a secondary containment system, in line with WBG EHS Guildlines, 2007. By locating substances in dedicated storage areas with appropriate flooring and bunding, spills/leaks can be contained and addressed rather than being able to enter the water environment.
- The landfill will be lined with geosynthetic and clay liners. It will also be engineered with a drainage layer and leak detection layer. HPDE liner will be used for the lining and capping – by fully engineering the landfill, the potential for discharge through the base or sides and transport into the groundwater environment is reduced.
- Organic waste will not be deposited in the landfill.
- There will be blow out preventors on wellheads during drilling – this will reduce the potential for hydrocarbons to be release at the surface during drilling and polluting the water environment by contact with surface water.
- Synthetic based mud drilling fluids will be recycled – by reusing substances, smaller quantities are required for storage and there is less potential for stored substances to present a source of contamination to the water environment.

- Hydrotest water will be reused where possible then directed to settlement ponds – this will reduce the potential for any additives to the water, or contaminants that may have come from inside the pipes, to be discharged to the surface water environment.
- Inert material will be used for backfilling and no foreign materials will be allowed in excavations. Any materials, which could lead to contamination, placed in trenches by third parties or otherwise, will be removed before trenches are backfilled – this will reduce the potential for leaching of contaminants to groundwater.
- There will be controlled discharge of uncontaminated water - no discharge of any effluent into the water environment will take place without a valid effluent discharge license issued by NEMA (as per the Environmental Management and Co-ordination (Water Quality) Regulations) – this will enable management of the potential to release polluting substances into the water environment.

7.4.8.2 Good Industry Practice

In addition to the mitigation specified within the Project description, this section presents accepted good practice that will also be implemented in order to remove or reduce the magnitude of potential impacts.

7.4.8.2.1 Construction Phase

- Dampening down of roads and construction areas will be undertaken if large quantities of resuspended dust are reported or observed – this will reduce the amount of dust that could be blown towards nearby watercourses and contribute to increases in suspended solid concentrations.
- The EPC contractor will produce and implement a waste management plan for all construction wastes.
- 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 working area.
- Works in, or adjacent to watercourses (within six meters and a maximum of thirty meters from the highest ever recorded flood level) shall not take place without consent from NEMA (as per the EMCA (Water Quality) Regulations, 2006) – appropriate consent and management of such activities will reduce the potential for releases of pollutants, including suspended solids, into the water environment.
- Drilling fluid quantities will be monitored – the volumes of drilling fluids used and returned will be monitored to enable rapid identification if unacceptable volumes are being lost to the ground. This will allow the potential for the loss to the ground, and potentially groundwater, of drilling fluids and any additives in it to be identified early and actioned.

7.4.8.2.2 Operational Phase

- Oil volume monitoring and management in storage facilities will be used to identify losses as soon as is practicable. Action plans will be followed if leaks are detected to reduce the potential for water contamination. Details of the leak monitoring procedure, monitoring locations, monitoring frequency and action plans will be recorded – this will reduce the potential for substance release, entry to the water environment and pollution.
- Wastes generated during operations will be transferred to the IWMF and landfill for disposal – managing waste at dedicated facilities that have been designed and constructed with the intention to limit the potential release of substances to the environment will reduce the potential for releases to impact the water environment.

- Waste will be segregated and there will be promotion of waste reuse and recycling at temporary waste facilities – this will reduce the amount of waste that has to be disposed of and allow the best route for disposal or reuse of different types of waste to be identified, which reduces the potential to unintended discharges to the environment.
- Ash from the waste treatment processes within the IWMF will be disposed of to landfill – this reduces the potential of unintended discharges of potentially contaminative substances to the environment.
- Treated sewage effluent will be reused or disposed of as irrigation water. There will be no discharge of any effluent into the water environment without a valid effluent discharge license issued by NEMA (as per the Environmental Management and Co-Ordination (Water Quality) Regulations) – this this reduces the potential of discharges of potentially contaminative substances to the environment.
- Waste being taken to landfill will be recorded and defined for specific cells that have been constructed as required for that waste stream – hazardous waste will be identified and sent to specifically engineered landfill cells to reduce the potential of discharges to the water environment.

7.4.8.2.3 All Project Phases

- All perimeter wellpad drainage will be regularly inspected in order to keep contact and non-contact water separate – this will reduce the potential for substance release, entry to the water environment and pollution.
- Infield flowline pressure will be monitored - this will enable losses of pressure, which could indicate leaks, to be identified and actioned as soon as is practicable – this will reduce the potential for substance release, entry to the water environment and pollution.
- Septic tank system, the tanks will be properly designed, installed and maintained to prevent contamination of groundwater.
- Sewage and effluent will be treated at the IWMF to appropriate standards before disposal – any disposals to the water environment will be to an appropriate standard for the receiving receptor; thereby reducing the potential of contamination.
- Good practice landfill construction and capping will be undertaken – to reduce the potential of discharges to the water environment.
- Handling, storage, treatment and disposal of hazardous substances will be in line with appropriate standards to reduce pollution potential. The procedures for all stages of hazardous substance handling, storage, use and disposal will be defined to reduce the potential for leaks and spills.
- Transfer of hazardous materials from tanks will take place in areas with surfaces sufficiently impervious to avoid loss to the environment. The surface will be sloped to a collection or a containment structure not connected to wastewater/storm water collection system.
- Substance inventory and monitoring will be undertaken to track what substances and quantities are present at different locations – this will enable a better understanding of the sources of potential impact to the water environment, appropriate storage to be identified, and for loses to be identified and actioned as soon as is reasonably practicable.
- Substance storage areas, facilities and equipment will be regularly inspected in order to identify leaks. This will include, but not be limited to, storage areas, yards, warehouses, welfare facilities, generators and pumps – good practice inspection and maintenance regimes will be detailed in management plans and followed to allows leaks to be identified and actioned as soon as is reasonably practicable.

- Appropriate inspection and maintenance of oil interceptors will be undertaken and recorded – this will enable the performance to be maintained and oil to be separated out from water and reduce the potential for discharges of contaminative substances.
- The Project will apply effective spill prevention, control and response procedures for non-emergencies to control releases that could pollute the water environment. Provision of, and training in use of spill containment equipment will be implemented where they are required.
- When selecting chemicals and materials this will, where practicable, aim to avoid or minimise the use of hazardous materials. Consideration will be given to selecting the items with the lowest potential for environmental harm possible without loss of effectiveness.
- Any discharges to the water environment will be to Kenyan water standards and under licence – discharges will be at or better than the rates and quality limits detailed in the consent to reduce the potential impact of poor water quality on the water environment.

7.4.9 Impact Classification

Taking into account the baseline water environment setting (Section 6.7), the relevant incorporated environmental measures (Section 7.4.8) and the potential sources of impact (Section 7.4.7) determined from the Project Description, the potential source-pathway-receptor impact linkages for the construction and the operational phases are presented in this section.

A discussion regarding feasible impact linkages during each of the Project phases is presented in each of the sub-sections below. Each discussion is followed by a table where the potential sources of impact and relevant additional mitigation applicable to each receptor are summarised.

Where mitigation measures are repeated for different receptors, they are stated as a numbered "Repeated mitigation" in the initial instance and referred back to thereafter.

7.4.9.1 Construction

The impact classification process focuses on the potential impacts to water quality that could result in significant impacts. As such some potential impacts are not considered further in this assessment as there is insufficient linkage between the source of impact and receptors, or the magnitude of this impact would be negligible when taking account of incorporated environmental measures.

The following bullets provide qualitative evaluation of impacts which are not considered for further impact classification:

- The discharge of hydrotest water for the proposed water pipeline and the LLCOP, which has been identified as part of the water demand for the Project from the Turkwel Gorge Reservoir (Section 5), will be assessed under separate ESIAs (one for the water pipeline – pending and one for LLCOP – already completed). This ESIA will address water used in hydrotesting of the infield infrastructure only.
- Construction of subsurface features (e.g., sumps, pits and trenches) and the backfilling of features such as trenches once pipework has been laid, has the potential to introduce foreign materials to the ground. Given the incorporated design measures and good practice, the potential for non-inert material to present a source of contamination is considered to be limited. It is predicted that the impact magnitude will be negligible and the significance of the impact on deep groundwater and shallow groundwater is **Negligible**.
- Treated discharges of process contact water or effluent will be controlled and undertaken under a valid effluent discharge license issued by NEMA. Therefore, the quality of surface water or groundwater will be maintained to approved standards, and so no impact is expected as a result of the discharge of treated

water. The impact magnitude will be negligible and the significance of the impact on all water receptors is **Negligible**.

- Accidental spills or leaks of fuels, oils, drilling muds, chemicals or other contaminants, through perforation for rupture of storage tanks, evaporation ponds, sanitation tanks and pipework or flowlines, via structural failure of a vehicle or plant or blow outs, plus well casing/cement integrity failure and down hole collisions are assessed under Emergency, Accidental and Non-Routine Events (Section 7.11) and the related Emergency Response Plans. Therefore, this potential impact is not considered further here.

The following potential sources of impact are, therefore, the focus of further assessment:

- Earth movements and concrete production resulting in increased suspended solids in waterbodies - activities such as vegetation clearing; topsoil stripping; grading/levelling; excavating and storage of excavated materials; and vehicle movements may result in ground disturbance leading to increased suspended solids being washed into the surface water environment, thereby changing water quality. The mobilised soils could also result in leaching of their constituent minerals (e.g., metals) that could also change water quality. The production of concrete has the potential to lead to run-off contaminated with suspended solids, a more alkaline pH, and higher alkalinity. Impacts on groundwater quality are possible through vertical seepage into groundwater. Surface water could be directly impacted if spills or leaks occurred into surface water, or indirectly through contaminated run-off.
- Discharges from construction waste storage facilities - this could include soils, general waste from camps, waste oils and filters from mobile plant and equipment and generators, oily rags, waste solvents and used chemical drums. Leaching from stored construction waste could lead to a change in water quality in receiving waterbody through direct disposal into the water environment. Impacts on groundwater quality are also possible through the infiltration of precipitation through waste, through the ground and into groundwater. Surface water could also be indirectly impacted through contaminated run-off.
- The discharge of used flushing and hydrotesting water from the testing of infield lines has the potential to introduce to the receiving surface water or groundwater environment any chemicals added to the water and any substances cleared from the inside of the infield pipework during flushing (e.g., rocks/fines, metal/plastic fragments, welding residue or manufacturing lubricants). Water will be used, reused where possible and the intention is for hydrotest water to be discharged into purpose-built ponds for evaporation, and the residue will be disposed of.

The impact assessment is discussed in more detail in the sub-sections below. The construction phase impact assessment with respect to water resources is presented in Table 7.4-2.

7.4.9.1.1 Construction activities and Concrete Production

Vehicle movements, vegetation clearing, channel diversions, topsoil stripping, excavating and storage of excavated materials, construction of bunds, ditches and trenches and concrete production all have the potential to increase suspended solids in surface water if the works take place near watercourses, or near them where there is the potential for the suspended solids to be transported by drainage or run-off. These suspended solids could also lead to a change in water quality with respect to parameters such as pH, alkalinity, and metal concentrations. Without mitigation, the potential impact magnitude to surface water (either direct or indirect) is high (adverse). The associated impact significance on the Kalabata, seasonal rivers and luggas and water users (hand dug wells in dry riverbeds in areas downstream of construction activities) is **Moderate**.

7.4.9.1.2 Mitigation

In addition to the incorporated measures (e.g., using existing infrastructure where possible, dust suppression, and working under a consent for works in, or within, watercourses), the following additional specific mitigation can be adopted to further reduce the potential impact:

- The Operator Environmental Performance Plan will include soil erosion management controls to prevent increases in sediment transport towards the Kalabata and season rivers during construction and to monitor water quality throughout construction.
- Lugga crossings will be designed and completed according to procedures defined in the Operator Environmental Performance Plan and will include procedures to prevent increases in sediment transport towards and within luggas during construction and to monitor water quality throughout construction.
- The amount of time trenches or other excavations will be open will be minimised.
- Riparian vegetation (e.g., trees and shrubs) and areas that may be sensitive to erosion will be avoided with micro alignment identified during the pre- construction survey.
- **Repeated Mitigation – Water Quality 01 – Erosion control:**
  - Works in, or within watercourses shall not take place without consent from NEMA (as per the EMCA (Water Quality) Regulations, 2006).
  - Works planned during periods of extreme rainfall and rainy seasons will be managed, as far is it is practicable, to limit the generation and mobilisation of suspended solids into the water environment and to manage safety of workers.
  - Temporary erosion control measures will be installed prior to earth-moving activities, to limit the likelihood of sediment mobilisation to the water environment. Suspended solid management techniques will be used. The procedures being followed will be audited and monitored throughout construction.
  - The amount of time the trenches will be open will be minimised, reducing the time per location when excavated soils are exposed to limit the likelihood of sediment mobilisation to the water environment. Any materials, which could lead to contamination, placed in trenches by third parties or otherwise, will be removed before trenches are backfilled to remove potential sources of contamination.
  - Construction activities in seasonal rivers and smaller streams/luggas will be planned for dry season periods or when no or low flow is anticipated. If unavoidable, flow will be diverted and redirected into same watercourse further downstream.
  - Any cleared areas within the footprint, where topsoil is salvageable, measures will be taken by Operator and their contractors to store topsoil and maintain the existing seed bed. If additional re-seeding is required during rehabilitation, it will be seeded/replanted with locally sourced seed/plants of suitable species. Topsoil management will allow reestablishment/re-generation of vegetation on bare areas and limit the erosion potential.
- **Repeated Mitigation – Water Quality 02 – Triggers and Actions:** The Operator Environmental Performance Plan will include the following procedures:
  - Definition of trigger values for action should they be exceeded. Trigger values for all parameters will be set as no less stringent than an exceedance of 20% beyond the range of normalised concentrations observed during the baseline at the closest baseline monitoring location, or the Kenyan water quality standard (whichever is the most conservative).

  - Actions will be set out to identify the construction activities leading to the source of any exceedances, and subsequent improvements to erosion control and environmental protection will be set out should trigger values be exceeded.

- **Repeated mitigation – Water Quality 03– Groundwater Quality Monitoring:** All monitoring locations will be established (boreholes drilled, installed and verified) prior to construction. Monitoring will be completed throughout construction and one year after construction on a monthly basis, with further inspections following any extreme rainfall/flood events (greater than 1 in 30-year return period rainfall). Groundwater monitoring will comprise the following, as a minimum:

  - Monthly groundwater sampling and laboratory analysis (by an ISO accredited lab) plus in-situ field analysis. Laboratory analysis will include all parameters reported in the baseline including major ions, nutrients, organics and oils, polyaromatic hydrocarbons, inorganics and bacteriological (full suite in Annex I). In-situ field analysis will be completed for pH, Temperature, Dissolved Oxygen, Electrical Conductivity, Turbidity. Monthly groundwater quality data will be gathered at two shallow groundwater monitoring locations sited downgradient of all infrastructure in construction, including wellpad locations, waste facilities and CFA located along the downgradient groundwater contours identified in the baseline (Figure 6.8-11).

  - If surface water is present during monthly groundwater sampling rounds, *ad hoc* surface water sampling will occur at the sampling locations (including hand dug wells) used in the baseline downgradient of the wellpad locations, waste facilities and CFA. Laboratory analysis (by an ISO accredited lab) will include all parameters reported in the baseline including major ions, nutrients, organics and oils, polyaromatic hydrocarbons, inorganics and bacteriological (full suite in Annex I). In-situ field analysis will be completed for pH, Temperature, Dissolved Oxygen, Electrical Conductivity, Turbidity

- **Repeated Mitigation – Water Quality 05 – Scour:** A pre-construction survey of each lugga/watercourse crossing will be completed to verify the assumptions and outcome of the desk based scour assessment, which will be completed to understand hydraulics and sediment transport for up to a 1 in 100 year return period and provide the scour potential and scour depth at each crossing, plus any additional measures required to manage scour during construction and maintain downstream water quality below trigger levels.

- **Repeated Mitigation – Water quality 06 – Channel morphology:** The Operator Environmental Performance Plan will include procedures for a visual and photographic inspection of the channel, to identify if construction works have changed the channel morphology. The Plan will also outline procedures for actions to rehabilitate the channel to minimise changes to sedimentology in the channel, should it be required.

7.4.9.1.3 Residual Impact

Taking account of the mitigation, the predicted residual impact magnitude to nearby surface water bodies is low (negative). The impact significance on the Kalabata, seasonal rivers and luggas and water users (hand dug wells in dry riverbeds in areas downstream of construction activities) is **Minor.**

7.4.9.1.4 Discharges/Releases from Waste Storage and Disposal Activities

Stored waste can leach contaminants that can enter the water environment (nearby surface water bodies and/or shallow groundwater). Without mitigation there is the potential that such releases could result in a decrease in water quality to a degree that baseline concentrations and water quality standards could be exceeded. Therefore, the impact magnitude to nearby surface water bodies and/or shallow groundwater is predicted to be indirect high (negative). The impact significance on the Kalabata and seasonal rivers and luggas is **Moderate** and the impact significance on shallow groundwater is **Major**. The impact would remain as long as the waste source remains. Waste does degrade over time and the source concentrations of contaminants will decrease. Therefore, the impact would be temporary until the waste is removed or the source is depleted and long term because waste will remain in the landfill beyond the end of the operational phase.

7.4.9.1.5 Mitigation

The Operator Environmental Performance Plan will include procedures to avoid disturbance of and release of contaminants from any existing waste storage.

In addition, **Repeated Mitigation – Water Quality 02 – Triggers and Actions** and **Repeated mitigation – Water Quality 03 – Groundwater Quality Monitoring** will be implemented to monitor all potential impacts and set trigger values and actions should exceedances be observed.

7.4.9.1.6 Residual Impact

Taking account of the mitigation, the predicted residual impact magnitude to nearby surface water bodies is low (negative) and impact classification on the Kalabata, seasonal rivers and on shallow groundwater will be **Minor.**

7.4.9.1.7 Discharge of used flushing and hydrotest water

Hydrostatic testing ("Hydrotesting") of equipment and pipelines involves pressure testing with water to detect leaks and verify equipment and pipeline integrity. Hydrotesting typically occurs during pre-commissioning. Pipelines are filled with hydrotest water, which is then raised to greater than operating pressure, allowing infrastructure to be assessed in terms of its structural integrity. Used hydrotest water could typically contain chemical additives such as corrosion inhibitors and tracer chemicals used during, or present prior to, testing. Oxygen depleting compounds such as sodium sulphite may for example be used to protect against corrosion inside tanks and pipelines and other contaminants may include suspended solids, iron, and chlorine. If released to the environment, hydrotest water has the potential to contaminate surface waters and groundwater.

Hydrotest water will be discharged into purpose-built ponds for evaporation. However, although unplanned in the event that evaporation is not possible, discharge into the surrounding environment may occur.

The discharge to the environment without mitigation will have a direct high (negative) impact, short term, and temporary because they can be reversed if discharges cease. The impact significance to the Kalabata and ephemeral streams and the lugga network is **Moderate** and the impact significance on shallow groundwater is **Major.**

7.4.9.1.8 Mitigation

The incorporated mitigation measures mean that discharge locations and rates will be controlled through GIP (i.e., undertaken under a valid effluent discharge license issued by NEMA).

In addition, The Operator Environmental Performance Plan will define all procedures relating to the management of hydrotest water, including:

Repeated Mitigation - Water Quality 04 – Hydrotest discharge management:

- The Operator will minimise the need for chemicals in hydrotest water, by reviewing hydrotest water requirements considering chemical effectiveness and stability, toxicity, compatibility with other additives used and reactivity towards other materials and compounds used. All hydrotest chemicals will be selected based on toxicity, biodegradation and bioaccumulation data provided by suppliers and the most environmentally benign selected for use;
- Procedures relating to abstraction, use, storage, and disposal of water used during hydrotest of pipelines and how water reuse will be maximised, including:
  - The same hydrotest water will be used for tests on multiple sections if practicable. Treatment/filtering may be required to make sure the test water is suitable for re-use in the next section of pipe;

- Once the final testing has been completed, further water reuse should also be considered;
- Re-use will be maximised. Before re-use, water will first be collected, tested and treated if required. Depending on the quality of the water, reuse could include grey water for toilets, floor washing water, vehicle washing, dust suppression, or cleaning of construction equipment; and
- Reuse, or storage before disposal, may require holding a facility (e.g., pond or tank). Losses (e.g., evaporation or leaks) from such facilities will be minimised.

- Evaporation will be used to dispose of hydrotest water, wherever possible. Evaporation ponds will be constructed using the following:
  - Lined with an impermeable liner;
  - Fenced to prevent intrusion by people, livestock and wildlife;
  - Constructed to prevent any failure during a flood event (up to 100-year return period); and
  - Any evaporite remaining will be packaged up with the liner and disposed of as part of the Operator Waste Management Plan.
- In the event that discharge into the surrounding environment is the only available option, the following will be applied relating to water quantity:
  - Appropriate approval under the appropriate Kenyan permitting regime; any wastewater disposal will be undertaken with cognisance of Kenya legislation and the nature of the receiving environment;
  - Discharge location selection and rates will be managed to limit the potential for increased erosion or flooding (i.e., at a controlled rate and use of erosion control measures);
  - Sediment control measures will be used, where required, to protect aquatic biota, water quality, and water users from the potential effects of discharging;
  - Pollution prevention control will be implemented - water quality (chemistry and physical parameters) of the discharge will have to be suitable for the chosen discharge location and meet Project Standards;
  - A discharge method statement and monitoring programme will be developed;
  - The monitoring locations will be selected with the objective of providing representative monitoring data;
  - Monitoring of discharge quality will be undertaken before discharge. This may be required to meet permit requirements for volume and quality. Discharge monitoring will target parameters of concern;
  - The temperature of the discharged water will not cause an unacceptable increase in the temperature of the receiving water environment;
  - Monitoring will be conducted by trained individuals who are following monitoring, record-keeping procedures and using properly calibrated and maintained equipment; and
  - Monitoring data will be analysed and reviewed at regular intervals and compared with appropriate environmental standards, so that the requirement for any necessary actions can be identified and those actions can be taken.

7.4.9.1.9 Residual Impact

Including the incorporated and additional mitigation, the predicted impact magnitude on the Kalabata and seasonal rivers and luggas and water users (hand dug wells in dry riverbeds) in areas downstream of discharge locations and on shallow groundwater is **Minor.**

Table 7.4-2: Construction Phase Impact Assessment

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
The Kalabata River adjacent or downgradient / downstream of Project construction activities where water users dig shallow hand dug wells in the dry riverbeds (medium)	Construction activities of Project infrastructure, including wellpads and CFA, located within catchment of the Kalabata River. including: ground disturbance, construction, contamination due to storage and use of hazardous or non-hazardous substances, leaching from backfill materials and/or concrete batching	High (indirect, temporary, short term, negative)	Moderate	The Operator Environmental Performance Plan will include soil erosion management controls to prevent increases in sediment transport towards the Kalabata during construction and to monitor water quality throughout construction. **Repeated Mitigation – Water Quality 01 – Erosion control:** ■ Works in, or within watercourses shall not take place without consent from NEMA (as per the EMCA (Water Quality) Regulations, 2006). ■ Works planned during periods of extreme rainfall and rainy seasons will be managed, as far is it is practicable, to limit the generation and mobilisation of suspended solids into the water environment and to manage safety of workers. ■ Temporary erosion control measures will be installed prior to earth-moving activities, to limit the likelihood of sediment mobilisation to the water environment. Suspended solid management techniques will be used. The procedures being followed will be audited and monitored throughout construction.	Low	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				■ The amount of time the trenches will be open will be minimised, reducing the time per location when excavated soils are exposed to limit the likelihood of sediment mobilisation to the water environment. Any materials, which could lead to contamination, placed in trenches by third parties or otherwise, will be removed before trenches are backfilled to remove potential sources of contamination. ■ Construction activities in seasonal rivers and smaller streams/luggas will be scheduled for dry season periods or when no flow is anticipated. ■ Any cleared areas within the footprint, where topsoil is salvageable, measures will be taken by the Operator and their contractors to store topsoil and maintain the existing seed bed. If additional re-seeding is required during rehabilitation, it will be seeded/replanted with locally sourced seed/plants of suitable species. Topsoil management will allow reestablishment/re-generation of vegetation on bare areas and limit the erosion potential; **Repeated Mitigation – Water Quality 02 – Triggers and Actions:** The Operator		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				Environmental Performance Plan will include the following procedures: ■ Definition of trigger values for action should they be exceeded. Trigger values for all parameters will be set as no less stringent than an exceedance of 20% beyond the range of normalised concentrations observed during the baseline at the closest baseline monitoring location, or the Kenyan water quality standard (whichever is the most conservative). ■ Actions will be set out to identify the construction activities leading to the source of any exceedances, and subsequent improvements to erosion control and environmental protection will be set out should trigger values be exceeded. **Repeated mitigation – Water Quality 03– Groundwater Quality Monitoring:** All monitoring locations will be established (boreholes drilled, installed and verified) prior to construction. Monitoring will be completed throughout construction and one year after construction on a monthly basis, with further inspections following any extreme rainfall/flood events (greater than 1 in		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				30-year return period rainfall) Groundwater monitoring will comprise as a minimum: ■ Monthly groundwater sampling and laboratory analysis (by an ISO accredited lab) plus in-situ field analysis. Laboratory analysis will include all parameters reported in the baseline including major ions, nutrients, organics and oils, polyaromatic hydrocarbons, inorganics and bacteriological (full suite in Annex I). In-situ field analysis will be completed for pH, Temperature, Dissolved Oxygen, Electrical Conductivity, Turbidity. Monthly groundwater quality data will be gathered at two shallow groundwater monitoring locations sited downgradient of all infrastructure in construction, including wellpad locations, waste facilities and CFA located along the downgradient groundwater contours identified in the baseline (Figure 6.8-11). ■ If surface water is present during monthly groundwater sampling rounds, adhoc surface water sampling should occur at the sampling locations (including hand dug wells) used in the baseline downgradient of the wellpad locations, waste facilities and CFA.		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				Laboratory analysis (by an ISO accredited lab) will include all parameters reported in the baseline including major ions, nutrients, organics and oils, polyaromatic hydrocarbons, inorganics and bacteriological (full suite in Annex I). In-situ field analysis will be completed for pH, Temperature, Dissolved Oxygen, Electrical Conductivity, and Turbidity.		
	Discharges/ releases from waste storage and disposal activities and facilities,	High (indirect, temporary, long term, negative)	Moderate	The Operator Environmental Performance Plan will include procedures to avoid disturbance of and release of contaminants from any existing waste storage. **Repeated Mitigation – Water Quality 02 – Triggers and Actions** **Repeated mitigation – Water Quality 03 – Groundwater Quality Monitoring**	Low	Minor
	Water Discharges from hydrotest water leading to change in water quality	High (direct, temporary, short term, negative)	Moderate	**Repeated Mitigation - Water Quality 04 – Hydrotest discharge management:** - The Operator will minimise the need for chemicals in hydrotest water, by reviewing hydrotest water requirements considering chemical effectiveness and stability, toxicity, compatibility with other additives used and	Low	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				reactivity towards other materials and compounds used; ▪ The Operator Environmental Performance Plan will define all procedures relating to abstraction, use, storage, and disposal of water used during hydrotest of pipelines and how water reuse will be maximised. ▪ Where possible, evaporation from fenced, lined ponds will be used to dispose of hydrotest water. Any evaporite remaining will be packaged up with the liner and disposed of as part of the Operator Waste Management Plan. ▪ Should disposal of hydrotest water to the environment be required and evaporation is not possible. The disposal location and method of disposal will be in line with Kenya legislation and details of permitting agreed with the Kenya regulator, and. criteria for water quality monitoring of discharge will meet permitting requirements		
Seasonal rivers/streams and drainage luggas downgradient /	Construction activities near or within watercourses including:	High (direct or indirect, temporary, short term, negative)	Moderate	Lugga crossings will be designed and completed according to procedures defined in the Operator Environmental Performance Plan and will include procedures to prevent increases in sediment transport towards and within luggas during	Low	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
downstream of Project construction activities where water users dig shallow hand dug wells in the dry riverbeds (medium)	ground disturbance, construction, contamination due to storage and use of hazardous or non-hazardous substances, leaching from backfill materials and/or concrete batching			construction and to monitor water quality throughout construction. The amount of time trenches or other excavations will be open will be minimised. Work on ephemeral rivers, smaller streams/luggas and wetland crossings will be planned to take place during the dry seasons when no or low flow is anticipated. If unavoidable, flow will be diverted (e.g., through use of coffer dams) and redirected into same watercourse further downstream. Riparian vegetation (e.g., trees and shrubs) and areas that may be sensitive to erosion will be avoided with micro alignment, where possible, identified during the pre- construction survey. **Repeated Mitigation – Water Quality 01 – Erosion control** **Repeated Mitigation – Water Quality 05 – Scour:** ■ A pre-construction survey of each lugga/watercourse crossing will be completed to verify the assumptions and outcome of the desk-based scour assessment, which will be completed to understand hydraulics and sediment transport for up to a 1 in 100-year return period and provide the scour potential and scour depth at each crossing, plus any		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				additional measures required to manage scour during construction and maintain downstream water quality below trigger levels. **Repeated Mitigation – Water quality 06 – Channel morphology:** ■ The Operator Environmental Performance Plan will include procedures for a visual and photographic inspection of the channel, to identify if construction works have changed the channel morphology. The Plan will also outline procedures for actions to rehabilitate the channel to minimise changes to sedimentology in the channel, should it be required		
	Discharges/ releases from waste storage and disposal activities and facilities	High (indirect, temporary, long term, negative)	Moderate	The Operator Environmental Performance Plan will include procedures to avoid disturbance of and release of contaminants from any existing waste storage. **Repeated Mitigation – Water Quality 02 – Triggers and Actions** **Repeated mitigation – Water Quality 03 – Groundwater Quality Monitoring**	Low	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
	Water Discharges from hydrotest water, leading to change in water quality	High (direct, temporary, short term, negative)	Moderate	**Repeated Mitigation - Water Quality 04 – Hydrotest discharge management**	Low	Minor
Groundwater - shallow aquifers beneath and downgradient of the waste facilities or hydrotest discharge locations (high)	Discharges/ releases from waste storage and disposal activities	High (indirect, temporary, long term, negative)	Major	The Operator Environmental Performance Plan will include procedures to avoid disturbance of and release of contaminants from any existing waste storage and to monitor water quality throughout construction. **Repeated Mitigation – Water Quality 02 – Triggers and Actions** **Repeated mitigation – Water Quality 03 – Groundwater Quality Monitoring**	Low	Minor
	Water Discharges from hydrotest water, leading to change in groundwater quality	High (direct, temporary, short term, negative)	Major	**Repeated Mitigation - Water Quality 04 – Hydrotest discharge management**	Low	Minor

7.4.9.2 Operational Phase

This section focuses on the potential impacts to water quality that could result in significant impacts. As such some potential impacts are not considered further in this assessment as there is insufficient linkage between the source of impact and receptors, or the magnitude of this impact would be negligible when taking account of incorporated environmental measures. The following potential impacts are not considered further in the assessment:

- Treated discharges of process contact water or effluent will be controlled and undertaken under a valid effluent discharge license issued by NEMA. Therefore, the quality of surface water or groundwater will be maintained to approved standards, and impact magnitude will be negligible and the significance of the impact on all water receptors is assessed to be **Negligible**.

The following potential sources of impact are the focus of further assessment:

- The storage and disposal of waste – operational waste could come from a range of sources, such as general waste from permanent camps, waste oils and filters from plant and equipment and generators, oily rags, waste solvents and used chemical drums. Leaching from stored operational waste (either locally to its generation or at the IWMF), or inappropriate disposal of the waste, could lead to a change in water quality in receiving waterbody through direct disposal into the water environment.
- Impacts on groundwater quality are also possible through the infiltration of precipitation through waste, through the ground and into groundwater. Surface water could also be indirectly impacted through contaminated run-off.
- Waste in the operational landfill will start to generate leachate. The leachate has the potential to contain above baseline concentrations of a range of substances (e.g., metals, major ions, various forms of nitrogen and hydrocarbons) depending on the wastes deposited. Should leachate leak through the base or sides of the landfill it could contaminate groundwater. If leachate increased to a level higher than the outer sides of a landfill cell, the leachate could overflow and enter the surface water environment.

7.4.9.2.1 Discharges/Releases from Waste Storage and Disposal Activities

Stored waste can leach contaminants that can enter the water environment (nearby surface water bodies and/or shallow groundwater). Waste disposed in the landfill will generate leachate that could, if not managed and contained, could also enter the water environment. Without mitigation there is the potential that such releases could result in a decrease in water quality to a degree that baseline concentrations and water quality standards could be exceeded.

The impact magnitude to nearby surface water bodies and/or shallow groundwater is predicted to be high (negative). The impact significance on the Kalabata (closest watercourse to the Project waste facilities) and seasonal rivers and luggas is **Moderate** and the impact significance on shallow groundwater is **Major**. The impact would remain as long as the waste source remains. Waste does degrade over time and the source concentrations of contaminants decrease. Therefore, the impact would be temporary until the waste is removed or the source is depleted and long term because waste will remain in the landfill beyond the end of the operational phase.

In addition to incorporated design measures, the following addition specific mitigation will be adopted to reduce the potential impact:

- **Repeated Mitigation – Water Quality 07– Operational Waste Facility Management**: Prior to construction of the landfill facility, baseline monitoring will be carried out to establish an environmental baseline of the groundwater conditions beneath the site. The groundwater monitoring points will be installed as a part of the geotechnical investigations undertaken as a part of detailed design of the facility.

Monitoring of groundwater will continue from installation of the boreholes throughout the operational life of the site and into closure to monitor the groundwater beneath the site to ensure that the site is not have a negative effect on the local and regional groundwater. Gas and leachate monitoring will be undertaken to understand any gas and leachate migration in the landfill.

There will be a surface water management system at the landfill. (e.g., drainage ditches and slope design) that will redirect rainfall run-off away from open landfill cells to reduce leachate generation rates. The Operator Environmental Performance Plan will include procedures for landfill leachate management.

Drainage systems used to capture leaks/leachate/drainage in the IWMF, will be isolated from surface and groundwater.

- **Repeated Mitigation – Water Quality 02 – Triggers and Actions:** The Operator Environmental Performance Plan will include the following procedures for operations:
  - Definition of trigger values for action should they be exceeded. Trigger values for all parameters will be set as no less stringent than an exceedance of 20% beyond the range of normalised concentrations observed during the baseline at the closest baseline monitoring location, or the Kenyan water quality standard (whichever is the most conservative).
  - Actions will be set out to identify the construction activities leading to the source of any exceedances, and subsequent improvements to erosion control and environmental protection will be set out should trigger values be exceeded.
- **Repeated Mitigation – Water Quality 03 – Groundwater Quality Monitoring.**

  Groundwater monitoring during operations will comprise, as a minimum,
  - Quarterly groundwater sampling and laboratory analysis (by an ISO accredited lab) plus in-situ field analysis. Laboratory analysis will include all parameters reported in the baseline including major ions, nutrients, organics and oils, polyaromatic hydrocarbons, inorganics and bacteriological (full suite in Annex I). *In-situ* field analysis will be completed for pH, temperature, dissolved oxygen, electrical conductivity and turbidity. Quarterly surface water quality data will be gathered at two shallow groundwater monitoring locations sited downgradient of landfill and the CFA along the downgradient contour of the phreatic surface identified in the baseline.
  - If surface water is present during quarterly groundwater sampling rounds, *ad hoc* surface water sampling will occur at the sampling locations (including hand dug wells) used in the baseline downgradient of the wellpad locations, waste facilities and CFA. Laboratory analysis (by an ISO accredited lab) will include all parameters reported in the baseline including major ions, nutrients, organics and oils, polyaromatic hydrocarbons, inorganics and bacteriological (full suite in Annex I). In-situ field analysis will be completed for pH, temperature, dissolved oxygen, electrical conductivity and Turbidity.
  - Monitoring will be completed throughout operations and disclosed publicly.

Taking account of the incorporated measures and additional mitigation, the predicted residual impact magnitude to nearby surface water bodies and/or shallow groundwater is low (negative). The impact significance on the main rivers or seasonal rivers and luggas is **Minor** and the impact significance on shallow groundwater is **Minor**.

Table 7.4-3: Operational Phase Impact Assessment

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
The Kalabata River adjacent or downgradient / downstream of Project construction activities where water users dig shallow hand dug wells in the dry riverbeds (medium)	Discharges/ releases from waste storage and disposal activities and facilities	High (indirect, temporary, long term, negative)	Moderate	**Repeated Mitigation – Water Quality 07 – Operational Waste Facility Management:** - Prior to construction of the landfill facility, baseline monitoring will be carried out to establish an environmental baseline of the groundwater conditions beneath the site. The groundwater monitoring points will be installed as a part of the geotechnical investigations undertaken as a part of detailed design of the facility. Monitoring of groundwater will continue from installation of the boreholes throughout the operational life of the site and into closure to monitor the groundwater beneath the site to ensure that the site is not have a negative effect on the local and regional groundwater. Gas and leachate monitoring will be undertaken to understand any gas and leachate migration in the landfill. There will be a surface water management system at the landfill. (e.g., drainage ditches	Low	Minor
Seasonal rivers/streams and drainage luggas downgradient / downstream of Project construction activities where water users dig shallow hand dug wells in the dry riverbeds (medium)	Discharges/ releases from waste storage and disposal activities and facilities	High (indirect, temporary, long term, negative)	Moderate		Low	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Groundwater - shallow aquifers beneath and downgradient of the waste facilities (high)	Discharges/ releases from waste storage and disposal activities	High (indirect, temporary, long term, negative)	Major	and slope design) that will redirect rainfall run-off away from open landfill cells to reduce leachate generation rates. The Operator Environmental Performance Plan will include procedures for landfill leachate management. Drainage systems used to capture leaks/leachate/drainage in the IWMF, will be isolated from surface and groundwater. **Repeated Mitigation – Water Quality 02 – Triggers and Actions** Groundwater monitoring during operations will comprise as a minimum: Quarterly groundwater sampling and laboratory analysis (by an ISO accredited lab) plus in-situ field analysis. Laboratory analysis will include all parameters reported in the baseline including major ions, nutrients, organics and oils, polyaromatic hydrocarbons, inorganics and bacteriological (full suite in Annex I). In-situ field analysis will be completed for pH, Temperature, Dissolved Oxygen, Electrical Conductivity, Turbidity. Quarterly surface water quality data will be gathered at two shallow	Low	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				groundwater monitoring locations sited downgradient of landfill and the CFA along the downgradient contour of the phreatic surface identified in the baseline. If surface water is present during quarterly groundwater sampling rounds, adhoc surface water sampling will occur at the sampling locations (including hand dug wells) used in the baseline downgradient of the wellpad locations, waste facilities and CFA. Laboratory analysis (by an ISO accredited lab) will include all parameters reported in the baseline including major ions, nutrients, organics and oils, polyaromatic hydrocarbons, inorganics and bacteriological (full suite in Annex I). In-situ field analysis will be completed for pH, Temperature, Dissolved Oxygen, Electrical Conductivity, Turbidity. Monitoring will be completed throughout operations and disclosed publicly.		

7.4.9.3 Decommissioning Phase

The potential impacts to water quality at the decommissioning stage are likely to be similar to those in the construction phase, such as the following:

- Demolition, earth movement, restoration/regrading of surfaces could lead to the increase of suspended solids in nearby watercourses;
- The storage, transport, handling and use of chemicals and fuel; leaks from which could lead to changes in water quality;
- Hydrocarbon release during well and pipework decommissioning;
- Leaching from waste; and
- Sanitation leaks and wastewater discharge (including discharges from camps).

It is not known what the accepted procedures will be at the time of the future decommissioning phase; however, potential mitigation to manage the impacts could include the following:

- 5 years prior to the planned ‘End of Project’, a Decommissioning Plan will be developed for agreement with the appropriate authorities;
- Emptying/clearing/flushing and appropriate disposal of substances from pipes/storage/sumps prior to decommissioning;
- All underground equipment (pipeline) will be emptied of oil product, left in a clean state and left *in situ*;
- All above ground infrastructure will be evaluated for dismantling, removal and rehabilitation. This will be undertaken in consultation with Affected Communities and County Government to identify any facilities than can be safely handed over for community use;
- All decommissioning waste will be handled, stored and managed through GIP; and
- Decommissioning in accordance with Kenyan legislation - including disposal of waste/contaminated materials.

7.4.10 Summary of Mitigation

The following measures that are in addition to the incorporated design and GIP measures presented can reduce the potential impact of the Project on water quality:

- Works in, or within watercourses shall not take place without consent from NEMA;
- Works planned during periods of extreme rainfall and rainy seasons will be managed, as far is it is practicable, to limit the generation and mobilisation of suspended solids into the water environment. The amount of time the trenches will be open will be minimised;
- Temporary erosion control measures will be installed prior to earth-moving activities, to limit the likelihood of sediment mobilisation to the water environment. The procedures being followed will be audited and monitored throughout construction;
- Any materials, which could lead to contamination, placed in trenches by third parties or otherwise, will be removed before trenches are backfilled to remove potential sources of contamination;
- The amount of time trenches or other excavations will be open will be minimised;

- Riparian vegetation (e.g., trees and shrubs) and areas that may be sensitive to erosion will be avoided with micro alignment, where possible, identified during the pre- construction survey;
- A pre-construction survey of each lugga/watercourse crossing will be completed to verify the assumptions and outcome of the desk-based scour assessment, which will be completed to understand hydraulics and sediment transport for extreme events and provide the scour potential and scour depth at each crossing;
- Construction activities in luggas will be scheduled for dry season periods or when no flow is anticipated;
- The Project will complete visual and photographic inspection of channels, to identify if construction works have changed the channel morphology, and outline procedures for actions to rehabilitate the channel to minimise changes to sedimentology in the channel;
- Where topsoil is salvageable, measures will be taken by Operator and their contractors to store topsoil and maintain the existing seed bed;
- The Project will define trigger values for action should they be exceeded. Trigger values for all parameters will be set as no less stringent than an exceedance of 20% beyond the range of normalised concentrations observed during the baseline at the closest baseline monitoring location, or the Kenyan water quality standard (whichever is the most conservative). Actions will be set out to identify the construction activities leading to the source of any exceedances, and subsequent improvements to erosion control and environmental protection will be set out should trigger values be exceeded;
- All monitoring locations will be established (boreholes drilled, installed and verified) prior to construction. Monitoring will be completed throughout construction and one year after construction on a monthly basis, with further inspections following any extreme rainfall/flood events;
- Monthly groundwater sampling and laboratory analysis (by an ISO accredited lab) plus in-situ field analysis will be completed during construction. Quarterly groundwater sampling and laboratory analysis plus in-situ field analysis will be completed during operations. Laboratory analysis will include all parameters reported in the baseline. Monthly groundwater quality data will be gathered at two shallow groundwater monitoring locations sited downgradient of all infrastructure in construction;
- If surface water is present during monthly groundwater sampling rounds (construction) or quarterly monitoring (operations), adhoc surface water sampling will occur at the sampling locations used in the baseline downgradient of infrastructure;
- The Project will avoid disturbance of and release of contaminants from any existing waste storage and to monitor water quality throughout construction;
- Prior to construction of the landfill facility, monitoring will be carried out to establish an environmental baseline of the groundwater conditions beneath the site. Groundwater monitoring points will be installed. Monitoring of groundwater will continue from installation of the boreholes throughout the operational life of the site. Gas and leachate monitoring will also be undertaken to understand any gas and leachate migration in the landfill;
- There will be a surface water management system at the landfill that will redirect rainfall run-off away from open landfill cells to reduce leachate generation rates. The Project will maintain landfill leachate management;
- Drainage systems used to capture leaks/leachate/drainage in the IWMF, will be isolated from surface and groundwater;

- The Project will minimise the need for chemicals in hydrotest water. The Project will define all procedures relating to abstraction, use, storage, and disposal of water used during hydrotest of pipelines and how water reuse will be maximised; and
- Where possible, evaporation from fenced, lined ponds will be used to dispose of hydrotest water. Should disposal of hydrotest water to the environment be required and evaporation is not a feasible option. The disposal location and method of disposal will be in line with Kenya legislation. Water quality monitoring of hydrotest discharge will meet permitting requirements.

7.4.11 Summary of Residual Impacts

The prediction of water quality impacts (pre-mitigation) identified impacts with predominantly minor or negligible significance. Major significance impacts (without mitigation) were predicted to the Turkwel Gorge Reservoir as a result of construction activities in or near that waterbody and from discharges/releases from waste storage and disposal activities.

During construction, Moderate significance impacts (without mitigation) were predicted to the Kalabata River and the seasonal watercourses/luggas as a result of construction activities within the catchment. Moderate significance impacts (without mitigation) were also predicted to the Kalabata River and seasonal watercourses/luggas from discharges/releases from waste storage and disposal activities and discharges of hydrotest water to the water environment. A Major significance impact was assigned for shallow groundwater subject to discharges/releases from waste storage and disposal activities and discharges of hydrotest water to the water environment.

During operations, Moderate significance impacts (without mitigation) were also predicted to the Kalabata River and seasonal watercourses/luggas from discharges/releases from waste storage and disposal activities. A Major significance impact was assigned for shallow groundwater subject to discharges/releases from waste storage and disposal activities.

Taking account of the additional mitigation that is proposed, the Major and Moderate significance impacts are predicted to be reduced to minor significance residual impacts. All residual impacts to water quality are predicted to be **Minor** or **Negligible**.

7.5 Soils

7.5.1 Introduction

This section provides an assessment of the potential effects of the Project on, or to the Project from soils. As geology and seismicity/geohazards do not include environmental receptors, this impact assessment focuses exclusively on potential impacts to soils. Potential effects have been determined using a qualitative assessment methodology. Where potential impacts have been identified, these are considered in turn and mitigation is set out where necessary to ensure that any potential impacts are reduced as far as is practicable. Seismicity risks are considered further in the Environmental Risks and Accidents chapter (Section 7.11).

7.5.2 Area of Influence

The AoI for soils is limited to the direct disturbance area of the Project infrastructure, and a 100 m buffer around it for indirect effects such as water/wind erosion and dust deposition. The AoI for soils is located within the Project AoI presented in Section 3.13 and is shown on Figure 7.5-1.

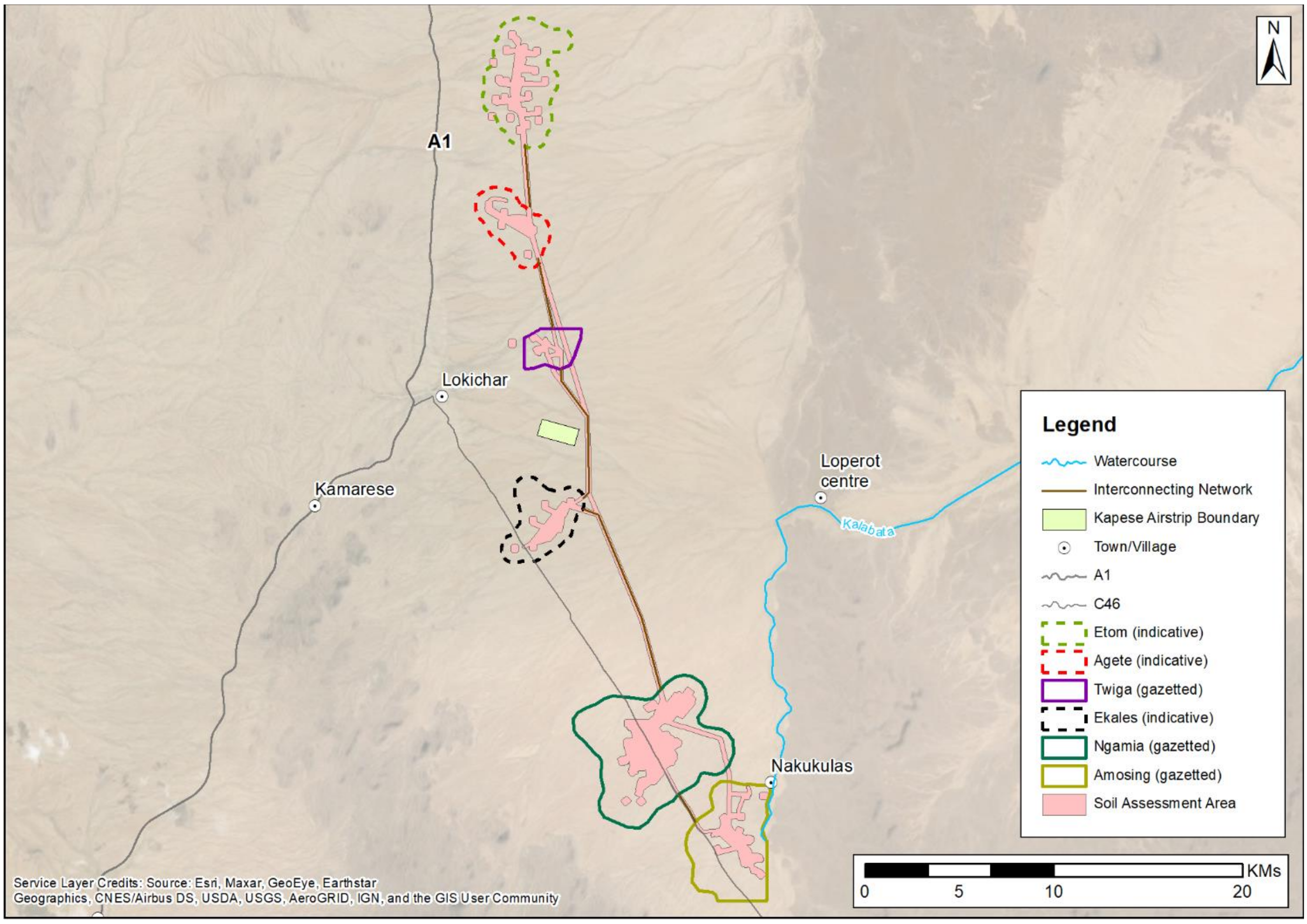

Figure 7.5-1: Project AoI for Soils

7.5.3 Receptor Importance

In order to identify the importance of the receptors, the scale of relative importance presented in Table 7.5-1 has been used with reference to the information collated in the baseline to classify the selected receptors.

Table 7.5-1: Criteria for Determining Importance of Receptors

Receptor Importance	Example Receptor Types
Very high	▪ Soils of international importance, high quality and rarity, regional or national scale and limited potential for substitution/replacement (not applicable in this ESIA).
High	▪ Soils or land use of national importance; ▪ Soils with a high quality, local scale and limited potential for substitution/replacement; and/or ▪ Soils with a medium quality and rarity, regional or national scale and limited potential for substitution/replacement.
Medium	▪ Soils or land use of regional importance; ▪ Soils with a medium quality and rarity, local scale and limited potential for substitution/replacement; and/or ▪ Soils with a low quality and rarity, regional or national scale and limited potential for substitution/replacement.
Low	▪ Soils or land use of local, limited or no known importance; and/or ▪ Soils with a low quality and rarity, local scale.

7.5.4 Magnitude of Impact

The characterisation of the magnitude of the impact considers the description of Project processes and how the Project could result in a change at each of the receptors. The potential for an impact to occur at a receptor has been determined using the understanding of the baseline environment and consideration of whether there is a feasible linkage between a source of the potential impact and each receptor. The magnitude of each potential impact has then been classified between ‘negligible’ and ‘high’, as described in Table 7.5-2. These criteria allow for a qualitative assessment and are applied using professional experience and judgement.

Each potential impact can be either adverse or positive to the receptor of interest and vary in its duration (i.e. can be long term, medium or short term and either permanent or temporary). For the purposes of this assessment the following durations apply:

- A short-term impact is defined as up to 66 months (the maximum anticipated construction period). The CFA/CPF will be constructed within the first 36 months;
- A medium-term impact is defined as between 66 months and 25 years (anticipated duration of operations); and
- A long-term impact is defined as one that is predicted to last beyond the end of the operational life of the project (>25 years).

A permanent impact is defined as a change to the baseline that would not reverse itself naturally. A temporary impact is defined as a change to the baseline conditions that would reverse naturally once the source of the impact is exhausted or has stopped.

Potential impacts are also assigned descriptors to identify whether the impact is direct or indirect. For the purposes of this assessment, a direct impact is one that occurs as a direct result of the Project and is likely to occur at the Project itself. Indirect impacts (or secondary/tertiary impacts) are those where a direct impact on one receptor has another knock-on impact on one or more other related receptor(s). Indirect impacts are likely to occur away from the Project.

Table 7.5-2: Criteria for Assessing Magnitude of Impact

Magnitude of Impact	Description Criteria	
	Adverse	Positive
High	Severe damage to soil quality and/or extensive loss of pastoral land use capability (grazing/agriculture). Concentrations of contaminants in soils exceeding baseline concentrations and standards for parameters that could affect human health.	Large scale or major improvement to pastoral land use capability (grazing/ agriculture), extensive restoration or enhancement above baseline conditions.
Medium	Measurable damage to soil quality and/or land use capability for pastoral farming (grazing/agriculture). Concentrations of contaminant in soils are likely to exceed baseline concentrations and standards for parameters that are unlikely to affect human health.	Some benefit to key soil quality characteristics or land use capability.
Low	Some measurable change in/damage to soil quality or vulnerability to pastoral land use capability (grazing/agriculture). Minor loss of, or alteration to, key soil quality characteristics or land use capability. With respect to soil quality, concentrations are unlikely to exceed baseline concentrations and standards (e.g. soil organic matter, salinity, pH, fertility, metal concentrations).	Minor benefit to, or addition of, one or more key soil quality characteristics that improves pastoral land use capability.
Negligible	No, or very minor (immeasurable), change to soil characteristics or parameters describing soil quality or pastoral land use capability (e.g. soil organic matter, salinity, pH, fertility, metal concentrations).	

The definitions applied to resulting significance categories for the purposes of this assessment are summarised as follows:

- Major: If adverse, impacts with this significance represent key factors in the decision-making process or the feasibility of the Project. They are generally, but not exclusively, associated with human health or features of international or national importance and/or resources/features that are unique, which, if lost, cannot be replaced or relocated.
- Moderate: If adverse, impacts with this significance may contribute to the decision-making process. These impacts are generally, but not exclusively, expected to be important at a regional or local scale.
- Minor: These impacts may be raised as local issues but are unlikely to be of importance in the decision-making process. Nevertheless, they are of relevance in the detailed design of the Project.
- Negligible: Impacts that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

7.5.5 Key Guidance and Standards

The Kenyan policy and legislation documents presented in Section 2.2 and the international guidance and standards presented in Section 2.3 are relevant to this assessment. The guidance and standards that are relevant to the protection of geology and soils to which the Project will be required to conform are as follows:

- Kenyan policy and legislation, including:
  - Kenyan Government EMCA, 1999 and Amendments, 2016; and

- Republic of Kenya National Environment Policy, 2013.

- National Soil and Water Conservation Project (Machakos District) FAO UN, 1989;
- IFC PS, 2012; and
- WBG EHS Guidelines, 2007.

The impact assessment mitigations were developed by applying international industry standards for construction of oil and gas facilities on undisturbed ground, including considerations for topsoil salvage, storage and replacement where applicable. These soil conservation and reclamation principles are common in the oil and gas industry worldwide and are consistent with FAO UN standards.

7.5.6 Receptors of Interest and Importance

The focus of this assessment is on the quality of soil. Baseline environmental information indicates the importance and types of soil that occur in the AoI. Potential impacts on nomadic pastoralists are considered in the social impact assessment (Section 7.9).

Using the Project Description and the baseline soil environment information presented in Chapter 6.0, the following primary soil resources have been identified as being susceptible to changes in soil quality:

- Regosols, which occupy much of the footprint of the Upstream project infrastructure, are of low importance agricultural land potential.

In addition to the receptors that could be impacted by changes in soil quality, this assessment also considers changes to soil quantity through the risk of erosion.

Figure 7.5-2 illustrates the soil resources within the Project footprint and Table 7.5-3 presents the assigned importance for these resources following the criteria presented in Section 7.5.3.

Table 7.5-3: Receptors and Importance (Soil Quality, Quantity and Erosion Risk)

Receptor	Importance	Comment
Regosols	Low	Poor agricultural land potential, limited potential for degradation of land use capability. Limited potential for degradation of land use capability due to wind/water erosion.

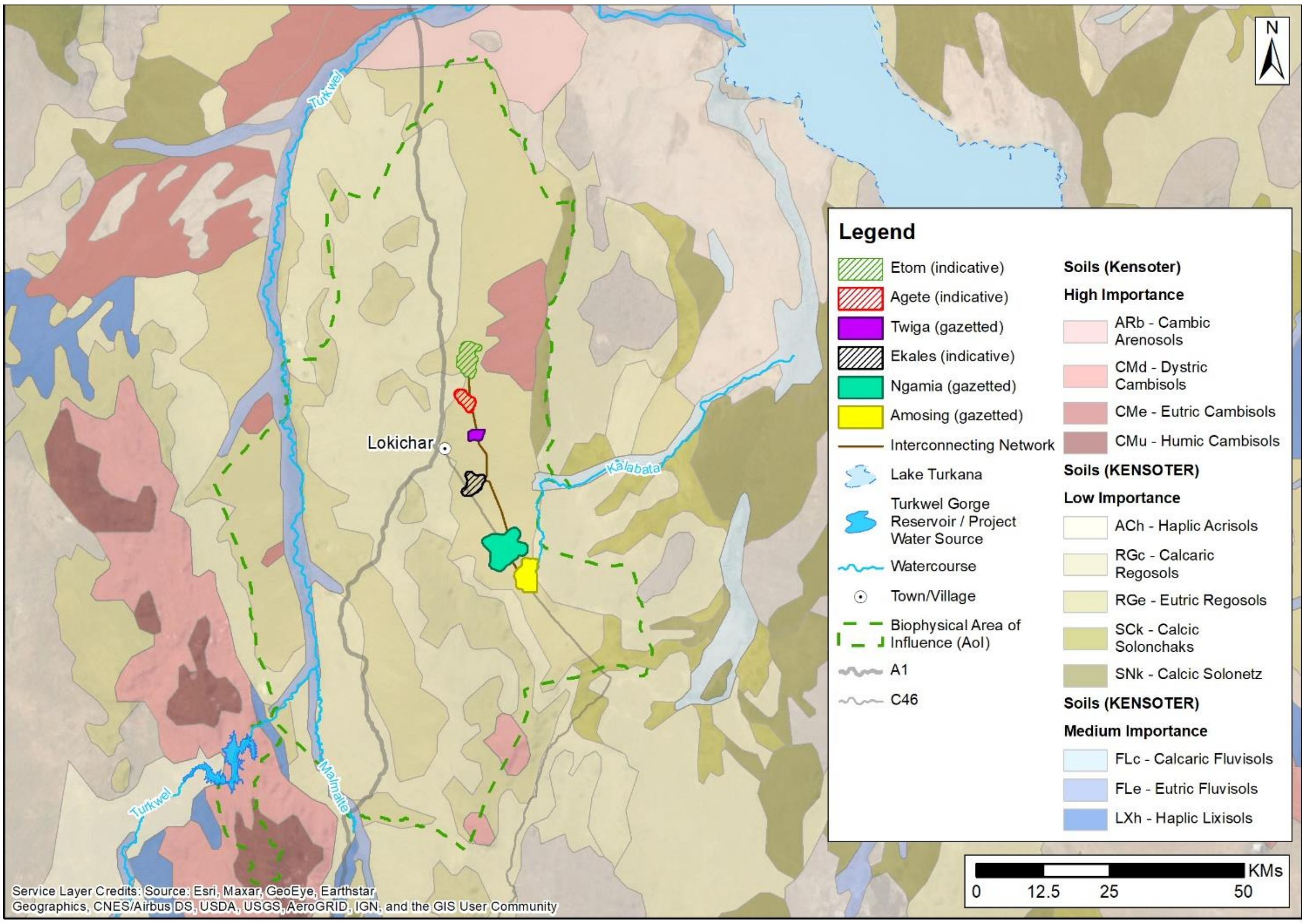

Figure 7.5-2: Soil Types in the Project AoI

To aid in the evaluation of the magnitude of impact on soils due to erosion, the AoI was evaluated in GIS using the Revised Universal Soil Loss Equation (RUSLE) toolkit by inputting applicable parameters including:

- The LiDAR bare earth Digital Elevation Model (DEM), ASTER Global Digital Elevation Model (GDEM) and Pleiades Satellite derived DEM for the topographical factors;
- Soil erosivity values based on known literature values for the soil textural types found in the AoI (based on soil type receptors above);
- Rainfall Erosivity values based on actual regional rainfall intensity data from Global Rainfall Erosivity (ESDAC 2017); and
- Cover and management factors assuming bare soil.

The resultant output was rated into a relative erosion risk rating (low, moderate, high) that could be visualised and used for future mitigation/design measures.

7.5.7 Sources of Impacts

Potential sources of impact of a range of magnitudes that will occur throughout the life of the Project are set out below by Project phase.

7.5.7.1 Construction Phase

Based on the Project Description and the understanding of the baseline soil conditions that has been developed, there are aspects of the Project that have been identified as having the potential to present sources of impact to either soil quality or soil loss due to erosion during the construction phase. The potential sources of impact and routes by which they could impact soil resources are as follows:

- Construction activities disrupting the surface soil crust or root mats resulting in localised loss of topsoil due to erosion (wind and/or water);
- Stripping of surface soil during construction resulting in admixing of subsoil into the topsoil and dilution of organic matter;
- High vehicle traffic during construction on ground surfaces causing compaction of medium and fine-textured topsoil (rutting) and subsoil;
- Earthworks construction activities associated with the physical disturbance of soil resources, their handling, storage, and replacement could lead to a change in soil quality and expose soil resources to elevated risk of soil erosion while soil is in stockpile and the landscape is altered (i.e. trench excavation); and
- Reclamation of the infield pipeline trenches will result in topsoil having been in storage and may have degraded due to organic matter loss, soil biodiversity loss, and/or erosion.

7.5.7.2 Operational Phase

Based on the Project Description, the following aspects of the Project have been identified as presenting potential sources of impact to soil quality and/or pastoral land use capability during the operational phase:

- Presence of the backfilled infield pipeline trenches – the pipework and associated backfill materials that will be installed within the trench will have different hydraulic properties to the original soils/rock that are excavated. This could lead to localised changes in soil drainage and soil water availability;
- Operation of the permanent Project infrastructure will result in a long-term loss of pastoral land use capability and will be degraded due to organic matter loss; and
- Heavy equipment traffic leading to compaction and rutting.

7.5.7.3 Climate Change

Soil taxonomy and soil characteristics are not expected to change due to climatic change, and the Project is not expected to accelerate taxonomic or soil chemical/physical property changes in correlation with climatic change.

The impacts of changes in temperature and rainfall as a result of climate change (as detailed in Section 6.4.6), which have the potential to result in increased erosion, are considered in Section 7.3 (Water Quantity).

7.5.8 Incorporated Environmental Measures

The Project has been designed and planned to incorporate a range of incorporated environmental measures that provide measures to avoid potential impacts or reduce their magnitude, prior to the impact analysis being completed.

The measures presented in this section either relate to Project infrastructure (design measures) or are widely accepted GIP.

7.5.8.1 Design Measures

The following measures are part of the Project design and reduce the potential impact of the Project on soil quality/availability:

- All substance storage (chemicals and fuels) will be bunded – all on-site hazardous materials storage will feature a secondary containment system, in line with IFC EHS Guidelines, 2007. By locating substances in dedicated storage areas with appropriate flooring and bunding, spills/leaks can be contained and addressed rather than being able to enter the environment;

- Existing infrastructure has been identified for use where possible (e.g. existing roads instead of new ones) to reduce the need to create new infrastructure - the construction of which could have led to increased suspended solids and changes to infiltration; and
- Oil water separators will be installed and maintained, as appropriate.

7.5.8.2 Good Industry Practice

- The Project will be constructed to comply with relevant Kenyan laws/regulations and with environmental permits in place;
- Only inert backfill materials will be used for the trenching process to reduce the potential for introducing new sources of contamination;
- Waste disposal will be to a NEMA licensed facility to reduce pollution potential;
- The Project will apply effective spill prevention, control and response procedures for non-emergencies to control releases that could pollute the soil environment; provision, and training in use, of spill containment equipment will be implemented where they are required;
- Operational waste (e.g. effluents from tank bottom water, storm water, and other waste) will be handled in a way that follows environmental legislative requirements and reduces pollution potential;
- When selecting chemicals and materials this will, where practicable, aim to avoid or minimise the use of hazardous materials; consideration will be given to selecting the items with the lowest potential for environmental harm possible without loss of effectiveness;
- Transfer of hazardous materials from tanks to storage will take place in areas with surfaces sufficiently impervious to avoid loss to the environment; the surface will be sloped to a collection or a containment structure not connected to municipal wastewater/storm water collection system;
- The amount of time the infield pipeline trenches will be open will be minimised;
- Topsoil will be salvaged, sorted and protected along the length of the infield pipeline trench and replaced following pipeline installation and trench backfilling; this will minimise degradation of soil quality and limit erosive losses of soil while in stockpiles; and
- Any materials, which could lead to contamination, placed in trenches by third parties or otherwise, will be removed before trenches are backfilled.

7.5.9 Impact Classification

Taking into account the baseline soil environment setting (Section 6.3), the relevant incorporated environmental measures (Section 7.5.8), and the potential sources of impact (Section 7.5.7) determined from the Project Description, the potential source-pathway-receptor impact linkages for the construction and the operational phases are presented in this section.

A discussion regarding feasible impact linkages during each of the Project phases is presented in each of the sub-sections below. Each discussion is followed by a table where the non-negligible potential sources of impact and relevant additional mitigation applicable to each receptor are summarised.

7.5.9.1 Construction

The impact classification process prioritises potential impacts to soil that could result in significant impacts. As such some potential impacts can be "*scoped out*" where there is insufficient linkage between the source of impact and receptors, or the magnitude of this impact would be negligible when taking account of incorporated environmental measures.

The following list provides the qualitative evaluation of impacts that are not considered for further impact classification:

- High vehicle traffic during construction on ground surfaces causing compaction of medium and fine-textured topsoil (rutting) and subsoil. The Project will reuse existing infrastructure where possible; thereby reducing the amount of new hardstanding. The area taken up with Project infrastructure is also small compared to the wider soil availability and the soil is of relatively poor quality. Given this, it is predicted that the impact magnitude will be negligible and the significance of the impact is **Negligible**.
- Reclamation of the infield pipeline trenches will result in topsoil having been in storage and may have degraded due to organic matter loss, soil biodiversity loss, and/or erosion. However, with the incorporated environmental measures in place, such changes and the likely poor quality of the soil in disturbed areas, impacts would be localised and very small scale. Therefore, it is predicted that the impact magnitude will be negligible**,** and the significance of the impact is **Negligible.**

7.5.9.1.1 Soil Quality

With the exception of the luggas interspersed throughout the area of the CFA, wellpads, landfill, and roads, the soils in the areas of permanent Project infrastructure are of low quality for pastoral use (Regosols) and lack a thick topsoil horizon with organic carbon enrichment and are mineral nutrient poor. It is expected that the Project will result in a low magnitude impact on soil quality/loss of pastoral land use capability, which, for a receptor of low importance, has a **Negligible** significance.

7.5.9.1.2 Soil Erosion

Table 7.5-4 presents locations relating to Project infrastructure that have been identified as potentially prone to soil erosion.

Table 7.5-4: Soil Erosion Risk Rating and Locations of Soils

Soil Reference Group	Erosion Risk Rating	Rationale	Locations identified as having potential for specific soils
Regosols	Low	Weakly developed soil structure and horizons makes these soils susceptible to erosion on high slopes.	All Project infrastructure will interact with Regosols, however they occur primarily in locations with low slope gradients and therefore the risk rating is low.

Figure 7.5-3 to Figure 7.5-6 show the RUSLE output for erosion risk ratings spatially for the Project, which generally coincide with the Reference Group soil types described in Table 7.5-4 above. The figures demonstrate that for the majority of the Project, erosion risk rates are predominantly low.

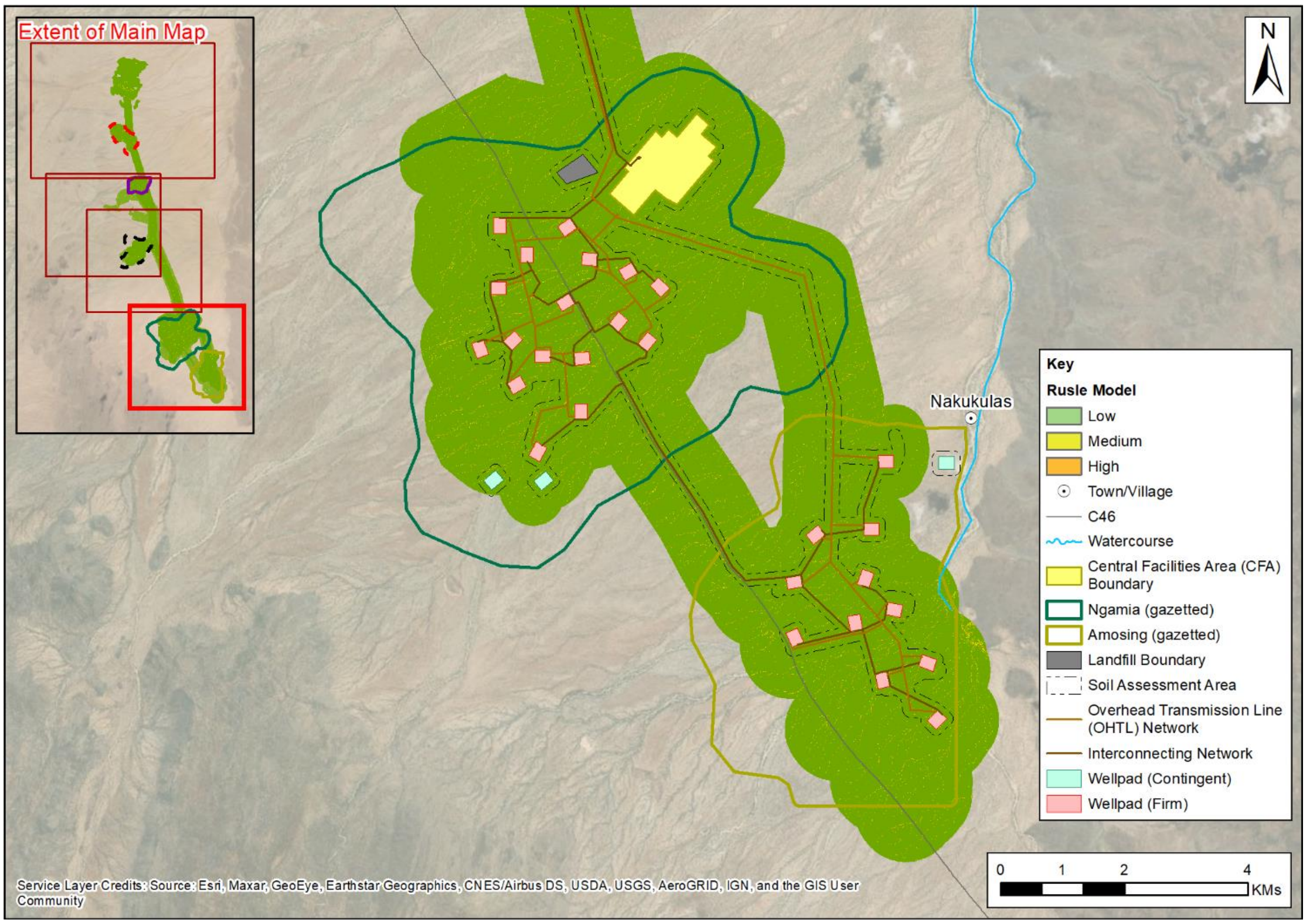

Figure 7.5-3: Soil Erosion Risk in the Upstream Oil & Gas Facilities (CFA, Ngamia and Amosing Wellpads, Landfill and Interconnecting Network RoW)

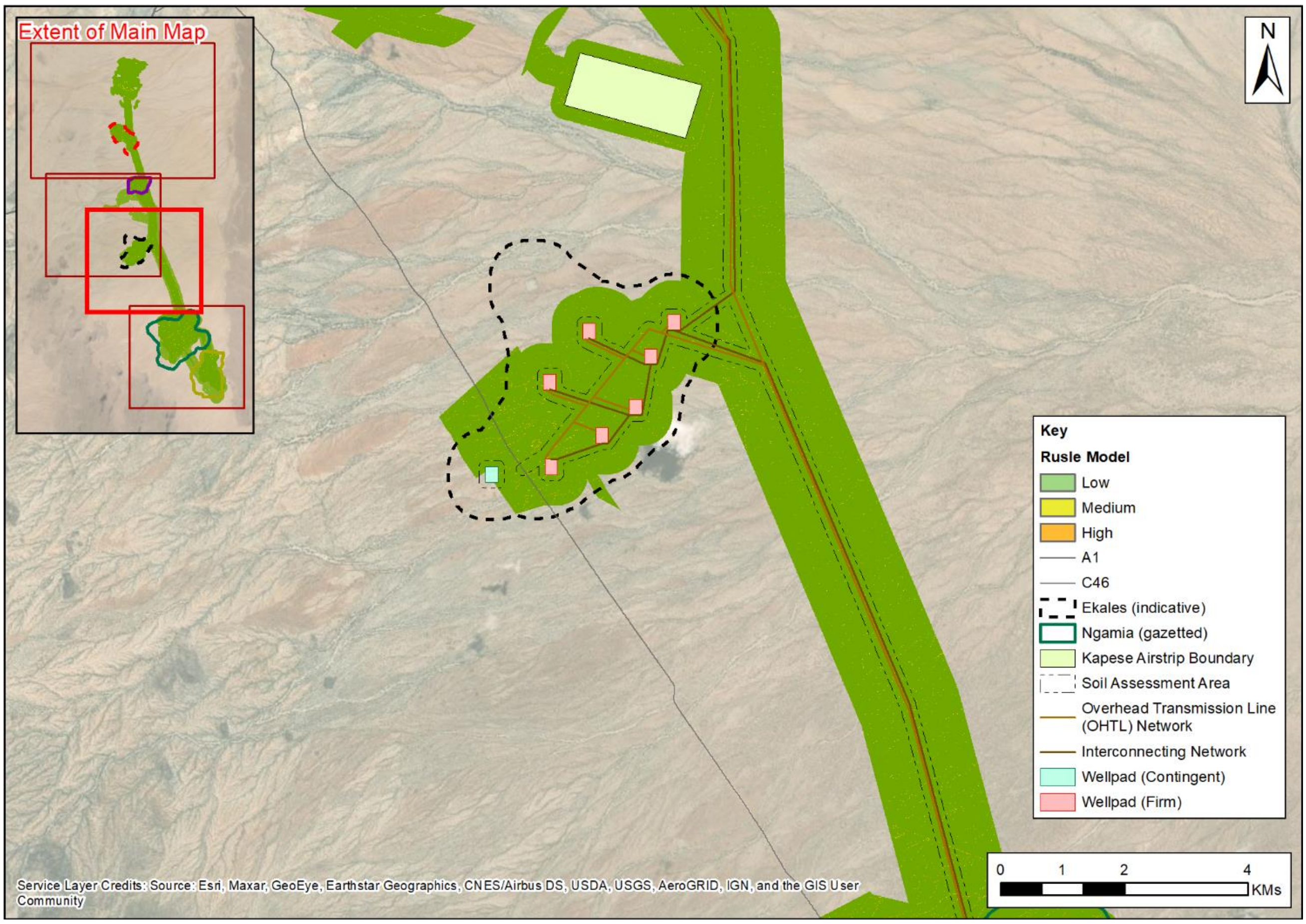

Figure 7.5-4: Soil Erosion Risk in the North Upstream Oil & Gas Facilities (Twiga Wellpads, Interconnecting Network RoW and Kapese Airstrip).

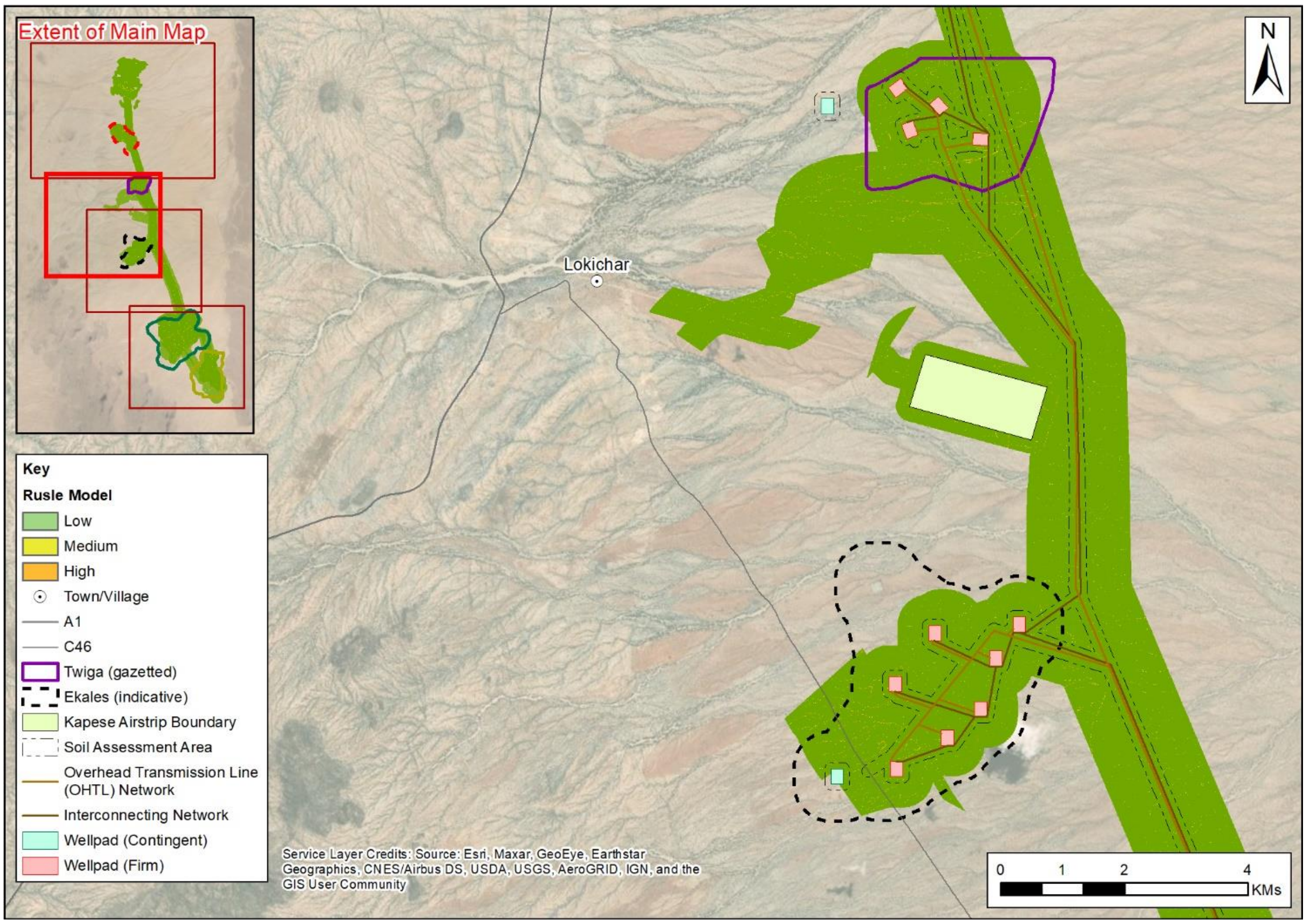

Figure 7.5-5: Soil Erosion Risk in the North Upstream Oil & Gas Facilities (Twiga and Ekales Wellpads, Kapese Airstrip and Interconnecting Network RoW).

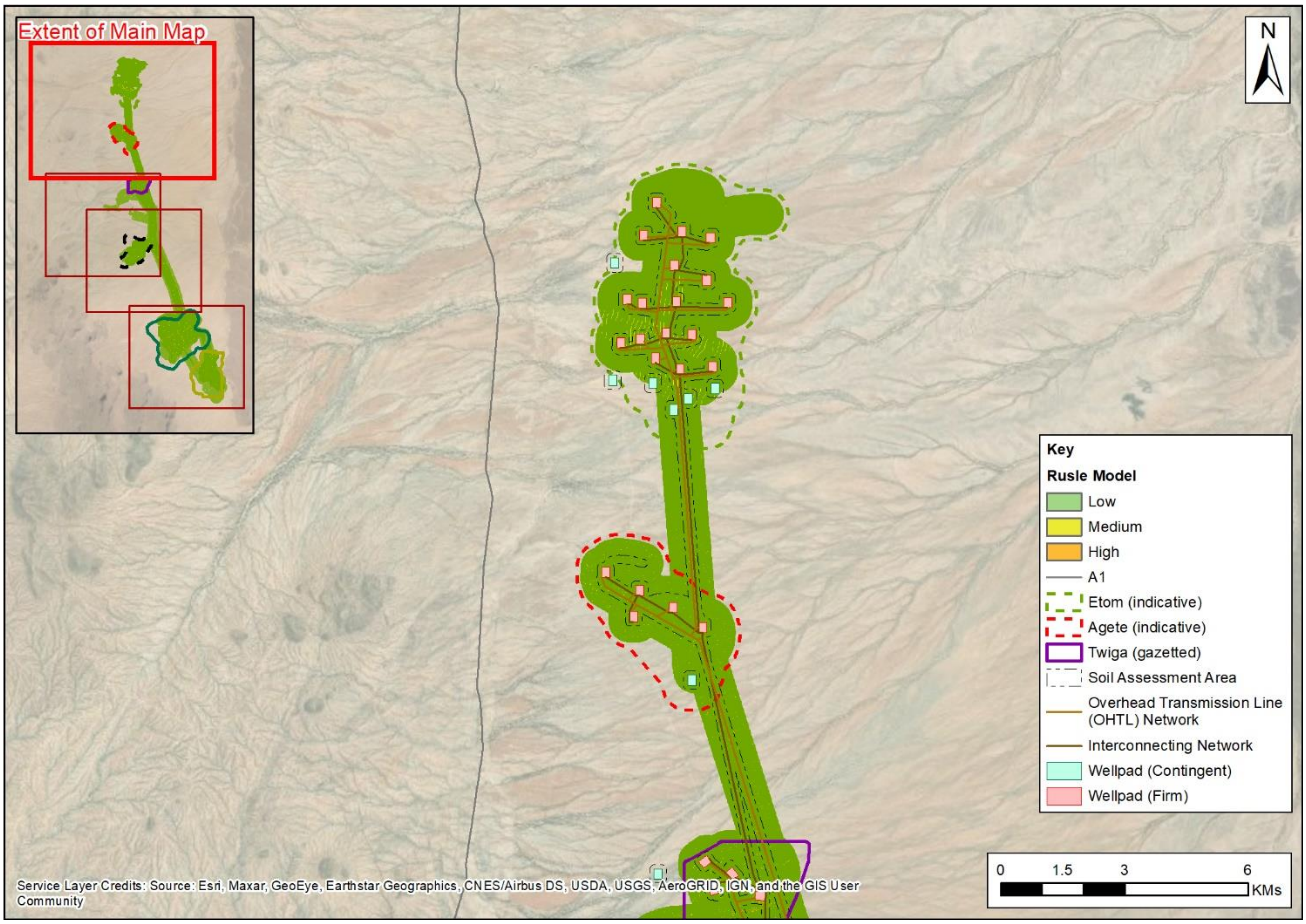

Figure 7.5-6: Soil Erosion Risk in the North Upstream Oil & Gas Facilities (Etom, Agete and Twiga Wellpads and Interconnecting Network RoW).

Section 7.3 (Water Quantity) sets out mitigation measures to minimise soil erosion relating to water quality impacts, which includes:

- Management Controls for Soil Erosion
  - Temporary erosion control measures will be installed prior to earth-moving activities, to limit the likelihood of sediment mobilisation to the water environment. Suspended solid management techniques will be used. The procedures being followed will be audited and monitored throughout construction.
  - Works in periods of extreme rainfall and rainy seasons will be managed, as far is it is practicable, to limit the generation and mobilisation of suspended solids into the water environment and to manage safety of workers.
  - The amount of time the trenches will be open will be minimised, reducing the time per location when excavated soils are exposed to limit the likelihood of sediment mobilisation to the water environment. Any materials, which could lead to contamination, placed in trenches by third parties or otherwise, will be removed before trenches are backfilled to remove potential sources of contamination.
  - Where topsoil is salvageable, it will be stored for no more than 6 months.
  - Any cleared areas within the footprint, where topsoil is salvageable, measures will be taken by the Operator and their contractors to store topsoil and maintain the existing seed bed. If additional re-

seeding is required during rehabilitation, it will be seeded/replanted with locally sourced seed/plants of suitable species. Topsoil management will allow reestablishment/re-generation of vegetation on bare areas and limit the erosion potential.

- To address impacts from topsoil handling and mixing, all construction activities will be undertaken in line with the following measures:
  - Salvage topsoil in areas where it occurs in the direct soil disturbance footprint of the CFA, wellpads, landfill, roads and camps. Given the major soil types in these areas, it is expected that topsoil will be limited to the areas of the luggas.
  - Procedures for rehabilitation and revegetation.

7.5.9.2 Operational Phase

For the operational phase soil resources impact assessment, the following has been taken into account:

- No additional direct soil disturbance will take place beyond the construction phase. Impacts associated with this have been assessed in the construction phase assessment; and
- As with the construction phase, some operational impact pathways are considered to be direct (i.e. topsoil quality degradation due to disturbance, storage and replacement).

Once a source of impact to soil quality has been removed or the construction process is over and rehabilitation is in place at the end of construction or operations, baseline conditions can return, so the impacts are temporary. Areas of permanent above-ground Project infrastructure where soils have been displaced will have long-term effects to pastoral land uses as described in Section 7.5.7.2. These impacts are addressed in the construction phase assessment.

During the operational phase there will be negligible to low magnitude of impacts on soils as a result of compaction and rutting from heavy equipment traffic. This can reduce soil porosity and negatively impact soil structure and water permeability in the rooting zone. This impact will be limited in extent and would be expected to recover over a short period of time following the application of management controls outlined in the Operator Environmental Performance Plan. The impact is therefore considered to be of **Negligible** significance.

7.5.9.3 Decommissioning

As the operational phase of the Project nears its end, a decommissioning plan will be developed for agreement with the appropriate authorities that will include measures to protect soil resources. The decommissioning plan will include general and specific mitigation measures for erosion and sediment control, topsoil conservation, and the preservation of soil quality.

When the Project is decommissioned, the following decommissioning philosophy will be adopted:

- All above ground infrastructure will be evaluated for dismantling, removal and rehabilitation. This will be undertaken in consultation with Affected Communities and County Government to identify any facilities than can be safely handed over for community use;
- All decommissioning waste will be handled, stored and managed through the good practice outlined in the Waste Management section of the Decommissioning Plan.

7.5.10 Summary of Mitigation

In addition to the incorporated mitigation measures (Section 7.5.8), the following additional mitigation and monitoring is recommended. This mitigation is not required to reduce the impact significance, but it is a Project commitment which will lead to enhanced conditions:

7.5.10.1.1 Construction Phase

Management Controls for Soil Erosion

- The Operator Environmental Performance Plan will present management controls for soil erosion, including:
  - Temporary erosion control measures will be installed prior to earth-moving activities, to limit the likelihood of sediment mobilisation to the water environment. Suspended solid management techniques will be used. The procedures being followed will be audited and monitored throughout construction.
  - Works planned during periods of extreme rainfall and rainy seasons will be managed, as far is it is practicable, to limit the generation and mobilisation of suspended solids into the water environment and to manage safety of workers.
  - The amount of time the trenches will be open will be minimised, reducing the time per location when excavated soils are exposed to limit the likelihood of sediment mobilisation to the water environment. Any materials, which could lead to contamination, placed in trenches by third parties or otherwise, will be removed before trenches are backfilled to remove potential sources of contamination.
  - Where topsoil is salvageable, it will be stored for no more than 6 months.
  - Any cleared areas within the footprint, where topsoil is salvageable, measures will be taken by the Operator and their contractors to store topsoil and maintain the existing seed bed. If additional re-seeding is required during rehabilitation, it will be re-seeded/replanted with locally sourced seed/plants of suitable species. Topsoil management will allow reestablishment/re-generation of vegetation on bare areas and limit the erosion potential.

To address impacts from topsoil handling and mixing, all construction activities will be undertaken in line with the measures defined in the Operator Environmental Performance Plan, including:

  - Salvage topsoil in areas where it occurs in the direct soil disturbance footprint of the CFA, wellpads, landfill, roads and camps. Given the major soil types in these areas, it is expected that topsoil will be limited to the areas of the luggas.
  - Topsoil will be stored for no more than 6 months.
  - Procedures for rehabilitation and revegetation.

7.5.11 Summary of Residual Impacts

With mitigation that has been incorporated into the design, or will take place during pre-construction, construction or operational phases, it is considered that the sources of potential impacts to soil resources are manageable. Most impacts are also considered to be temporary, except where they are associated with physical changes to drainage. Where these are identified, they will be monitored and rectified.

The residual impact significance on soils is classified as **Negligible**.

7.6 Landscape and Visual

7.6.1 Introduction

This section provides an assessment of the potential impacts of the Project on landscape and visual elements. There are two main parts to the assessment:

- Landscape impacts: which relate to the temporary or permanent impacts 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); and
- Visual impacts: which relate to changes in existing views due to Project infrastructure and activities, and the impacts of those changes on the current population (e.g., residents or visitors).

Potential impacts have been determined using a qualitative assessment methodology presented in Section 7.6-9. Where potential impacts have been identified, these are considered in turn and mitigations are set out where necessary to ensure that any potential impacts are minimised as far as practicable.

7.6.2 Area of Influence

The Project AoI is presented in Section 3.13. This has been used as a base to formulate a LVAA for the landscape and visual elements of the ESIA.

The LVAA comprises a 10 km buffer around aboveground Project facilities (shown in Figure 7.6-1). The 10 km distance enables a comprehensive overview of the immediate landscape and visual context and covers receptors considered to have the potential to be affected by Project facilities.

Potential receptors located within the Project AoI have been identified as part of the baseline studies. Receptors that have been carried forward into the assessment are presented in Section 7.6.6.

7.6.3 Receptor Importance

In order to identify the importance of the receptors, the scale of relative importance presented in Table 7.6-1 have been used with reference to the information collated in the baseline to classify the selected receptors.

7.6.3.1 Landscape and Visual Receptor Importance

Table 7.6-1: Criteria for Determining Landscape Importance of Receptors

Receptor Importance	Example Receptor Types
Very high	■ Landscape including protected or designated areas of international importance (e.g., World Heritage Sites).
High	■ Landscape including protected or designated areas of national importance (National Reserves); and/or ■ Views for permanent residential receptor with open or limited views.
Medium	■ Landscape including designated areas of national or regional importance (e.g., Community Conservancies); and/or ■ Views for transient human or tourist receptor.
Low	■ Landscape including designated areas of local, limited or no known importance; and/or ■ Views for incidental/transient and amenity user.

7.6.4 Magnitude of Impact

The characterisation of the magnitude of the impact considers the description of Project processes and how the Project could result in a change at each of the receptors. The potential for an impact to occur at a receptor has been determined using the understanding of the baseline environment and consideration of whether there is a feasible linkage between a source of the potential impact and each receptor. The magnitude of each potential impact has then been classified between 'negligible' and 'high', as described in Table 7.6-2.

Each potential impact can be either adverse or beneficial to the receptor of interest and vary in its duration (i.e., can be long-term, medium or short-term and either permanent or temporary). For the purposes of this assessment the following durations apply:

- A short-term impact is defined as up to 66 months (the maximum anticipated construction period), where CFA/CPF construction will be within the first 36 months;
- A medium-term impact is defined as between 66 months and 25 years (anticipated duration of operations); and
- A long-term impact is defined as one that is predicted to last beyond the end of operations (>25 years).

A permanent impact is defined as a change to the baseline that would not reverse itself naturally. A temporary impact is defined as a change to the baseline conditions that would reverse naturally once the source of the impact is exhausted or has stopped.

Potential impacts are also assigned descriptors to identify whether the impact is direct or indirect. For the purposes of this assessment, a direct impact is one that occurs as a direct result of the Project and is likely to occur at the Project itself and all landscape and visual impacts are anticipated to be direct in nature.

The definitions applied to resulting significance categories for the purposes of this assessment are summarised as follows:

- Major: If adverse, impacts with this significance represent key factors in the decision-making process or the feasibility of the Project. They are generally, but not exclusively, associated with human health or features of international or national importance and/or resources/features that are unique, which, if lost, cannot be replaced or relocated.
- Moderate: If adverse, impacts with this significance may contribute to the decision-making process. These impacts are generally, but not exclusively, expected to be important at a regional or local scale.
- Minor: These impacts may be raised as local issues but are unlikely to be of importance in the decision-making process. Nevertheless, they are of relevance in the detailed design of the Project.
- Negligible: Impacts that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

7.6.4.1 Landscape Magnitude of Impact

Changes to the landscape attributes within each LCA were assessed and categorised individually using the criteria in Table 7.6-2 to determine the magnitude of impact on the landscape.

Table 7.6-2: Criteria for Assessing Magnitude of Landscape Impact

Magnitude of Impact	Description Criteria		
	Adverse	**Beneficial**	**Geographical Extent**
High	Loss of resource/receptor, loss of quality and integrity of the resource/receptor, severe damage to key characteristics, features or elements. Major loss or alteration to the landscape.	Large scale or major improvement to resource/ receptor quality, extensive restoration or enhancement.	Very extensive or complete impact on landscape character area.
Medium	Partial loss of resource/ receptor, but not adversely affecting the integrity, partial loss or damage to key characteristics, features or elements. Notable loss or alteration to the landscape character.	Some benefit to key characteristics, features or parameters describing resource/ receptor quality.	Affecting a substantial proportion of the landscape character area.
Low	Some measurable change in/ damage to attributes, quality or vulnerability. Minor loss or alteration to the landscape character.	Minor benefit to, or addition of, one or more key characteristics, features or parameters describing resource/ receptor quality.	Impacted by the immediate setting of the Project component site.
Negligible	No, or very minor (immeasurable), change to characteristics, features or parameters describing resource/ receptor quality. No or very minor loss or alteration to the landscape character.		Typically, no major changes to key landscape attributes.

7.6.4.2 Visual Magnitude of Impact

The overall impacts on view composition, prominence and distance are calculated using the criteria in Table 7.6-3. The magnitude of change is based on a qualitative assessment by Golder and does not necessarily reflect the individual opinions or perception of the viewers within the communities who may be disposed or predisposed to the Project, altering their tolerance to visual change.

Table 7.6-3: Criteria for Assessing Magnitude of Visual Impact

Magnitude of Impact	Description Criteria[(a)]	
	Change to the composition and quality of the view	**Prominence of the development**
High	Major change to all attributes.	The development is dominant.
Medium	Moderate change to all attributes or major change to some attributes.	The development is prominent.
Low	Low change to all attributes or moderate change to some attributes.	The development is discernible.
Negligible	Negligible change to attributes.	The development is not visible or barely discernible.

a) Description criteria, including terminology used in Table 7.6-3, are described in Section 7.6.4

7.6.5 Key Guidance and Standards

The Kenyan policy and legislation documents presented in Section 2.2 and the international guidance and standards presented in Section 2.3 are relevant to this assessment. The following are of particular relevance:

- Kenya's Environmental (Impact Assessment and Audit) Regulations (2003), which identifies the following landscape issues which have been considered in this landscape and visual impact assessment:
  - Views opened up or closed;
  - Visual impacts (features, removal of vegetation, etc.);
  - Compatibility with surrounding area; and
  - Amenity opened up or closed, e.g., recreation possibilities.
- The IFC PS3: Resource Efficiency and Pollution Prevention (2012) highlights the need to reduce pollution from new development. The standard includes "*potential visual impacts, including the impacts of lighting*".
- Landscape Institute with the Institute of Environmental Management and Assessment. 2013
- [22]. *Guidelines for Landscape and Visual Impact Assessment, Third Edition*.

7.6.6 Receptors of Interest and Importance

As presented in the Landscape and Visual Baseline (Section 6.11), a number of primary landscape and visual receptors have been identified as being potentially susceptible to changes in the landscape and visual setting.

7.6.6.1 Landscape Receptors

Table 7.6-4 presents landscape features considered to be of particular importance due to their respective designations, importance for local communities and tourism, and proximity to proposed Project infrastructure. The table presents the assigned landscape character areas of these features and their importance as receptors.

Table 7.6-4: Landscape Receptors and Importance

Receptor	Importance	Comment
LCA 1 – Semi-desert	Low	The semi-desert landscape is relatively commonplace across the LVAA, with few distinctive elements of notable quality. There are no landscape designations within this LCA.
LCA 2 – Dense bushland	Medium	The dense bushland landscape is relatively commonplace across the LVAA, with few distinctive elements of notable quality. There are no landscape designations within this LCA.
LCA 3 – Rocky Habitat/Stunted Bushland	Medium	The dense bushland landscape is generally situated at the borders of the LVAA and signifies higher relief/altitude areas with few distinctive elements of notable quality. There are no landscape designations within this LCA.
LCA 4 – Alluvial woodland (riparian)	High	The riparian landscape comprises a fundamental aspect of the LVAA and is an important resource for human activity and ecological value. The LCA is therefore vulnerable to changes to landscape features and characteristics.

[22] In the absence of international guidance, the proposed methodology employed for this assessment is based primarily on this current UK guidance

Receptor	Importance	Comment
		There are no landscape designations within this LCA.

Figure 7.6-1 presents the key landscape receptors and their location in relation to Project facilities.

The Turkwel Gorge Reservoir and Dam, from which the make-up water will be abstracted, has not been further assessed as a receptor as it will not be significantly impacted by the Project from a landscape or visual perspective.

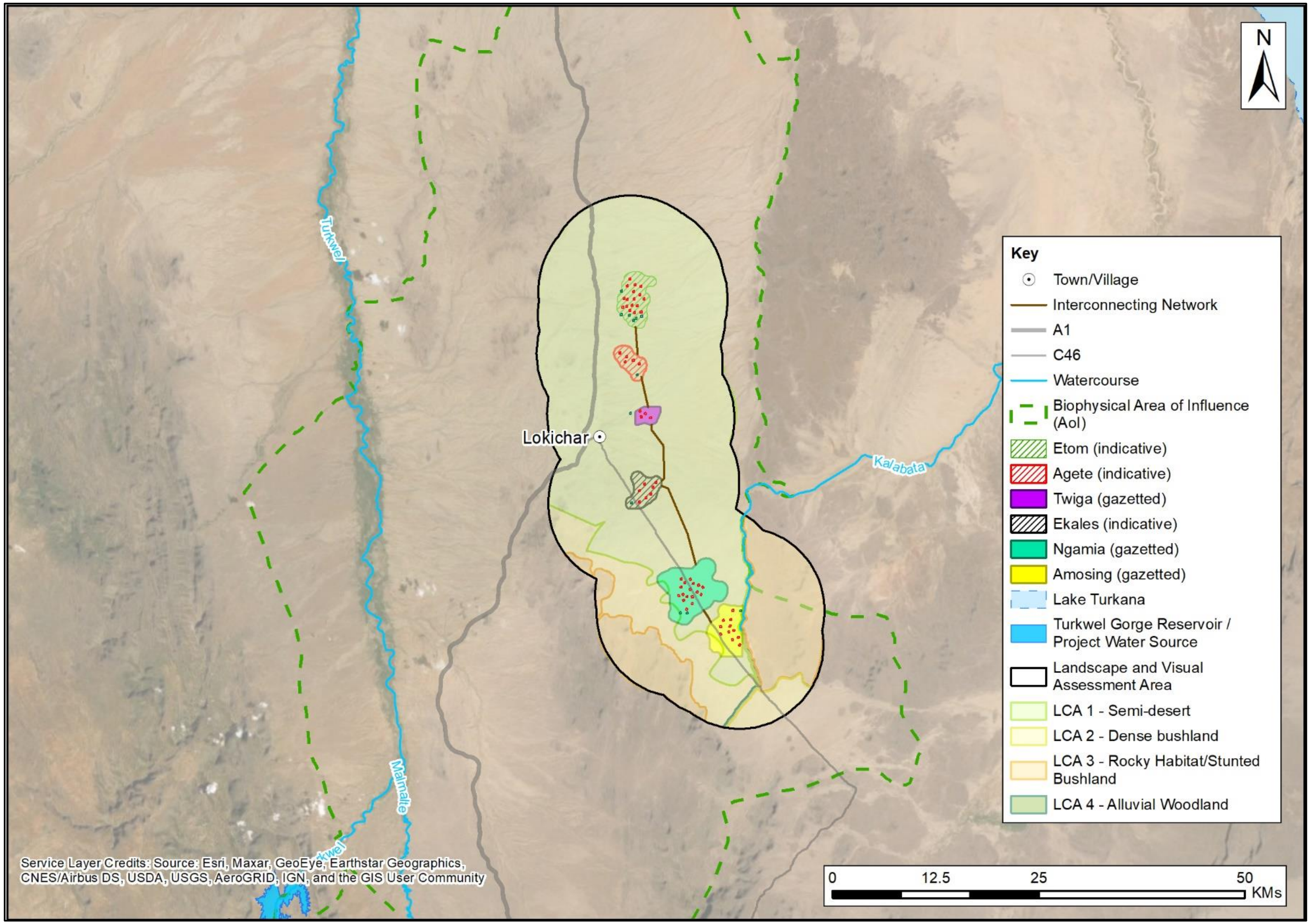

Figure 7.6-1: Landscape Receptors of Importance

7.6.6.2 Visual Receptors

Receptors included in the assessment, where present, are as follows:

- Permanent human receptors (high importance) – residential settlements indicative of PAP; and
- Transient human receptors (high importance) – due to the prevalence of nomadic pastoralism in the region and the associated transience of settlement, sensitive receptors cannot be easily defined.

Twenty-five viewpoints were identified to cover the LVAA and to provide a representative sample of the typical views experienced by the local receptors/populations. These viewpoints are presented in Table 7.6-5 along with their assigned importance and are shown on Figure 7.6-2.

Table 7.6-5: Visual Receptors, Importance and Setting

Receptor	Receptor Representation	Importance	Setting
PL-1 – view of Twiga	Residential users (permanent settlements – nomadic view)	High	Represents views from settlements (homesteads) to Twiga wellpads. Viewpoint is located 120 m from TW-04 wellpad.
PL-2 – view of Twiga	Residential users (permanent settlements – nomadic view)	High	Represents views from settlements (homesteads) to Twiga wellpads. Viewpoint is located 1,380 m from TW-04 wellpad.
PL-3 – view of Ngamia	Residential users (permanent settlements – nomadic view)	High	Represents views from settlements (homesteads) to Ngamia wellpads and CFA/CPF. Viewpoint is located 190 m from NG-03 wellpad.
PL-4 – view of Ngamia	Residential users (permanent settlements – nomadic view)	High	Represents views from settlements (homesteads) to Ngamia wellpads. Viewpoint is located 240 m from NG-02 wellpad.
PL-5 – view of Ngamia	Residential users (permanent settlements – nomadic view)	High	Represents views from settlements (homesteads) to Ngamia wellpads. Viewpoint is located 130 m from NG-24 wellpad.
PL-6 – view of Ngamia	Residential users (permanent settlements – nomadic view)	High	Represents views from settlements (homesteads) adjacent to C46 and Ngamia lugga to Ngamia wellpads. Viewpoint is located 300 m from NG-11 wellpad.
PL-7 – view of Ngamia	Residential users (permanent settlements – nomadic view)	High	Represents views from settlements (homesteads) adjacent to C46 and Ngamia lugga to Ngamia wellpads. Viewpoint is located 140 m from NG-11 wellpad.
PL-8 – view of Ngamia	Residential users (permanent settlements – nomadic view)	High	Represents views from settlements (homesteads) adjacent to C46 and Ngamia lugga to Ngamia wellpads. Viewpoint is located 220 m from NG-01 wellpad.

Receptor	Receptor Representation	Importance	Setting
PL-9 – view of Ngamia	Residential users (permanent settlements – nomadic view)	High	Represents views from settlements (homesteads) adjacent to C46 and Ngamia lugga to Ngamia wellpads. Viewpoint is located 120 m from NG-16 wellpad.
PL-10 – view of Ngamia	Residential users (permanent settlements – nomadic view)	High	Represents views from settlements (homesteads) to Ngamia wellpads. Viewpoint is located 650 m from NG-10 wellpad.
PL-11 – view of Ngamia	Residential users (permanent settlements – nomadic view)	High	Represents views from settlements (homesteads) adjacent to C46 and Ngamia lugga to Ngamia wellpads. Viewpoint is located 150 m from NG-16 wellpad.
PL-12 – view of Amosing	Residential users (permanent settlements – nomadic view)	High	Represents views from settlements (homesteads) to Amosing wellpads. Viewpoint is located 1,150 m from AM-19 wellpad.
PL-13 – view of Amosing	Residential users (permanent settlements – nomadic view)	High	Represents views from settlements (homesteads) adjacent to C46 and Amosing lugga to Amosing wellpads. Viewpoint is located 600 m from AM-03 wellpad.
PL-14 – view of Amosing	Residential users (permanent settlements – nomadic view)	High	Represents views from settlements (homesteads) adjacent to C46 and Amosing lugga to Amosing wellpads. Viewpoint is located 840 m from AM-03 wellpad.
PL-15 – view of Amosing	Residential users (permanent settlements – nomadic view)	High	Represents views from settlements (homesteads) adjacent to C46 and Amosing lugga to Amosing wellpads. Viewpoint is located 350 m from AM-01 wellpad.
PL-16 – view of Amosing	Residential users (permanent settlements – nomadic view)	High	Represents views from settlements (homesteads) adjacent to Amosing lugga to Amosing wellpads. Viewpoint is located 760 m from AM-10 wellpad.
PL-17 – view of Amosing	Residential users (permanent settlements – nomadic view)	High	Represents views from settlements (homesteads) adjacent to C46 to Amosing wellpads. Viewpoint is located 180 m from AM-09 wellpad.
PL-18 – view of Amosing	Residential users (permanent settlements – nomadic view)	High	Represents views from settlements (homesteads) adjacent to C46 to Amosing wellpads. Viewpoint is located 630 m from AM-09 wellpad.
PL-19 – view of Etom	Transient users (nomadic view)	High	Represents views from transient pastoralists. Viewpoint is located adjacent to ET-03 wellpad.

Receptor	Receptor Representation	Importance	Setting
PL-20 – view of Etom	Transient users (nomadic view)	High	Represents views from transient pastoralists. Viewpoint is located adjacent to ET-03 wellpad.
PL-21 – view of Etom	Transient users (nomadic view)	High	Represents views from transient pastoralists. Viewpoint is located adjacent to ET-03 wellpad.
PL-22 – view of Ekales	Transient users (nomadic view)	High	Represents views from transient pastoralists. Viewpoint is located adjacent to EK-03 wellpad.
PL-23 – view of Ekales	Transient users (nomadic view)	High	Represents views from transient pastoralists. Viewpoint is located along C46, approximately 2 km north-west of Ekales.
PL -24 view of Ekales	Transient users (nomadic view)	High	Represents views from transient pastoralists. Viewpoint is located along C46, approximately 2 km north-west of Ekales.
PL-25 – view of Ekales	Transient users (nomadic view)	High	Represents views from transient pastoralists. Viewpoint is located along C46, approximately 2 km north-west of Ekales.

**Note: PL - Photo Location.*

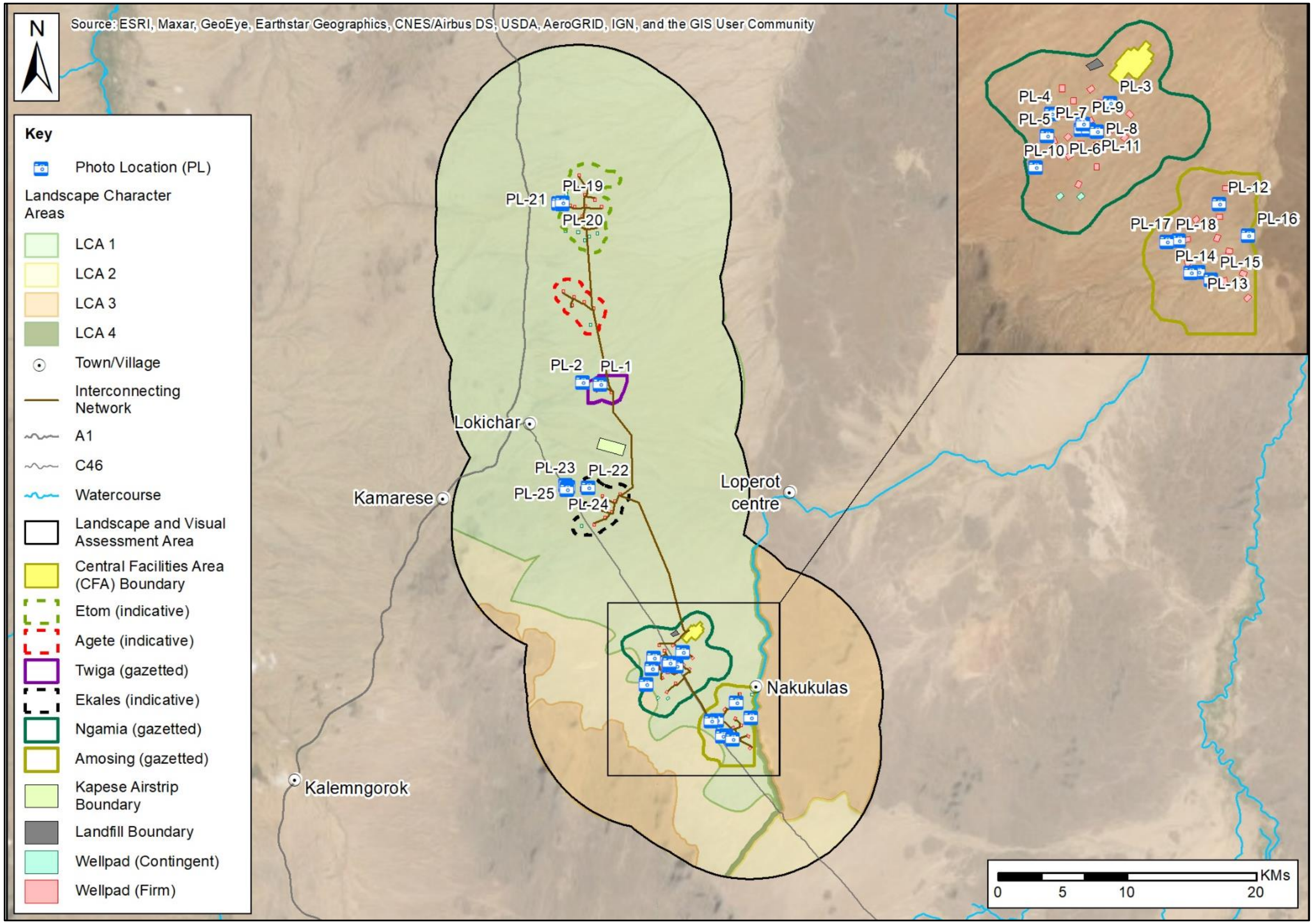

Figure 7.6-2: Project Viewpoints

7.6.7 Sources of Impacts

Potential sources of impact of a range of magnitudes will occur throughout the life of the Project are set out below by Project phase.

7.6.7.1 Construction Phase

Based on the Project Description and the understanding of the baseline landscape and visual conditions, there are aspects of the Project that have been identified as having the potential to present sources of impact to landscape and visual receptors during the construction phase. The potential sources of impact and routes by which they could impact landscape and visual receptors are as follows:

- Works associated with the construction of wellpads, including initial well drilling;
- Works associated with the construction of OHTLs (including large-scale plant and machinery e.g., cranes);
- Works associated with the construction of the CFA and CPF (including large-scale plant and machinery e.g., cranes);
- Works associated with the construction of below ground project facilities (interconnecting flowlines, landfill);
- Works associated with the construction of temporary infrastructure (including temporary access roads, camps, laydown areas);
- Mobilisation of plant, delivery of materials and supplies, transportation of construction personnel by vehicles and physical movement of construction workers;
- Site activity during construction, including dust plumes and lighting emissions associated with construction works;
- Clearance/removal of vegetation and soils (screening elements) during construction; and
- Material and construction waste generation, storage/stockpiles and disposal.

7.6.7.2 Operational Phase

Based on the Project Description and the understanding of the baseline landscape and visual conditions, there are aspects of the Project that have been identified as having the potential to present sources of impact to landscape and visual receptors during the operation phase. The potential sources of impact and routes by which they could impact landscape and visual receptors are as follows:

- Presence and operation of wellpads and supporting infrastructure;
- Presence and operation of OHTLs;
- Presence and operation of CFA (CPF) and supporting infrastructure, including:
  - Emergency flaring (enclosed ground flare) at the CPF; and
  - Incinerator flue stack at the IWMF in the CFA.
- Presence and operation of the landfill;
- Site activity during operation, including dust plumes and lighting emissions; and
- Mobilisation of plant, delivery of materials and supplies and transportation of operational and maintenance personnel by vehicles.

7.6.7.3 Climate Change

Climate change is not considered relevant to this section of the ESIA.

7.6.8 Incorporated Environmental Measures

The Project has been designed and planned to incorporate a range of incorporated environmental measures to avoid potential impacts or reduce their magnitude, prior to the impact analysis being completed.

The measures presented in this section either relate to design measures or are widely accepted GIP.

7.6.8.1 Design Measures

The following measures are part of the Project design and reduce the potential impact of the Project on landscape and visual elements:

- Reducing the height of the flare at the CPF (ground flare stack height reduction to 23 m during FEED review process);
- Physical disturbance areas will be limited to within the Project facilities and RoW areas;
- The infield flowlines will be buried below the surface;
- Where practicable, linear Project infrastructure, including the OHTLs, follow existing infrastructure or transport routes, limiting impacts on unspoilt landscape areas;
- Construction activities will be sequentially staggered and therefore will not take place concurrently at the same location, where the construction of the CFA/CPF will be within the first 36 months; and
- Laydown areas at each of the wellpad sites and at the CFA will be located within the footprint of the facility; there will be no additional site clearance required outside the facility footprint.

7.6.8.2 Good Industry Practice

In addition to the mitigation specified within the Project description, this section presents accepted good practice that will also be implemented in order to remove or reduce the magnitude of potential impacts.

7.6.8.2.1 Construction Phase

- All temporary land take associated with the construction of the Project facilities and roads will be left to revert to natural condition and returned to communities following construction;
- Prompt removal of materials that have a potential to produce dust (including spoil), unless being re-used on site;
- Where practical, trucks transporting dusty material associated with the project will be covered to prevent escape of materials during transport;
- Daily site inspections will be undertaken when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions;
- A permitted water supply will be available for on the site for dust/particulate matter suppression/mitigation, using non-potable water where possible and deemed appropriate; and
- Open burning of waste materials will be prohibited.

7.6.8.2.2 Operations Phase

- Lighting will be limited to within perimeter fencing of Project facilities (i.e., not on access roads).

7.6.8.2.3 All Project Phases

- Speed limits will be adhered to on all roads; and
- Lighting will be reduced to the practical minimum, without impacting safety and security. Where feasible, the light will be directed inwards towards the facilities and will be of a warm/neutral colour so as to limit nuisance to the surrounding communities and to avoid attracting animals.

7.6.9 Impact Classification

Taking into account the baseline landscape and visual setting (Section 6.11), the relevant incorporated environmental measures (Section 7.6.8), and the potential sources of impact (Section 7.6.7) determined from the Project Description, the potential source-pathway-receptor impact linkages for the construction and the operational phases are presented in this section.

A discussion regarding feasible impact linkages during each of the Project phases is presented in each of the sub-sections below. Each discussion is followed by a table where the potential sources of impact and relevant additional mitigation applicable to each receptor are summarised.

The following methodology was used to evaluate the impacts on the landscape:

- Overlaying the infrastructure footprints on the LCA plan and aerial photographs to estimate the physical extent of the changes to the landscape attributes within the LCAs; and
- Comparing the main Project components with observations/judgements made during the baseline study.

The following methodology was used to evaluate visual impacts:

- Generating ZTV mapping and analysis to predict the visual envelope for indicative heights of infrastructure, to inform the baseline data gathering; and
- Comparing the main project components with observations/judgements made during the baseline study.

Impacts on viewers 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.

Where mitigation measures are repeated for different receptors, they are stated as a numbered "Repeated mitigation" in the initial instance and referred back to thereafter.

7.6.9.1.1 The Composition and Quality of the View

A view comprises a number of attributes which collectively contribute to the composition and scenic quality of the view. The assessment considers changes to these attributes (which include scale, colour, texture, form and pattern) to determine the overall impacts on the view composition.

7.6.9.1.2 Prominence of the Development

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

7.6.9.1.3 Distance between the Viewer and the Development

There is usually a correlation between viewer distance and magnitude of change (i.e., the greater the distance, the less the visual impact), though occasionally distant viewers may be more adversely affected than closer viewers whose views are screened by intervening landform and/or vegetation.

7.6.9.2 Construction

The impact classification process focuses on the potential impacts to landscape and visual that could result in significant impacts. As such some potential impacts are not considered further in this assessment as there is insufficient linkage between the source of impact and receptors, or the magnitude of this impact would be negligible when taking account of incorporated environmental measures.

The following bullets provide a qualitative evaluation of landscape and/ or visual impacts that are not considered for further impact classification:

- Due to the temporary nature of the construction activities, landscape and visual impacts to transient receptors are considered to be **Negligible**.
- Due to the relatively short time period of construction and lack of significant visual impact for the laying of below-ground infrastructure, visual impacts associated within construction activities along infield flowlines are considered to be **Negligible**.

The potential sources of impact are the focus of further construction impact classification as described in Section 7.6.7.1:

The impact assessment is discussed in more detail in the sub-sections below. The construction phase impact assessment with respect to landscape and visual is presented in Table 7.6-6. Any additional mitigation is also presented in that table.

7.6.9.2.1 Summary of Impacts on the Landscape

The following impacts require no additional measures beyond those described in Section 7.6.8, with no change in impact significance pre and post mitigation, and are therefore not considered further in Table 7.6-8:

- Construction activities within the oilfields relate to the installation of infrastructure on the 61 firm and 12 contingent wellpads, construction of the CFA (and the CPF) as well as the OHTLs, occurring throughout the 36-month construction period. This change to the existing landscape character would be relatively short-term, and partially reversible for temporary construction sites:
  - For LCA 2 (dense bushland) and LCA 3 (rocky habitat/stunted bushland), due to the limited value of these character areas, predicted residual impacts during construction will be **Minor**.
  - Similarly, **Minor** residual impacts are predicted for LCA 1 (semi-desert) as a result of construction works associated with both above-ground and below-ground Project infrastructure.
  - For LCA 4 (alluvial woodland), there will be limited construction related impacts due to the relatively small area affected by the Project infrastructure. Therefore, the predicted residual impacts during construction on LCA 4 will also be **Minor**.

7.6.9.2.2 Summary of Significant Visual Impacts

A number of permanent residences (homesteads) are located within close proximity to Project facilities (as shown inn Figures 7.6-3 and 7.6-4, and receptors at these locations are of high importance. During the construction of the wellpads, CFA (CPF) and OHTL, full views of the infrastructure will be possible from a number of these settlements.

The facilities outline will break the skyline in many areas, as the surrounding landscape has particularly flat ground. Existing vegetation within luggas offers some natural screening in certain areas; however, work within the RoW for the flowlines will result in the clearance/removal of this vegetation. Ultimately, this will mean that as taller infrastructure elements are progressively constructed, the extent of the area from which the development will be seen will progressively increase. In addition, these activities would temporarily introduce further large-scale plant and machinery including cranes (required to construct the tallest structures) and drilling rigs at the wellpads (three rigs, one at each wellpad). Therefore, without mitigation in place, PAP within close proximity to the oilfields may be impacted by infrastructure development during construction, in particular works associated with the construction of wellpads (initial well drilling), the CFA (and CPF) and the OHTL. Without mitigation this will cause a medium impact, which translates to a **Moderate** significance.

At locations where construction will occur, the Operator or the EPC contractor will engage stakeholders in affected areas to inform them where, when and for how long temporary works are taking place. The EPC contractor will maximise the retention and preservation of existing vegetation outside and in proximity to the infrastructure fence-lines (particularly large trees and shrubs located along luggas), which acts as natural screening of Project facilities (Repeated Mitigation– Landscape & Visual 01– Retention of Existing Vegetation). Earth bunding will be developed and maintained around wellpad fencelines to provide screening (Repeated Mitigation– Landscape & Visual 05 – Earth Bunding). The Operator and their contractors will monitor grievances and improvements through the Operator Grievance Management Procedure.

Site activity during construction will also result in the generation of dust plumes, lighting emissions, and material and waste storage/stockpiles, which could present a visual impact. In addition, there will be mobilisation of plant, transportation of construction personnel by vehicles and physical movement of construction workers.

The Operator Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders of the construction activity dates and the potential for increased visual disturbance from dust and artificial lighting. Signage will be put in place to inform people where, when and for how long temporary dust generating works are taking place. The Operator Environmental Performance Plan will include a procedure for daily visual dust monitoring around infrastructure fencelines which will be undertaken by the Environmental Supervisor. If high levels of dust are observed dust netting/ barriers will be used around high dust generating activities to limit the dispersion of dust.

The Operator and their contractors will limit light pollution with the following measures (Repeated Mitigation– Landscape & Visual 02 – Artificial Lighting):

- Use of lighting will be minimised and light spill controlled where possible by using directional lighting focussed downwards and the application of cowls;
- The wattage/ power of the lighting will be considered, and lights will be of the correct power for the application;
- Lighting will be used where required and unnecessary lighting avoided; and
- Blue light tones will be avoided, as these light tones are more disruptive to sleep patterns. Yellow tone lights or white lights which filter out blue or UV light will be used where possible.

The Operator Social Performance Plan will present procedures for the development and implementation of transport management system to mitigate impacts relating to dust trackout and dispersal by the Operator and their contractors (Repeated Mitigation– Landscape & Visual 03 – Transport Management System). The transport management system will require the following measures to minimise dust emissions:

- Project speed limits to be established and complied with by all Project vehicles;
- Night-time driving will be prohibited unless specifically authorised; and
- Off-road driving will be prohibited

Residual visual impacts associated with these activities change from a low impact magnitude and a **Minor** significance to **Negligible** significance.

Table 7.6-6: Construction Phase Impact Assessment

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Visual						
Permanent human receptors (settlements – nomadic view) (high) within area defined in Figure 7.6-3.	Works associated with the construction activities of wellpads (initial well drilling) and associated infrastructure (e.g., access roads) may result in temporary impacts such as plant mobilisation, transport and lighting emissions.	Medium (temporary, short-term)	Moderate (adverse)	At locations where construction will occur, the Operator or the EPC contractor will engage stakeholders in affected areas to inform them where, when and for how long temporary works are taking place. **Repeated Mitigation– Landscape & Visual 01– Retention of Existing Vegetation:** The EPC contractor will maximise the retention and preservation of existing vegetation outside and in proximity to the infrastructure fence-lines (particularly large trees and shrubs located along luggas), which acts as natural screening of Project facilities. **Repeated Mitigation– Landscape & Visual 05 – Earth Bunding:** Earth bunding will be developed and maintained around wellpad fencelines to provide screening. The Operator and their contractors will monitor grievances and improvements through the Operator Grievance Management Procedure.	Medium (temporary, short-term)	Moderate (adverse)
	Works associated with the construction of the CFA (and CPF) and associated infrastructure (e.g., access roads) may result in temporary impacts associated with construction works such as plant mobilisation, transport and lighting emissions.	Medium (temporary, short-term)	Moderate (adverse)		Medium (temporary, short-term)	Moderate (adverse)
	Works associated with the construction of the OHTL	Medium (temporary, short-term)	Moderate (adverse)		Medium (temporary, short-term)	Moderate (adverse)

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
	Clearance/ removal of vegetation (screening elements) and soils during construction	Medium (temporary, short-term)	Moderate (adverse)	**Repeated Mitigation– Landscape & Visual 01– Retention of Existing Vegetation** The Operator and their contractors will monitor grievances and improvements through the Operator Grievance Management Procedure.	Low (temporary, short-term)	Minor (adverse)
	Site activity and plant movement during construction (dust plumes, lighting emissions and material storage)	Low (temporary, short-term)	Minor (adverse)	The Operator Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders of the construction activity dates and the potential for increased visual disturbance from dust and artificial lighting. Signage will be put in place to inform people where, when and for how long temporary dust generating works are taking place. **Repeated Mitigation– Landscape & Visual 01– Retention of Existing Vegetation** **Repeated Mitigation– Landscape & Visual 05 – Earth Bunding** The Operator Environmental Performance Plan will include a procedure for daily visual dust monitoring around infrastructure fencelines which will be undertaken by the Environmental Supervisor. If high levels of dust are observed dust netting/ barriers will be used around high dust generating activities to limit the dispersion of dust.	Low (temporary, short-term)	Negligible

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				Repeated Mitigation– Landscape & Visual 02 – Artificial Lighting: The Operator and their contractors will limit light pollution with the following measures: - Use of lighting will be minimised and light spill controlled where possible by using directional lighting focussed downwards and the application of cowls; - The wattage/ power of the lighting will be considered, and lights will be of the correct power for the application; - Lighting will be used where required and unnecessary lighting avoided; and - Blue light tones will be avoided, as these light tones are more disruptive to sleep patterns. Yellow tone lights or white lights which filter out blue or UV light will be used where possible. **Repeated Mitigation– Landscape & Visual 03 – Transport Management System:** The Operator Social Performance Plan will present procedures for the development and implementation of transport management system		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				to mitigate impacts relating to dust trackout and dispersal by the Operator and their contractors. The transport management system will require the following measures to minimise dust emissions: ■ Project speed limits to be established and complied with by all Project vehicles; ■ Night-time driving will be prohibited unless specifically authorised; and ■ Off-road driving will be prohibited. The Operator and their contractors will monitor grievances and improvements through the Operator Grievance Management Procedure. Any complaints will be investigated and followed up		

7.6.9.3 Operational Phase

The following potential sources of impact are the focus of this operations impact classification:

- Visual impacts relating to the siting of above ground wellpads and supporting infrastructure during the operational lifetime of the Project potentially impacting the landscape character and visual elements within the vicinity of the Project facilities.
- Visual impacts relating to the siting of OHTLs (and associated pylons) during the operational lifetime of the Project potentially impacting the landscape character and visual elements within the vicinity of the Project facilities.
- Visual impacts relating to the siting of above ground CFA, including elevated structures (ground flare at CPF and incinerator flue stack at IWMF), and supporting infrastructure during the operational lifetime of the Project potentially impacting the landscape character and visual elements within the vicinity of the Project facilities.
- Visual impacts relating to site activity during operations will generate dust plumes and lighting emissions, potentially impacting visual elements within the vicinity of the Project facilities/activities. This includes impacts from the mobilisation of plant, delivery of materials and supplies, transportation of operations and maintenance personnel by vehicles and physical movement of workers.

The impact assessment is discussed in more detail in the sub-sections below. The operational phase impact assessment with respect to landscape and visual is presented in Table 7.6-8. Any additional mitigation is also presented in that table.

7.6.9.3.1 Summary of Impacts on the Landscape

The following impacts require no additional measures beyond those described in Section 7.6.8, with no change in impact significance pre and post mitigation, and are therefore not considered further in Table 7.6-8:

- The introduction and operation of the aboveground Project facilities will be highly contrasting with the existing rural, pastoral landscape character. Currently, there is limited industrial development within the LVAA, with the exception of EOPS infrastructure. The scale of the proposed industrial development would result in a relatively comprehensive change within a limited geographical area of the wider LCA 1 (semi-desert) and LCA 2 (dense bushland) over a long-term period. However, as the two LCAs comprise landscapes with a low or medium quality and rarity, local scale and limited potential for substitution/replacement, **Minor** residual impacts are anticipated.

7.6.9.3.2 Summary of Significant Visual Impacts

The following impacts require no additional measures beyond those described in Section 7.6.8 and are therefore not considered further in Table 7.6-8:

- Altered views as a result of Project facilities and operations will also be experienced by a large number of pastoralists/herders roaming the surrounding land for grazing and migration. Based on the mitigations presented for reducing operational related impacts on permanent receptors, residual impacts on transient users will be **Minor** for all sources.

Post-construction, visual impacts from the wellpads will be limited, with no operational infrastructure or machinery of significant height which extends above the existing tree canopy (see Table 7.6-7).

Table 7.6-7: Height of Structures Associated with Project Facilities

Facility	Structure	Height (m)[(a)]
Wellpad	Diesel and demulsifier shelters	10
CFA	Flue gas stack (IWMF)	4.9
CPF	Heater stack	26
OHTL	Pylons	21

(a) Fundamental height parameters for Project facilities, based on the maximum height of structures within the facility

The magnitude of impact is classified as medium, with a **Moderate** significance. In addition to Repeated Mitigation – Landscape & Visual 01 (Retention of Existing Vegetation) and Repeated Mitigation – Landscape & Visual 05 (Earth Bunding), where possible, Project infrastructure will be designed to blend in with the existing landscape. Where practicable and in particular for towers and elevated structures, metal surfaces will be matt (non-reflective finish) and painted surfaces will be muted with natural colours, to minimise visual impact (Repeated Mitigation – Landscape & Visual 04 – Project Infrastructure Design). The Operator will monitor grievances and improvements through the Operator Grievance Management Procedure. With the implementation of these additional mitigation measures, residual impacts can be reduced to from moderate to **Minor**.

In contrast, the CFA (particularly the CPF) and the OHTL will present more significant visual impacts during the operational lifetime of the Project, as illustrated by Figure 7.6-3 and Figure 7.6-4

[23]. The OHTL pylons will reach heights of up to 21 m, which is significantly greater than the canopy level of the existing lugga vegetation. A number of permanent settlements located within the AoI therefore have the potential to be visually impacted by the OHTL infrastructure, with temporary (for the Project lifetime) and medium-term changes to local views. The Operator will monitor grievances and improvements through the Operator Grievance Management Procedure, with a **Moderate** significance impact predicted.

The CFA will contain the most elevated and extensive Project facilities during operation. Within the CFA, the IWMF will contain the 4.9 m flue gas stack. In addition, the heater stack at the CPF will be 26 m in height and will present a significant visual feature to surrounding PAP. The Operator will implement Repeated Mitigation – Landscape & Visual 01 (Retention of Existing Vegetation) and Repeated Mitigation – Landscape & Visual 04 (Project Infrastructure Design) to mitigate for this. The Operator will monitor grievances and improvements through the Operator Grievance Management Procedure. Any complaints will be investigated and followed up. A **Minor** significance residual impact is predicted.

Site activity during operation, including operations, maintenance and vehicle movement, will result in the generation of dust plumes and lighting emissions (limited existing artificial lighting within the LVAA), which could present a visual impact. This will be mitigated through Repeated Mitigation – Landscape & Visual 02 (Artificial Lighting) and Repeated Mitigation – Landscape & Visual 03 (Transport Management System). The Operator Environmental Performance Plan will also include a procedure for visual dust monitoring during dust generating activities. If high levels of dust are observed, actions to limit the dispersion of dust will be identified. The Operator will monitor grievances and improvements through the Operator Grievance Management Procedure.

[23] It should be noted that these outputs are based solely on the existing terrain models, and do not take into account natural vegetative screening, which is present within the wellfield areas.

Any complaints will be investigated and followed up. These measures will reduce a low impact with **Minor** significance to a **Negligible** residual significance.

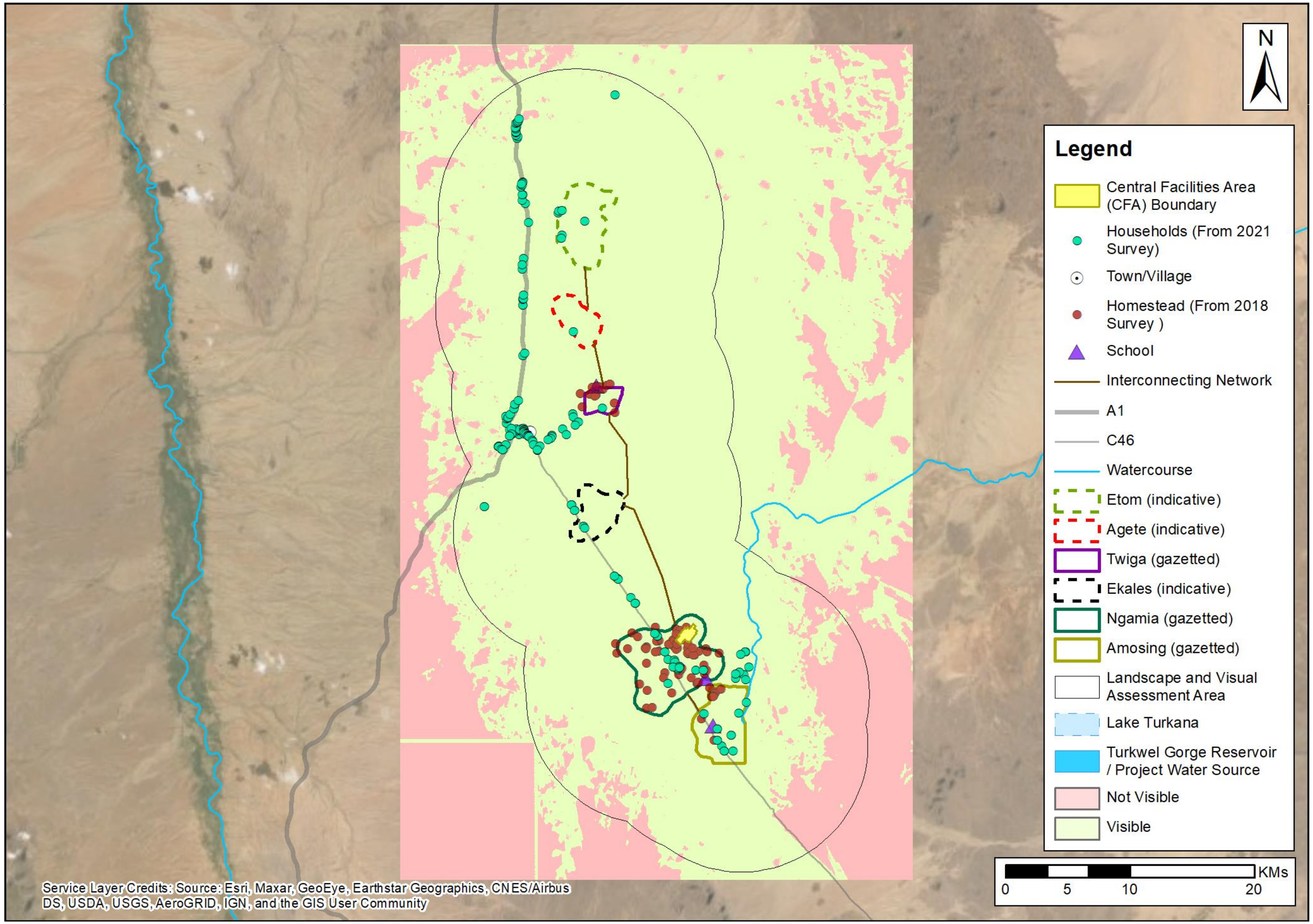

Figure 7.6-3: OHTL Zone of Theoretical Visibility

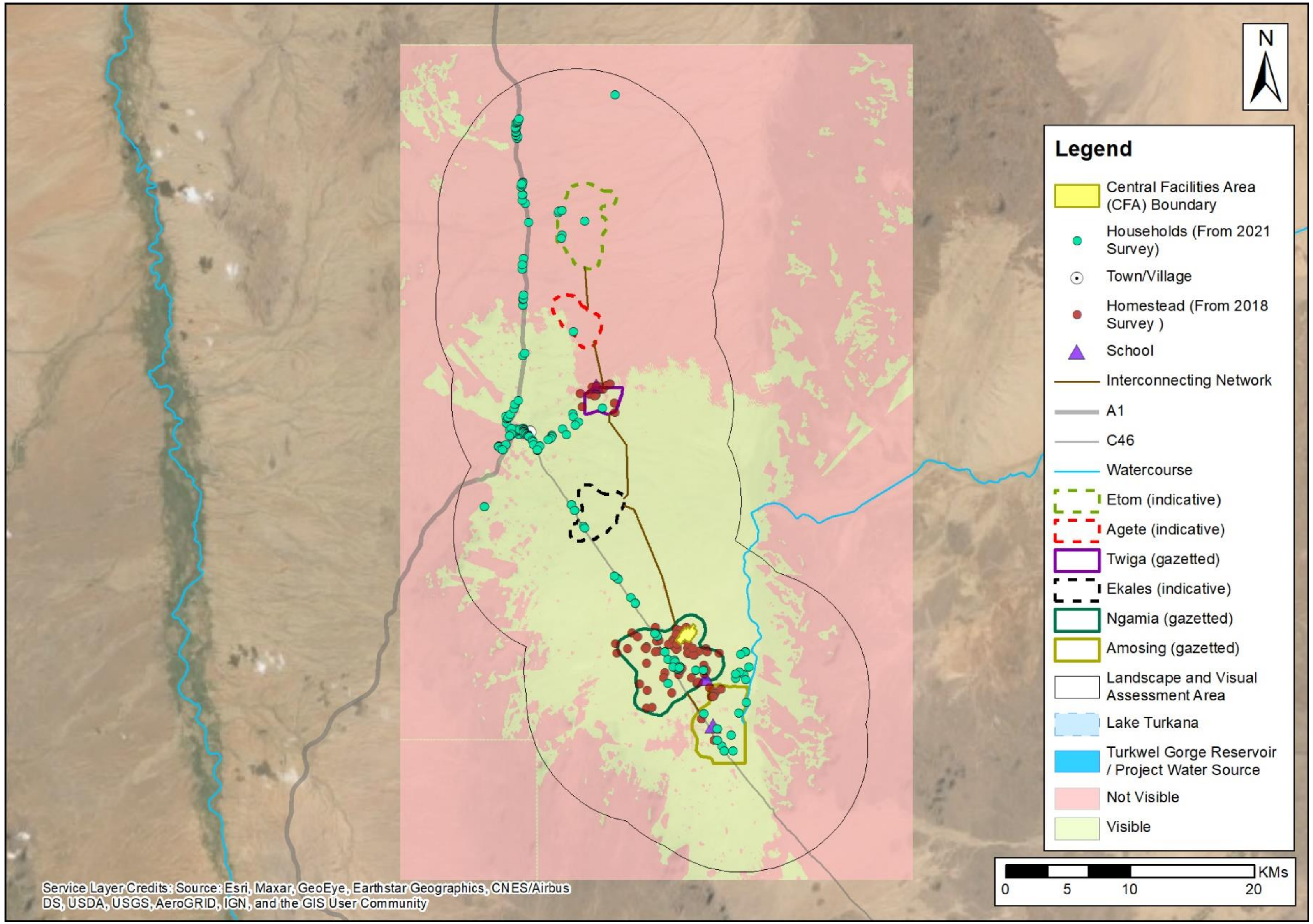

Figure 7.6-4: CFA Zone of Theoretical Visibility

Table 7.6-8: Operational Phase Impact Assessment

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Visual						
Permanent human receptors (settlements – nomadic view) (high).	Location of above ground wellpads and supporting infrastructure.	Medium (temporary, medium-term)	Moderate (adverse)	**Repeated Mitigation– Landscape & Visual 01– Retention of Existing Vegetation** **Repeated Mitigation– Landscape & Visual 04 – Project Infrastructure Design:** Where possible, Project infrastructure will be designed to blend in with the existing landscape. Where practicable and in particular for towers and elevated structures, metal surfaces will be matt (non-reflective finish) and painted surfaces will be muted with natural colours, to minimise visual impact. **Repeated Mitigation– Landscape & Visual 05 – Earth Bunding** The Operator will monitor grievances and improvements through the Operator Grievance Management Procedure.	Low (temporary, medium-term)	Minor (adverse)
	Location of above ground OHTL.	Medium (temporary, long-term)	Moderate (adverse)	The Operator will monitor grievances and improvements through the Operator Grievance Management Procedure.	Medium (temporary, long-term)	Moderate (adverse)
	Location of above ground	Medium (temporary, medium-term)	Moderate (adverse)	**Repeated Mitigation– Landscape & Visual 01– Retention of Existing Vegetation**	Low (temporary, medium-term)	Minor (adverse)

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
	CFA (CPF) and supporting infrastructure (buildings and flare at CPF and flue gas stack at IWMF).			**Repeated Mitigation– Landscape & Visual 04 – Project Infrastructure Design.** The Operator will monitor grievances and improvements through the Operator Grievance Management Procedure. Any complaints will be investigated and followed up.		
	Site activity and plant movement during operations (dust plumes, lighting emissions).	Low (temporary, medium-term)	Minor (adverse)	**Repeated Mitigation– Landscape & Visual 02 – Artificial Lighting** **Repeated Mitigation– Landscape & Visual 03 – Transport Management System** The Operator Environmental Performance Plan will include a procedure for visual dust monitoring during dust generating activities. If high levels of dust are observed, actions to limit the dispersion of dust will be set out. The Operator will monitor grievances and improvements through the Operator Grievance Management Procedure. Any complaints will be investigated and followed up.	Low (temporary, medium-term)	Negligible

7.6.9.4 Decommissioning

Decommissioning refers to the dismantling, decontamination and removal of process equipment and facility structures and any appropriate remediation.

Five years prior to the planned ‘End of Project’, a Decommissioning Plan will be developed for agreement with the appropriate authorities.

The likely decommissioning activities would be focused on:

- Production and injection wells with corresponding wellpads;
- The interconnecting network;
- Surface facilities in the CFA; and
- Other outfield infrastructure.

Assuming there is no other use for infield and outfield facilities, all structures including production, processing, treatment, storage, pumping, power, and related infrastructure facilities will be dismantled for recycling, sold for scrap, or disposed of in an appropriate manner following GIP. The areas impacted by Project facilities will be returned to their original (baseline) condition on decommissioning.

7.6.10 Summary of Mitigation

As identified in Table 7.6-6 and Table 7.6-8, additional mitigations are required to mitigate landscape and visual impacts from the Project, on top of the incorporated measures identified in Section 7.6.8, including:

- At locations where construction will occur, the Operator or the EPC contractor will engage stakeholders in affected areas to inform them where, when and for how long temporary works are taking place.
- The Operator Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders of the construction activity dates and the potential for increased visual disturbance from dust and artificial lighting. Signage will be put in place to inform people where, when and for how long temporary dust generating works are taking place.
- The EPC contractor (during construction) and the Operator (during operations) will maximise the retention and preservation of existing vegetation outside and in proximity to the infrastructure fence-lines (particularly large trees and shrubs located along luggas), which acts as natural screening of Project facilities.
- The Operator and their contractors will limit light pollution with the following measures:
  - Use of lighting will be minimised and light spill controlled where possible by using directional lighting focussed downwards and the application of cowls;
  - The wattage/ power of the lighting will be considered, and lights will be of the correct power for the application;
  - Lighting will be used only where required and unnecessary lighting avoided; and
  - Blue light tones will be avoided, as these light tones are more disruptive to sleep patterns. Yellow tone lights or white lights which filter out blue or UV light will be used where possible.
- The Operator Social Performance Plan will present procedures for the development and implementation of transport management system to mitigate impacts relating to dust trackout and dispersal by the Operator and their contractors. The transport management system will require the following measures to minimise dust emissions:

  - Project speed limits to be established and complied with by all Project vehicles;
  - Night-time driving will be prohibited unless specifically authorised; and
  - Off-road driving will be prohibited.
- Where possible, Project infrastructure will be designed to blend in with the existing landscape. Where practicable, and in particular for towers and elevated structures, metal surfaces will be matt (non-reflective finish) and painted surfaces will be muted with natural colours, to minimise visual impact.
- Earth bunding will be developed and maintained around wellpad fencelines to provide screening.
- The Operator Environmental Performance Plan will include a procedure for visual dust monitoring during dust generating activities. If high levels of dust are observed, actions to limit the dispersion of dust will be identified.
- The Operator will monitor grievances and improvements through the Operator Grievance Management Procedure. Any complaints will be investigated and followed up.

7.6.11 Summary of Residual Impacts

The Project has the potential to impact landscape and visual receptors during both the construction of Project facilities and the operations of above ground features. Overall, with incorporated environmental measures in the design and the additional mitigation presented above, residual impacts to identified landscape and visual receptors will be **Moderate**, with some **Minor** or **Negligible**. During operations impacts will mostly be **Minor**, with a **Moderate** residual impact predicted as result of the OHTLs.

7.7 Biodiversity, Ecology and Protected Areas

7.7.1 Introduction

The Project aims to ensure that biodiversity and ecosystem functions are not degraded or significantly impacted as a result of the Project's development, operation and decommissioning. Key to this commitment is securing the long-term survival of species and preservation of habitats that occur in the Project's AoI.

7.7.2 Area of Influence

The biodiversity assessment uses the biophysical AoI presented in Chapter 3.0, which comprises the areas of potential direct and indirect effects during construction and operation of the Project, based on the analyses completed as part of the wider ESIA.

Primary data sources used to support this assessment included land cover mapping and classification for the AoI, and baseline data gathered during a multi-seasonal field sampling programme, between 2015 and 2021. The field sampling programme included vegetation and flora, invertebrates, herpetofauna, birds, mammals and fish in representative locations. The baseline is presented in Chapter 6.0 of this ESIA.

7.7.3 Receptor Importance

In order to identify the importance of the receptors, the scale of relative importance presented in Table 7.7-1 has been used with reference to the information collated in the baseline to classify the selected receptors.

Table 7.7-1: Criteria for Determining Importance of Biodiversity Receptors

Receptor Importance	Criteria for Receptor Importance
Very high	■ International importance. ■ Nationally designated protected areas, IUCN protected area category II. ■ Receptor with a high quality and rarity, regional or national scale and limited potential for substitution/replacement. ■ Critical habitat triggers: ▪ Criterion 1: CR and/or EN species; ▪ Criterion 2: Endemic or restricted-range species; ▪ Criterion 3: Migratory or congregatory species; ▪ Criterion 4: Highly threatened and/or unique ecosystems; and ▪ Criterion 5: Key evolutionary processes. ■ Natural habitats as defined by IFC PS6: areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition (IFC, 2012[24]).
High	■ National importance; ■ Receptor with a high level of biotic integrity, uniqueness or restricted range; and/or ■ Receptor with a medium quality and rarity, regional or national scale and limited potential for substitution/replacement.

[24] Including amendments in 2019

Receptor Importance	Criteria for Receptor Importance
Medium	■ Regional importance. ■ Receptor with a medium quality and rarity, local scale and limited potential for substitution/replacement; and/or ■ Receptor with a low quality and rarity, regional or national scale and limited potential for substitution/replacement.
Low	■ Local, limited or no known importance; ■ Receptor with a low quality and rarity, local scale; and/or ■ Environmental equilibrium is stable and is resilient to impacts that are greater than natural fluctuations, without detriment to its present character and conservation status.

7.7.4 Magnitude of Impact

The characterisation of the magnitude of the impact considers the description of Project processes and how the Project could result in a change at each of the receptors. The potential for an impact to occur at a receptor has been determined using the understanding of the baseline environment and consideration of whether there is a feasible linkage between a source of the potential impact and each receptor. The magnitude of each potential impact has then been classified between 'negligible' and 'high', as described in Table 7.7-2.

Each potential impact can be either adverse or beneficial to the receptor of interest and vary in its duration (i.e., it can be long term, medium or short term and either permanent or temporary). For the purposes of this assessment the following durations apply:

- A short-term impact is defined as up to 66 months (the maximum anticipated construction period). The CFA/CPF will be constructed within the first 36 months;
- A medium-term impact is defined as between 66 months and 25 years (anticipated duration of operations); and
- A long-term impact is defined as one that is predicted to last beyond the end of the operational life of the project (>25 years).

A permanent impact is defined as a change to the baseline that would not reverse itself naturally. A temporary impact is defined as a change to the baseline conditions that would reverse naturally once the source of the impact is exhausted or has stopped.

Potential impacts are also assigned descriptors to identify whether the impact is direct or indirect. For the purposes of this assessment, a direct impact is one that occurs as a direct result of the Project and is likely to occur at the Project itself. Indirect impacts (or secondary/tertiary impacts) are those where a direct impact on one receptor has another knock-on impact on one or more other related receptor(s). Indirect impacts are likely to occur away from the Project.

Table 7.7-2: Criteria for Assessing Magnitude of Impact

Magnitude of Impact	Description Criteria	
	Adverse	Beneficial
High	Loss of resource/receptor, loss of quality and integrity of the resource/receptor, severe damage to key characteristics, features or elements (e.g., loss of natural or critical habitat).	Large scale or major improvement to resource/receptor quality, extensive restoration or enhancement.
Medium	Partial loss of resource/receptor, but not adversely affecting the integrity, partial loss or damage to key characteristics, features or elements.	Some benefit to key characteristics, features or parameters describing resource/receptor quality.
Low	Some measurable change in/damage to attributes, quality or vulnerability.	Minor benefit to, or addition of, one or more key characteristics, features or parameters describing resource/ receptor quality.
Negligible	No, or very minor (immeasurable), change to characteristics, features or parameters describing resource/receptor quality.	

7.7.5 Key Guidance and Standards

The biodiversity impact assessment has been completed in accordance with Kenyan legislation and to comply with international guidance and best practice, the IFC PSs and obligations from international conventions to which Kenya is a signatory.

7.7.6 Receptors of Interest and Importance

This assessment divides receptors into the following categories:

- Habitat receptors; and
- Species receptors.

Table 7.7-3 presents the assigned importance for these receptors following the criteria presented in Section 7.7.3.

7.7.6.1 Habitat Receptors

Habitat is defined as a terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the non-living environment (IFC GN6, 2019).

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

- Critical habitats as per the IFC PS6 (2012 and IFC GN6, 2019) criteria including:
  - Areas that meet the criteria of the IUCN's Protected Area Categories Ia, Ib and II;
  - KBAs which encompass IBAs, RAMSAR sites and World WWF Ecoregions; and
- Natural or modified habitats as defined by IFC PS6 (IFC GN6, 2019).

7.7.6.2 Species and Habitat Receptors

Species and habitat receptors were divided into the following categories:

- Critical habitat trigger species – species that qualify for critical habitat status based on the criteria and thresholds identified in IFC PS6 (IFC, 2019), or species that were deemed to qualify for critical habitat status based upon consultation with relevant specialists; and
- SoCC - this includes species that are listed either nationally or internationally as being of conservation concern, or range-restricted that do not meet the quantitative thresholds set by the IFC PS6 criteria for assigning critical habitat status.

The focus of the impact assessment is on receptors of medium to very high importance (SoCC and habitats), rather than those of lower conservation status. The development and implementation of mitigation and management for the SoCC and habitats of medium to very high importance (Table 7.7-3) will have mutual benefits to species and habitats of lower conservation status. Species and habitats categorised as low to medium importance are unlikely to be subject to significant residual effects.

The assessment of whether individual species qualify for critical habitat status was evaluated in consultation with external experts and the process is described in more detail in Annex I.

Table 7.7-3: Receptors and Importance

Receptor	Importance	Comment
Habitat Receptors		
Nasolot and South Turkana (NRs)	Very high	Nationally designated protected areas, IUCN protected area category II[25].; qualifying as critical habitat based on IFC PS6 criteria
Pellow Community Conservancy	Very high	Adjoining Nasolot NR and provides habitat for several critical habitat trigger species.
Faidherbia-Celtis riparian forest community along the Malmalte and Turkwel Rivers	Very High	Identified as natural habitat based on IFC PS6 criteria and critical habitat for several species.
Turkwel and Malmalte Rivers	Very high	Critical habitat for range restricted fish species.
Rocky ridges separating core Project area (Ngamia and Amosing) from Turkwel and Malmalte Rivers as well as rocky ridges to the east and south-east of Ngamia and Amosing	Very high	Critical habitat for several critical habitat trigger species.
Northern *Acacia-Commiphora* bushlands and thickets associated with the WWF Ecoregion	Medium	Extensively degraded throughout the AoI and specifically at the Project footprint due primarily to extensive overgrazing. Identified as modified habitat in terms of IFC PS6 criteria.
Species Receptors		
Euphorbia turkanensis	Very high	Range restricted plant species only known from the AoI but not recorded within or near the Project footprint, triggers critical habitat in terms of IFC PS6 Criterion 2 (IFC GN6, 2019)

[25] Large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible, spiritual, scientific, educational, recreational, and visitor opportunities (Dudley, 2008).

Receptor	Importance	Comment
Elephants	Very high	Listed as EN in the KWCMA (2013) and IUCN (2021) – critical habitat trigger species based on IFC PS6 Criterion 1 and Criterion 3 (IFC GN6, 2019).
Leopard and striped hyaena	Very high	Both species are listed as EN in the KWCMA (2013) – critical habitat triggers based on IFC PS6 Criterion 1 (IFC GN6, 2019).
Vultures[26] (3 species have been confirmed as present in the AoI namely Lappet-faced, Rüppell's and African White-backed)	Very high	■ African White-backed Vulture is listed as CR by the IUCN (2021). Qualifies for critical habitat status based on IFC PS6 Criterion 1; ■ Rüppell's Vulture is listed as CR by the IUCN (2021). Qualifies for critical habitat status based on IFC PS6 Criterion 1; and ■ Lappet-faced Vulture is listed as EN by the IUCN (2021) and qualifies as a critical habitat trigger based on IFC PS6 Criterion 1.
Turkana toad	Very high	Range-restricted amphibian species that triggers critical habitat in terms of IFC PS6 Criterion 2.
Ground beetle (*Omophron* sp)	Very high	Previously undescribed beetle species only known from the AoI. Qualifies as critical habitat trigger in terms of IFC PS6 Criterion 2.
Plant SoCC (non-critical habitat trigger species)	High	Three range restricted plant species recorded during the baseline surveys namely: ■ *Blepharis turkanae* – range restricted plant species only known from Turkana County, recorded east of Project area, not recorded within the AoI therefore no critical habitat could be designated within AoI; ■ *Neuracanthus kenyensis* – range restricted to northern Kenya but does not reach threshold for critical habitat in terms of IFC PS6 Criteria 2; and ■ *Xerophyta schnizleinia* – range restricted plant species known to occur in northern Kenya but does not reach threshold for critical habitat in terms of IFC PS6 Criteria 2.
Bird SoCC (non-critical habitat trigger species[27])	High	■ Steppe Eagle – listed as EN by IUCN (2021) but population does not meet threshold for critical habitat based on IFC PS6 Criteria 1; ■ Lesser Kestrel – listed as VU by KWCMA (2013); and ■ Tawny Eagle – listed as VU by IUCN (2021).
Mammal SoCC (non-critical habitat trigger species)	Medium	■ Lesser Kudu – listed as VU by KWCMA (2013) and NT by IUCN (2019). Confirmed as present along the Malmalte River, also known to occur in Nasolot NR and South Turkana NR;

[26] In addition to the 3 vulture species confirmed as present in the AoI, records of other species and the continued presence of wild ungulates in places such as the Nasolot NR and South Turkana NR suggests a high likelihood of occurrence of other species e.g., the White- headed vulture (listed as VU in Kenya and CR by the IUCN).

[27] Species are listed either nationally or internationally as being of conservation concern but that do not meet the IFC PS6 Critical Habitat thresholds.

Receptor	Importance	Comment
		■ Cape Buffalo – listed as near threatened (NT) by the IUCN (2019) and known to occur in Nasolot NR, South Turkana NR and along the Malmalte River; and ■ Cosen's gerbil. Range restricted mammal listed as data deficient (DD) by the IUCN.
Herpetofauna SoCC (non-critical habitat trigger species)	Medium	Three nationally protected (KWCMA, 2013) reptile species are known to occur in the AoI namely: ■ Kenyan sand boa; ■ Puff adder; and ■ Rock monitor.

7.7.7 Sources of Impacts

Potential sources of impact of a range of magnitudes will occur throughout the life of the Project and are set out below by Project phase.

7.7.7.1 Construction Phase

Direct impacts on habitat and species receptors:

- The temporary and/or permanent land take required to accommodate and construct Project facilities;
- Disturbance by plant, machinery and vehicles during construction;
- Temporary or permanent loss of habitat for critical habitat trigger species associated with Project facilities;
- Construction camp land take and disturbance;
- Temporary habitat severance during construction of linear infrastructure components e.g., OHTL;
- Temporary drawdown of groundwater in the Kalabata River;
- Clearing of vegetation prior to construction;
- Temporary changes to surface water regimes;
- Waste generated from the Project activities; and
- The introduction and spread of invasive plants, pests and diseases.

Indirect construction impacts resulting from the Project including:

- Light pollution attracting insects out of surrounding areas and contributing to shifts in predator – prey dynamics;
- Increases in air emissions and dust deposition during construction;
- Sensory disturbance (light and noise);
- Population influx to nearby settlements during construction, and subsequent increases to natural resource harvest, charcoal production, hunting and grazing/browsing pressure on vegetation communities and habitats; and
- Increased access for people and vehicles along permanent service tracks, Right of Way (RoW) and roads.

7.7.7.2 Operational Phase

- Deposition of dust on vegetation from increased traffic and Project activities;
- Sensory disturbance (light and noise) from operational activities;
- Light pollution attracting insects out of surrounding areas and contributing to shifts in predator – prey dynamics;
- Injury/mortality of individuals and/or local populations of birds and invertebrates due to the presence of and emergency flare at the CPF;
- Impacts on birds associated with infield and associated facilities including OHTLs (electrocution or direct impacts with lines or pylons);
- Increased access for people and vehicles along permanent service tracks and roads; and
- Access to permanent water sources. Water storage areas on the well-pads could attract fauna, both in a beneficial sense (provision of fresh water for drinking), and detrimentally (if they drown, or are poisoned).

7.7.7.3 Climate Change

Climate change predictions with respect to meteorological data can be highly variable. The uncertainty in precipitation projections for Kenya arises from the wide disagreement between different climate models in the projected change in amplitude of future El Niño events. Most climate predictions suggest there will be an increase in temperature and rainfall, and of extreme weather events (i.e., rainfall intensity and droughts).

Due to this uncertainty, impacts directly attributed to climate change are not assessed in this chapter, but the climate change management plan will evaluate linkages between impacts of climate change on physical sciences and biodiversity receptors.

7.7.8 Incorporated Environmental Measures

The Project has been designed and planned to incorporate a range of incorporated environmental measures that provide design solutions to avoid potential impacts or reduce their magnitude, prior to the impact analysis being completed.

The measures presented in this section either relate to design measures or are widely accepted good practice.

7.7.8.1 Design Measures

The following design measures will provide inherent mitigation to selected impacts:

- Burying of infield flowline network mitigates impact of habitat fragmentation;
- Well-pads are designed so that all clean rainwater runs to an external ditch that runs around the perimeter. Sumps are provided for collection of contaminated water;
- The three-casing policy for wells reduces the potential risks associated with uncontrolled hydrocarbon release;
- An artificial geosynthetic clay layer will be installed at the landfill site in order to mitigate the risk of groundwater contamination;
- Roads will be designed to manage runoff and discharge at equivalent rates to pre-construction, while maintaining quality in line with Kenyan water standards;

- Existing roads will be used where possible – avoiding the construction of new roads where existing ones can be used (with or without upgrade) reduces the requirement for unnecessary earth movement and land take;
- The use of synthetic liners for storage of waste on well-pads mitigates the risk of groundwater and soil contamination; and
- The chemical storage and pigging areas are provided with a kerbed concrete area to contain any spillages.

7.7.8.2 Good Industry Practice

The following measures included in the Project design are considered to be Good Industry Practice and will mitigate selected potential impacts:

- Education of staff about company environmental policies and procedures including ongoing training and auditing of effectiveness; and
- During construction, well-pads will have a bunded diesel storage area. The bunds will be lined to prevent soil contamination and will be designed to retain the larger of 110% of the volume of the largest tank or 25% of the combined tank volume of the diesel stored.

7.7.9 Impact Classification

Taking into account the biodiversity baseline conditions (Chapter 6.0), the relevant incorporated environmental measures (Section 7.7.8), and the potential sources of impact (Section 7.7.8) determined from the Project description, the potential source-pathway-receptor impact linkages for the construction and the operational phases are presented in this section. A discussion regarding feasible impact linkages during each of the Project phases is presented in each of the sub-sections below. Each discussion is followed by a table where the potential sources of impact and relevant additional mitigation applicable to each receptor are summarised. The magnitude, direction, timescale and significance of each impact linkage is assigned following the method presented in Section 7.7.4. Direct (within, and immediately adjacent to the Project footprint) and other non-footprint direct impacts (for example, sensory disturbance and edge impacts) were superimposed on the habitat mapping in GIS to evaluate the magnitude and extent of impacts on habitats.

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

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

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 impacts 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 non-footprint direct impacts, fragmentation, sensory disturbance (light and noise), and air emissions and dust. The majority of these impacts are wholly temporal in nature. The transient nature of these impacts reduces the magnitude to receptors.

Indicators used to assess impacts to species receptors were:

- No loss of habitat for critical habitat species;

- No mortality of individuals; survival and the subsequent ability to reproduce;
- Maintenance of species' functional habitat connectivity;
- Vegetation restoration and establishment efficacy post construction; monitoring to review the timely restoration of floral species composition and the potential introduction of invasive species; and
- Measurable changes in habitat quality and quantity from baseline.

The analysis focuses on assessing potential Project impacts relative to baseline conditions. The reason that displacement of SoCC individuals from suitable habitat is not considered is because habitat for SoCC does not exist within the Project footprint.

Potential changes in survival and reproduction were assessed qualitatively by considering potential disturbances (that is, severance, (temporary and permanent) traffic, light and noise). These disturbances were considered with relation to known or inferred impacts to the survival and reproduction of species for which data on these types of impacts are available as presented in published literature and in consultation with experts. Changes in habitat connectivity were assessed by identifying potential barriers, including sensory barriers, to movement and species mobility.

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[28] population was used as a benchmark when describing the magnitude of an impact.

Where mitigation measures are repeated for different receptors, they are stated as a numbered "Repeated mitigation" in the initial instance and referred back to thereafter.

7.7.9.1 Construction Phase

During the construction phase the EPC contractor will appoint a Biodiversity Supervisor to ensure compliance with relevant mitigation measures. The Biodiversity Supervisor will be responsible for implementation of biodiversity-related management controls and to have "*stop work*" authority if any unexpected very high or high-value receptors are encountered so that the appropriate management procedures can be implemented or if appropriate mitigation is not being implemented for expected receptors.

The construction phase impact assessment, with respect to biodiversity, is presented in Table 7.7-4.

7.7.9.1.1 Habitat Receptors

Habitat receptors are considered below. Where lower value habitat receptors host SoCC the impacts and mitigation are discussed in the species receptor section. This is the case with regard to the Kalabata lugga which has the potential to support SoCC.

7.7.9.1.1.1 Protected Areas and Community Conservancies

Protected areas that are classified as IUCN Protected Area Categories Ia, Ib and II qualify as critical habitat in terms of IFC PS6 (IFC GN6, 2019). Two IUCN Protected Area Category II reserves are situated within the Project AoI, namely Nasolot NR and South Turkana NR (Figure 7.7-1). Pellow Community Conservancy adjoins Nasolot NR and provides habitat for some of the same critical habitat trigger species and together with Masol Community Conservancy provides connectivity between Nasolot NR and South Turkana NR (Figure 7.7-2). The Masol Community Conservancy was not included in the scope of this assessment as it falls outside of the Project AoI, however as mentioned above it does form part of the larger biodiversity landscape. Neither of the IUCN

[28] 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). 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).

Protected Area Category II reserves (Nasolot and South Turkana) will be physically impinged by the Project. Similarly, the Pellow Community conservancy will not be physically impinged as it is situated ca. 25 km from the Project.

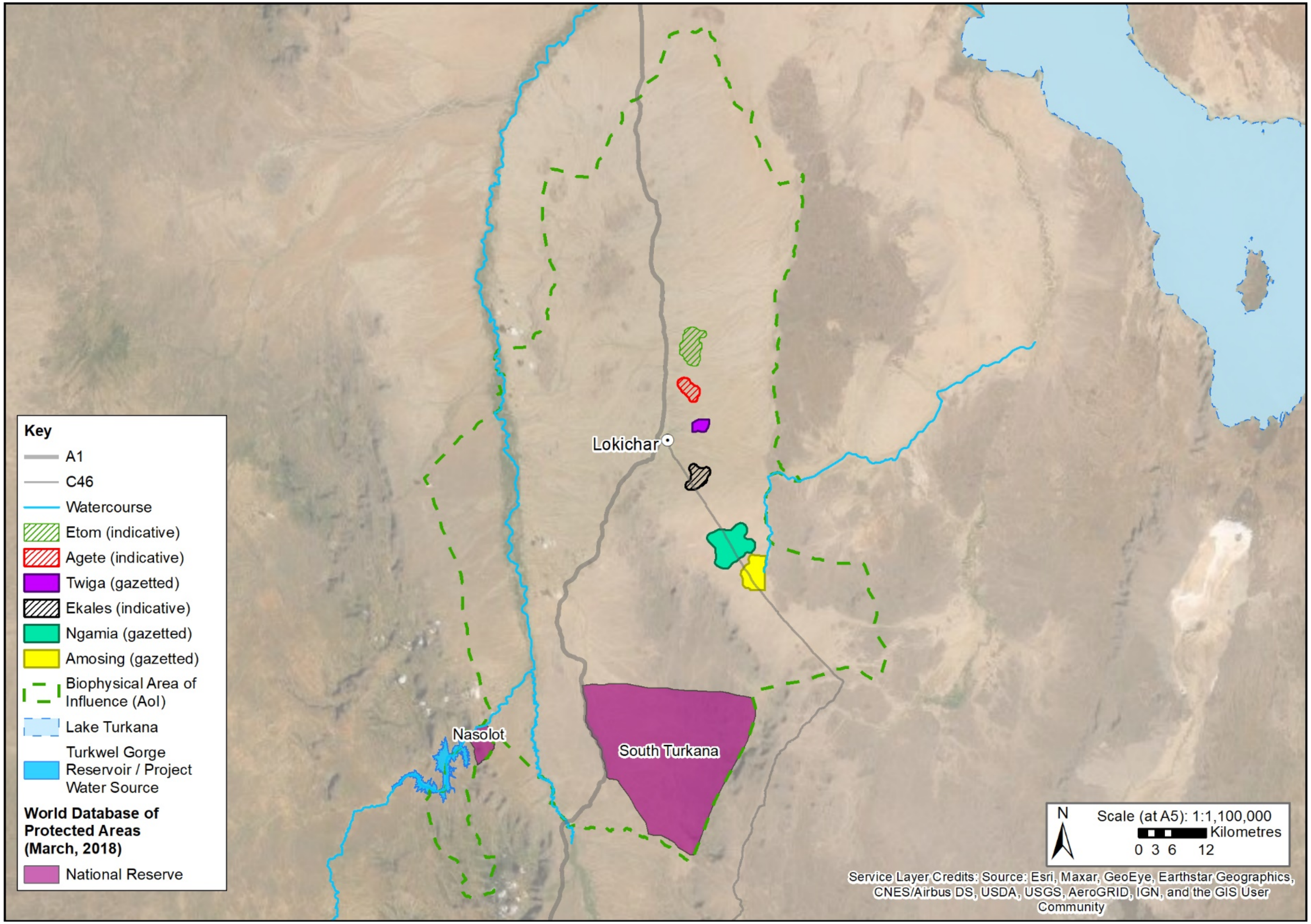

Figure 7.7-1: National Reserves Classified as IUCN Protected Area Categories Ia, Ib or II Located Within the Project AoI

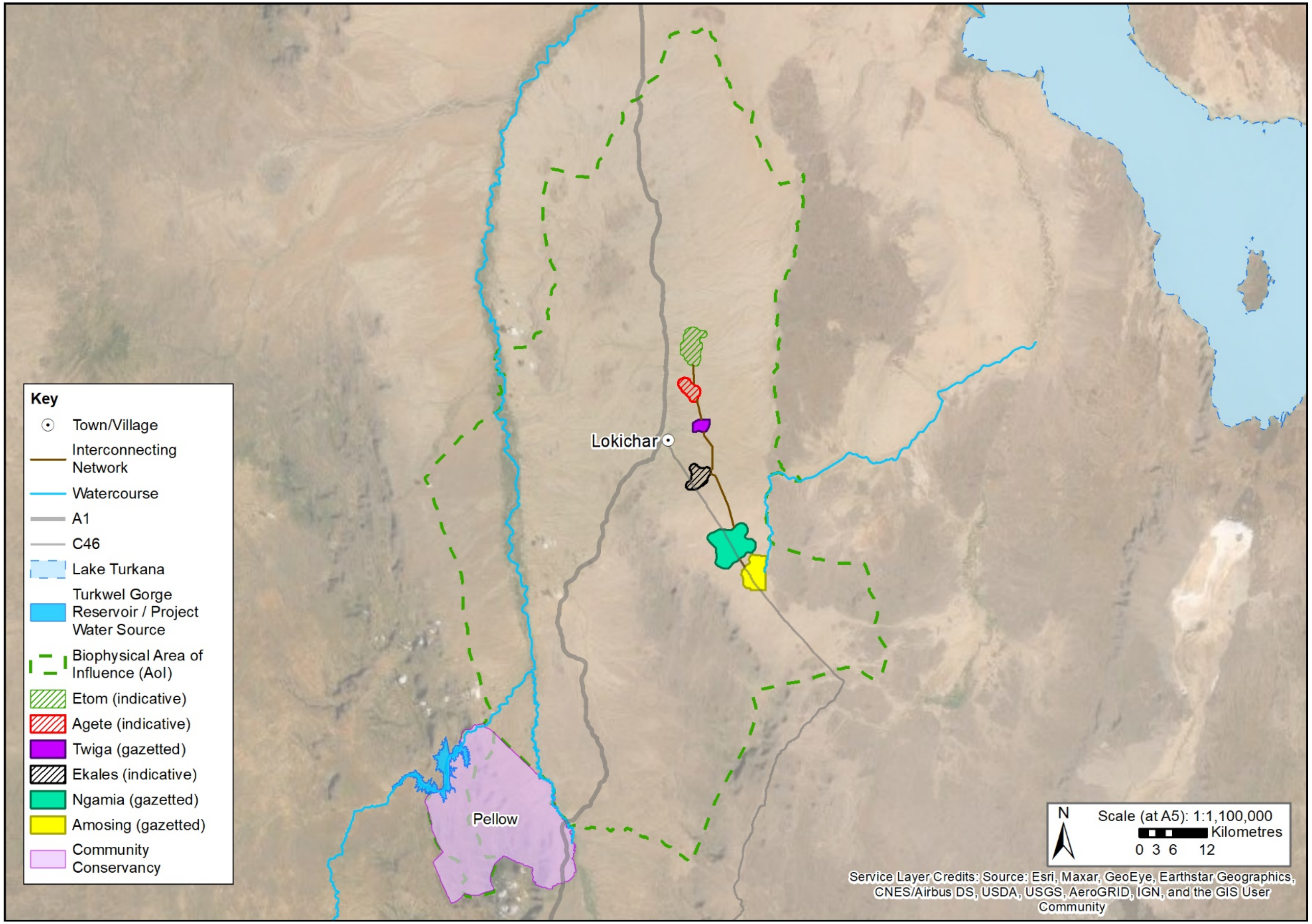

Figure 7.7-2: Location of the Pellow Community Conservancy Within the Project AoI

7.7.9.1.1.2 Natural and Modified Habitats

The IFC describe natural habitats as areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition (IFC GN6, 2019). In areas of natural habitat, mitigation measures have been designed to achieve no net loss of biodiversity, (IFC GN6, 2019). The IFC stipulates that the determination of natural habitat will be made using credible scientific analysis of best available information (IFC GN6, 2012).

The approach for quantifying habitat modification was based on the methodology proposed in the 2017 Golder Report (Golder Report No. 1433956.567 D.0, 2017) which in turn was based on the methodology proposed by Herlocker (1989). Degree of habitat modification was plotted based on the overlap of the buffers shown in Figure 7.7-3 below.

Areas located more than 5 km away from any of the known sources of anthropogenic impacts (settlements, roads, livestock corrals and Operator supplied community water points) were assigned a very low degree of modification (Figure 7.7-3 below). These areas are mostly situated on the periphery of the AoI far away from settlements, roads and tracks. A large portion of South Turkana NR in the south-central portion of the AoI, and the mountainous area that separates Amosing and Ngamia from the Malmalte and Turkwel rivers is classified as having a very low degree of modification.

Based on the IFC definition, these habitats would have the highest likelihood of being classified as natural. However, it should be noted that a large proportion of the population of Turkana County are nomadic pastoralists who move extensively with their livestock creating pressure on natural habitats.

Areas that only fall within the extent of a single buffer area (within 5 km of a single source of anthropogenic impact) were assigned a degree of modification of low (Figure 7.7-3 below). These are primarily peripheral areas, mostly located > 5 km away from settlements, livestock corrals and Operator community water points, but within 5 km from roads or tracks.

Habitats that overlap with 2 buffer areas were assigned a degree of modification of moderate. Again, these are mostly peripheral areas > 5 km away from settlements, but within proximity of livestock corrals, roads and tracks.

Areas within the 5 km buffer of settlements were mostly characterised as highly modified (Figure 7.7-3 below). These habitats are extensively utilised and modified, with vegetation intensively grazed and harvested for firewood. Little of the indigenous faunal community remains within these areas. It should, however, be remembered that both natural and modified habitats may contain high biodiversity values, thereby qualifying as critical habitat (IFC 2012b, GN28). In fact, the habitat along the Kalabata River was identified as critical habitat for the Turkana toad, undescribed Omophron beetle, and vulture species with much of this habitat categorised as highly modified. The full methodology used is provided in Annex I.

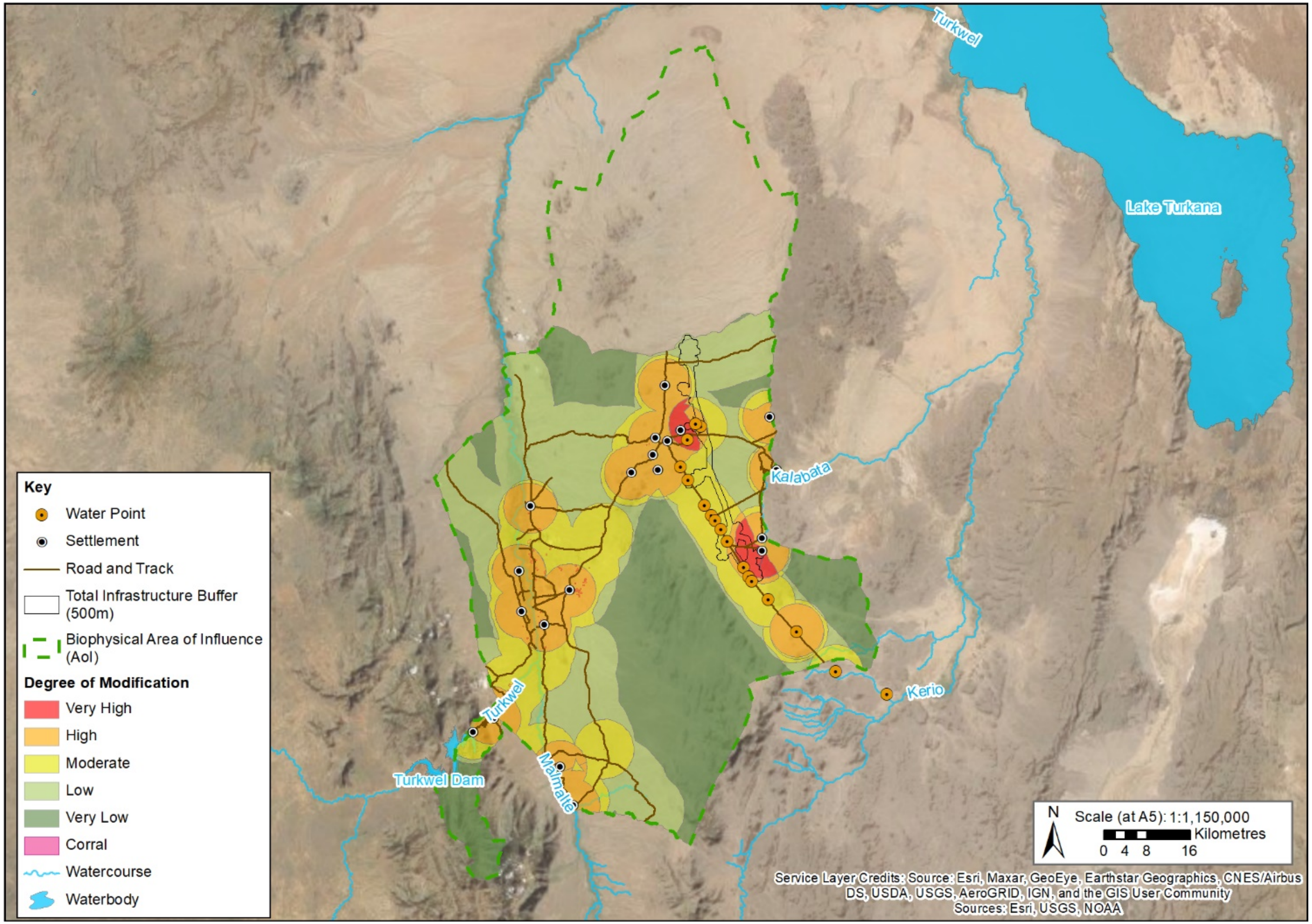

Figure 7.7-3: Degrees of Habitat Modification Mapped in the Biophysical AoI.

Critical, Natural and Modified habitats occur within the AoI. However, all vegetation communities within the Project footprint are classified as modified (Figure 7.7-4).

7.7.9.1.1.3 Rocky Ridges

Rocky ridge habitats exist to the east and south-east of Ngamia and Amosing. These were identified as critical habitat for several species (leopard, striped hyaena, lappet, white-backed and Rüppell's vultures Figure 7.7-5). These areas were therefore assigned a very high importance (Table 7.7-3). These habitats are mostly situated beyond the Project's direct footprint and are, therefore, only subject to indirect impacts, including the potential for sensory disturbance of fauna due to lights and noise (Table 7.7-4).

Mitigation measures will include the following for Rocky Ridges habitats:

The Operator Environmental Performance Plan will include procedures to manage potential impacts on the rocky ridge habitats and associated species including:

- **Repeated Mitigation - Biodiversity 01 - Transport Management System**

  The Operator Environmental Performance Plan will present procedures for the development and implementation of transport management system. The biodiversity specific transport management controls will require the following:

    - The Operator will train all employees and contractor workers in the Operator's Code of Conduct, ensure all drivers hold a valid driver's licence and meet Operator's driver standards and international standards as set out in IOGP Land Transport Safety Recommended Practice 365;
    - Vehicles will be fitted with inward and outward facing cameras to monitor driver performance and external hazards;
    - Project speed limits will be established and complied with by all Project vehicles;
    - Night-time driving will be prohibited unless specifically authorised; and
    - Off-road driving will be prohibited.

- **Repeated Mitigation - Biodiversity 05 - Sensory disturbance**.

    - Use of lighting will be minimised and light spill controlled where possible by using directional lighting focussed downwards and the application of cowls;
    - The wattage/ power of the lighting should be considered, and lights should be of the correct power for the application;
    - Lighting should be used where required and unnecessary lighting avoided; and
    - At locations where construction noise will temporarily exceed statutory limits (criteria is defined in Section 7.2– noise and vibration), NEMA will be notified.

The significance of this impact, pre-mitigation, was rated as **Moderate** for Rocky Ridges due to the indirect nature and short duration of the impact and decreased to **Minor** for Rocky Ridges after mitigation (Table 7.7-4).

7.7.9.1.1.4 Northern Acacia-Commiphora Bushland and Thicket

The Project AoI lies largely within the Northern *Acacia-Commiphora* bushlands and thicket ecoregion. This ecoregion occurs mostly in Kenya and is threatened by increasing human density contributing to unsustainable water usage, frequent burning, invasive species and overgrazing by livestock (WWF, 2019). Much of the habitat within the Project footprint, representative of this ecoregion, is degraded due to overgrazing and erosion, and is also under competitive pressure from non-native and invasive species. Therefore, it was assigned a medium importance (Table 7.7-3). Potential impacts on this ecoregion within the AoI include temporary and permanent land take required to accommodate and construct Project facilities and the introduction of invasive species. Dust deposition was considered as part of the construction impact assessment process. However, as indicated in Section 7.1 with incorporated best practice, air quality changes relating to dust deposition on vegetation species that are not rare and are not sensitive or located in a protected areas are predicted to be of low to negligible impact magnitude.

The significance of the impact on this habitat type, was rated as **Moderate** prior to implementation of mitigation (Table 7.7-4).

Mitigation measures will include:

- The Operator Environmental Performance Plan will include procedures to manage potential impacts on the Northern *Acacia-Commiphora* bushlands and thickets including:
  - The appointment of the EPC Biodiversity Supervisor; and
  - Procedures for contractor and staff environmental inductions on wildlife protection and biodiversity, and protocols for incident management.
- The Operator Environmental Performance Plan will include procedures to define the requirements for minimising land take and vegetation rehabilitation post construction;
- Cordon off infrastructure areas during construction to keep livestock, wildlife and people out. In addition, the following standard mitigations re applicable:
- **Repeated Mitigation - Biodiversity 01 - Transport Management System**;
- **Repeated Mitigation - Biodiversity 02 - Invasive Species**

  The Operator Environmental Performance Plan will present procedures for identification and removal of invasive species, and to prevent establishment and spread of invasive species after the ground has been disturbed in all Project footprint areas. Alien invasive species will be managed in accordance with species specific best practice. Procedures will include:

  - The appointed EPC Biodiversity supervisor will undertake monitoring to hygiene specifications for vehicles, cargo and site clearance and rehabilitation. Specifications and records of monitoring will be maintained on the occurrence and spread of invasive species.
  - The appointed EPC Biodiversity supervisor will undertake monitoring inspections of the Project footprint at monthly intervals during construction and the Operator Environmental Supervisor for the operational life of the Project in order to identify invasive species colonisation and actions for management (e.g., removal of invasive species).
- **Repeated Mitigation - Biodiversity 03 - Population Influx (Construction)**
  - The Operator Social Performance Plan will present influx management procedures to manage speculative influx (emergence of informal settlements, project construction activities (e.g., vegetation clearance) providing new access to natural resources) occurring. Procedures will be developed in coordination with Turkana and West Pokot County Governments and the respective County Commissioners.
  - Prior to start of construction, the Operator will work with National Government, County Government, the County Commissioner and key stakeholders to support the monitoring of population changes in key settlements (Lokichar, Nakukulas, Lokori) to identify significant changes in population.

- Prior to start of construction, the Operator will also develop a methodology to monitor growth of homesteads and physically monitor numbers and location of homesteads in the immediate areas surrounding Project facilities and project construction activities, which could have an impact on sensitive habitats. Monitoring data will be gathered for up to 3 years and used to identify in-migration "hot spots" and develop appropriate mitigation options. The Operator will determine thresholds for action should they be exceeded to reduce the impacts of population influx.
- The Operator will work with National Government, County Government, the County Commissioner and key stakeholders to establish and develop the terms of reference for an Influx working group, which will be chaired by a representative of county government and will include representatives from National and County government departments, and relevant CSOs. The Operator will sit as a member on the working group. The aim of the group will be to review, monitor and support actions to manage Project-induced influx.

- **Repeated Mitigation - Biodiversity 04 - Re-vegetation and remediation**.

  The Operator Environmental Performance Plan will include procedures for Vegetation rehabilitation including:

  - Developing a list and map of appropriate vegetation to be used in different areas of the project according to, provenance, endemicity, planting protocols, maintenance and monitoring procedures.
  - Soil strip management and storage, soils reinstatement and post-construction monitoring by the Operator or the EPC Biodiversity Supervisor
  - Any cleared areas within the footprint where topsoil is salvageable, measures will be taken by the Operator and their contractors to store topsoil and maintain the existing seed bed. If additional re-seeding is required during rehabilitation, it will be re-seeded/replanted with locally sourced seed/plants of suitable species. Topsoil management will allow reestablishment/re-generation of vegetation on bare areas and limit the erosion potential;

  The appointed EPC Biodiversity supervisor will undertake monitoring inspections of the Project footprint at monthly intervals during construction and for two years post construction in order to monitor rehabilitation and take alternative action should further re-vegetation be required to re-establish pre-construction conditions.

In addition, specifically for borrow pits, for which locations are not yet fixed:

- The Operator will obtain NEMA approval prior to commencing onsite activities. Borrow pits and quarries to be located more than 100 metres from watercourses to minimise storm water runoff into watercourse and mitigate potential conflicts;
- Borrow Pit locations will be sited in modified habitat wherever practicable (Figure 7.7-3) and will have minimum negative impacts on access to water points, breeding, feeding and wild animals' paths; and
- Prior to pit development, prepare a rehabilitation plan with details of final shape, method of achieving it, drainage, sediment control, soil reinstatement and revegetation measures.

Implementation of mitigation measures reduced the significance of this impact to **Minor** (Table 7.7-4).

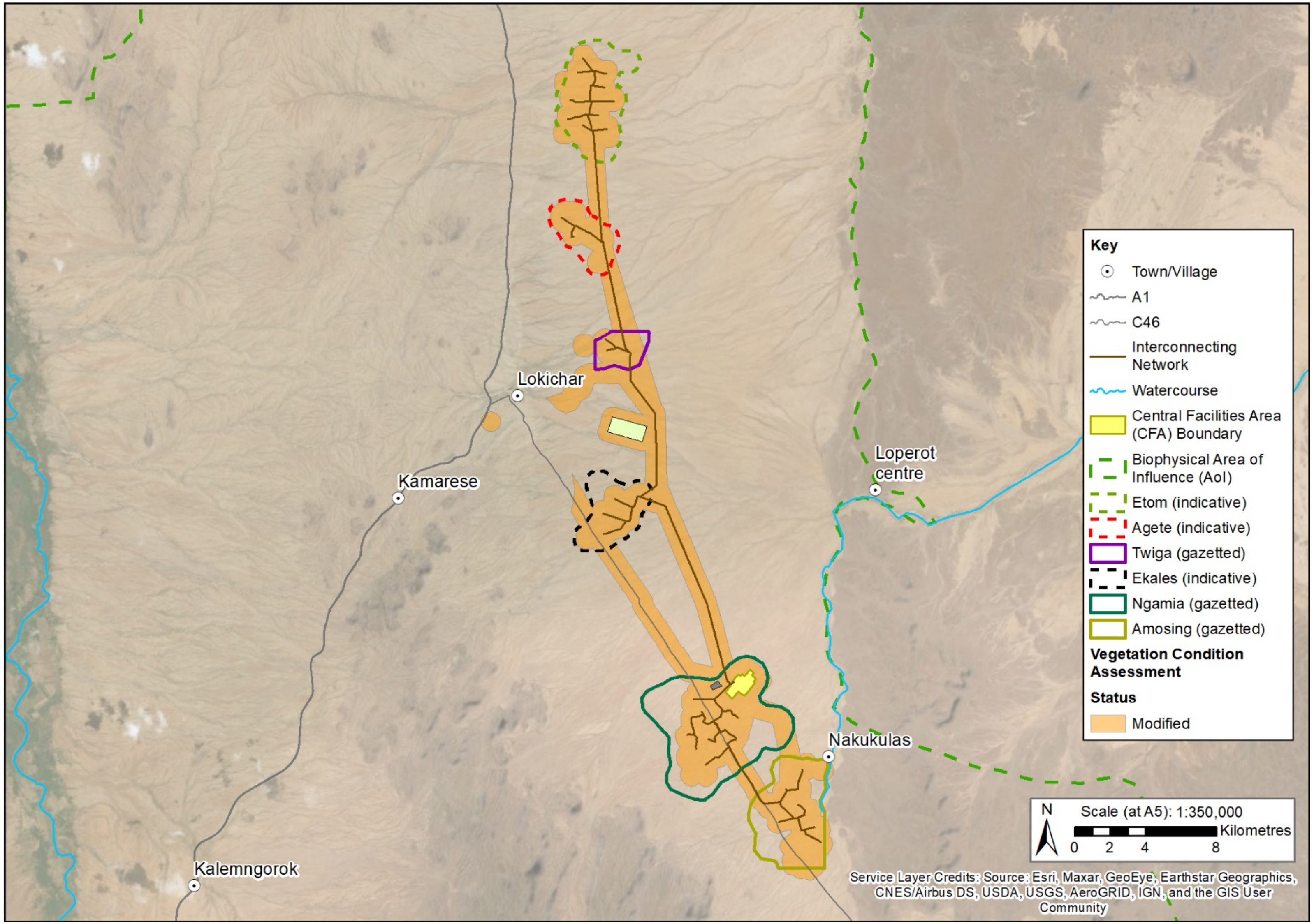

Figure 7.7-4: Vegetation Condition Assessment Conducted for the Project Footprint Showing areas of Natural and Modified Habitat

7.7.9.1.2 Species Receptors

The assessment of species receptors was divided into two categories, namely:

- Critical habitat trigger species – species that meet the numeric thresholds for critical habitat, based on the first four critical habitat criteria (i.e., CR/EN species; endemic/restricted-range species; migratory/ congregatory species; and
- SoCC - this includes species that are listed either nationally or internationally as being of conservation concern, but do not meet the IFC PS6 criteria for critical habitat status.

7.7.9.1.2.1 Plant Species of Conservation Concern

Of the plant SoCC recorded during the baseline surveys, *Blepharis turkanae* was not recorded within the AoI. Based on consultation with the external vegetation specialist (John Kimeu, NMK) it is not expected to occur in the AoI. The remaining plant SoCC (i.e., *Neuracanthus kenyensis* and *Xerophyta schnizleinia*) do not meet the threshold for critical habitat status, and neither were recorded within the Project footprint although they have been recorded in the AoI. Based on the low likelihood that any of the remaining SoCC occur within the direct Project footprint, the significance of vegetation clearing required to accommodate and construct Project facilities was rated as **Minor** both pre- and post-mitigation (Table 7.7-4).

7.7.9.1.2.2 Elephants

The elephants that populate the AoI form part of the Nasolot - Kamnarok population that extends from the Kerio Valley in the south, to South Turkana and Nasolot NRs in the north. This area includes four protected areas, namely South Turkana, Nasolot, Kerio Valley and Kamnarok National Reserves and is the largest elephant population in western Kenya (Chase *et al*., 2016). The commercial ivory trade is active in the area, and the Nasolot – Kamnarok elephant population is severely threatened (Omondi *et al* (2002). The results of the Great Elephant Census (Chase *et al*., 2016) also pointed to excessive mortality rates recorded in the area. Elephant are listed as EN in KWCMA (2013) and by the IUCN Red list; therefore, the species triggers CH status (Annex I).

A critical habitat map for elephants in the AoI was compiled primarily based on data collected from four elephants fitted with GPS collars in December 2017 (Ihwagi *et al.,* 2018). Maps showing the movements of those elephants between Nasolot and South Turkana were digitised and used as a basis to define the critical habitat map within the area (Figure 7.7-5). Elephant critical habitat is situated mostly in the south of the Project AoI but extends northwards along the Malmalte and Turkwel Rivers (Figure 7.7-5).

Due to the relative lack of proximity for known elephant movements near the Project infrastructure ; the impacts significance of the Project on elephants is **Negligible** and therefore scoped out from further consideration in this ESIA. Nevertheless, the Operator, as part of a wider commitment to coordinate with KWS, will offer SoCC monitoring support to KWS (i.e., sharing of *ad hoc* observations and data captured by Biodiversity Supervisor during construction). The results of this monitoring work will be formally shared with KWS to promote conservation knowledge and provide evidence of habitat net gain should it be required.

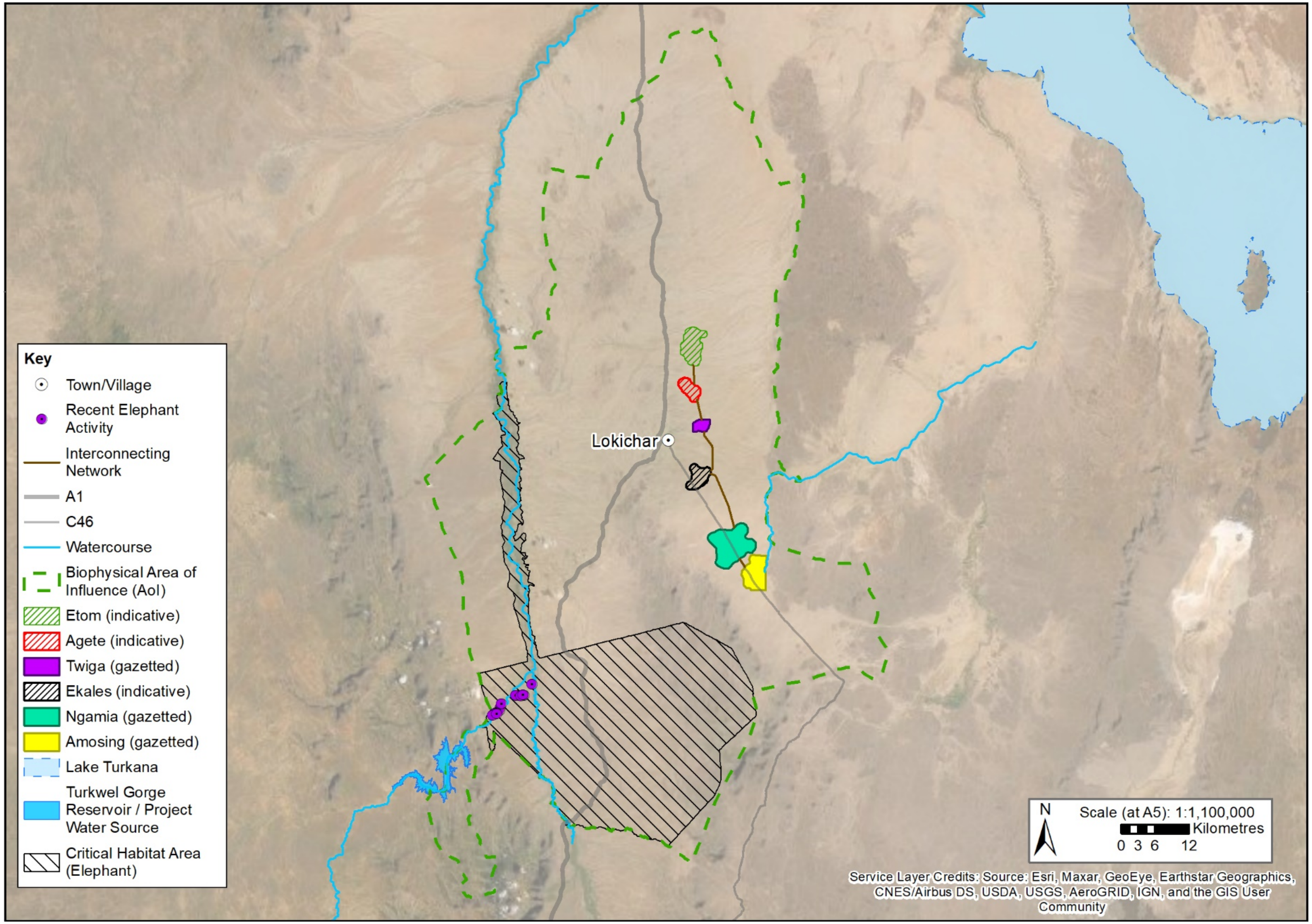

Figure 7.7-5: Map Showing Elephant Critical Habitat Within the Project AoI

7.7.9.1.2.3 Leopards and striped hyaena

Leopard and striped hyaena were both confirmed as present in the AoI during the biodiversity baseline (See Chapter 6.0). Both species are nationally listed as EN (KWCMA, 2013) and based on the critical habitat assessment conducted in consultation with B. Agwanda of NMK were deemed to meet the threshold for critical habitat status based on Criterion 1 (Annex I). It is expected that both species will experience a high level of persecution by nomadic pastoralists and that although they may occasionally move through the Project footprint under cover of darkness, they are unlikely to remain in these adjoining Critical Habitat Areas for extended periods of time. Instead, they are expected to reside in core Critical Habitat Areas such as the rocky ridges interspersed and adjoining the AoI as well as the less densely inhabited and densely vegetated habitats along the Malmalte and Turkwel Rivers. A map showing critical habitat for these two species is provided in Figure 7.7-6.

Potential impacts associated with the construction phase include:

- Direct mortality due to increased vehicle traffic, especially at night;
- Sensory disturbance due to noise and lights; and
- Increased Human-Wildlife Conflict (HWC) due to increased human density in the AoI and improved access to critical habitat areas due to construction RoWs.

Mitigation measures will include:

The Operator Environmental Performance Plan will contain procedures to manage any encounters between the construction team and Leopard, striped Hyaena and other mammal SoCC, including:

- **Repeated Mitigation - Biodiversity 01 - Transport Management System**;
- **Repeated Mitigation - Biodiversity 03 - Population Influx (Construction)**;
- **Repeated Mitigation - Biodiversity 05 - Sensory disturbance**; and
- **Repeated Mitigation - Biodiversity 06 - measures relating to critical habitat triggering species (Construction)**
    - The EPC contractor will engage with the relevant authority (likely NEMA/KWS and/or NGOs) (with support from the Operator) to identify any seasonal or temporal constraints in environmentally significant areas which will require demarcation as *No-Go* areas.
    - Procedures for demarcation of the species-specific critical habitat on construction plans. In the unlikely event that *Neuracanthus kenyensis* and *Xerophyta schnizleinia* (restricted range plants) are identified during pre-construction surveys these species will be avoided via micro-placement of Project footprint;
    - The EPC contractor will provide procedures for contractor and staff environmental inductions on wildlife protection and biodiversity, and protocols for incident management and SoCC species identification;
    - Provide detailed Wildlife rescue procedures, including, as a minimum, protocols for safe extraction of wildlife trapped in excavations, protocol for hazardous and non- hazardous spill in line with the Operator's Environmental Incident Reporting Procedure;
    - The Operator will offer SoCC monitoring support to KWS.

Implementation of mitigation measures reduced the significance of the impacts to **Moderate** (Table 7.7-4)**.**

7.7.9.1.2.4 Mammal Species of Conservation Concern

Other mammal SoCC that have been confirmed as present in the AoI include lesser kudu, Cosen's gerbil and Cape buffalo. Based on the critical habitat assessment (Annex I) these species do not meet the thresholds for critical habitat status and their importance was therefore rated as moderate. The potential impacts on these species match those listed above for leopard and striped hyaena but due to their reduced importance as receptors, the significance of the impact was rated as moderate pre mitigation and minor post mitigation (Table 7.7-4).

Mitigation measures mirror those defined for leopards and striped hyaenas. The *No-Go* areas for mammal SoCC mirror those for leopard and striped hyaenas (Figure 7.7-6).

7.7.9.1.2.5 Vultures

Three vulture species (white-backed, Rüppell's and lappet-faced) were recorded in the AoI during the biodiversity baseline and based on the critical habitat assessment (Annex I) all three qualify as Criterion 1 critical habitat triggers. Populations of all three species are known to be decreasing (IUCN, 2021) and therefore they were assigned a very high receptor importance. Although these species are expected to traverse the entire Project AoI, critical habitat was restricted to those areas where vultures are likely to encounter carrion, preferred flights paths and areas where they are likely to find large trees for nesting and roosting. These areas would include:

- Nasolot and South Turkana NRs;
- Malmalte, Turkwel and Kalabata Rivers; and
- Along rocky ridges.

A map of critical habitat for vultures is provided in Figure 7.7-6. The vulture critical habitat is situated beyond the direct Project footprint. Potential impacts to these vultures include:

- Direct mortality due to collisions and/or electrocution with the proposed infield and associated development OHTLs;
- Vulture behaviour being altered by the presence of waste produced during construction;
- Loss of critical habitat due to the potential dieback of suitable nesting and roosting trees associated with the dewatering of the Kalabata River
- [29]; and
- Sensory disturbance due to construction noise.

Power lines are a major cause of non-natural mortality for various species of birds across the globe (Birdlife International Data Zone, 2019). Collisions with wires affects large-bodied and migratory species characterised by low flight manoeuvrability (e.g., cranes, swans and bustards), whilst electrocutions on pylons may have a significant effect on large raptors (Birdlife International Data Zone, 2019).

In South Africa, mortality from power lines is widely considered to be an important contributory factor in the decline in range and numbers of the CR African White backed vulture (Birdlife International Data Zone, 2019). Vultures routinely perch and roost on power line structures (Birdlife International Data Zone, 2019). Due to their large wingspan, they can easily span the distance between energised and ground components of power lines

[29] Vultures typically nest in large acacia trees such as those along the Kalabata. Until impacts of groundwater abstraction (discussed further in relation to the Turkana toad and undescribed beetle) are fully understood this remains a potential impact.

(Lehman *et al.* 2007). Research globally has shown that bird interactions with overhead lines are almost all negative (Scottish Natural Heritage, 2016). Furthermore, mitigation measures such as marking of lines to increase visibility only reduce bird impacts by around 50% (Bernardino *et al*., 2018).

The significance of potential impacts on vultures was rated as **Major** pre-mitigation (Table 7.7-4).

Mitigation measures will include the following:

- The Operator Environmental Performance Plan will contain procedures to manage any encounters between the construction team and vultures and Bird SoCCs including:
- **Repeated Mitigation – Biodiversity 01 - Transport Management System**; and
- **Repeated Mitigation – Biodiversity 06 – measures relating to critical habitat triggering species**.
- The EPC appointed Biodiversity Supervisor will undertake and manage the delivery of bi-annual (wet and dry season) bird surveys in order to monitor SoCC bird species against baseline conditions. This will include the monitoring of flight diverters and review of other electrocution protection measures pertaining to bird safety (refer further below).
- Population increases or decreases would trigger management actions as required. The results of the bird monitoring will be formally shared with KWS.

In addition:

- The Operator will install bird flight diverters on top lines of the infield OHTL in areas where low-level migratory bird movements are considered likely (Amosing Wellpad). For the purposes of this mitigation, this will be considered to comprise locations within or adjacent (i.e., within 1 km) of protected areas and identified critical habitat; and
- The Operator will ensure that the design of conductors, poles, jump wires and dead ends include appropriate insulation to minimise the risk of electrocution to perching birds in all areas of the infield OHTL.

Implementation of the mitigation measures reduced the significance of this impact to **Moderate** (Table 7.7-4).

7.7.9.1.2.6 Bird Species of Conservation Concern

Although bird SoCC confirmed in the AoI (Steppe eagle, Bateleur and Martial eagle) do not meet the numerical thresholds for IFC critical habitat status (Appendix A); their importance as a receptor remains high. These species face the same threats as vultures and the significance of potential impacts was rated as **Moderate** pre-mitigation (Table 7.7-4).

Mitigation measures for bird SoCC mirror those listed for vultures (Figure 7.7-6). Implementation of the recommended mitigation measures reduced the significance of impacts on these species to a **Minor** level.

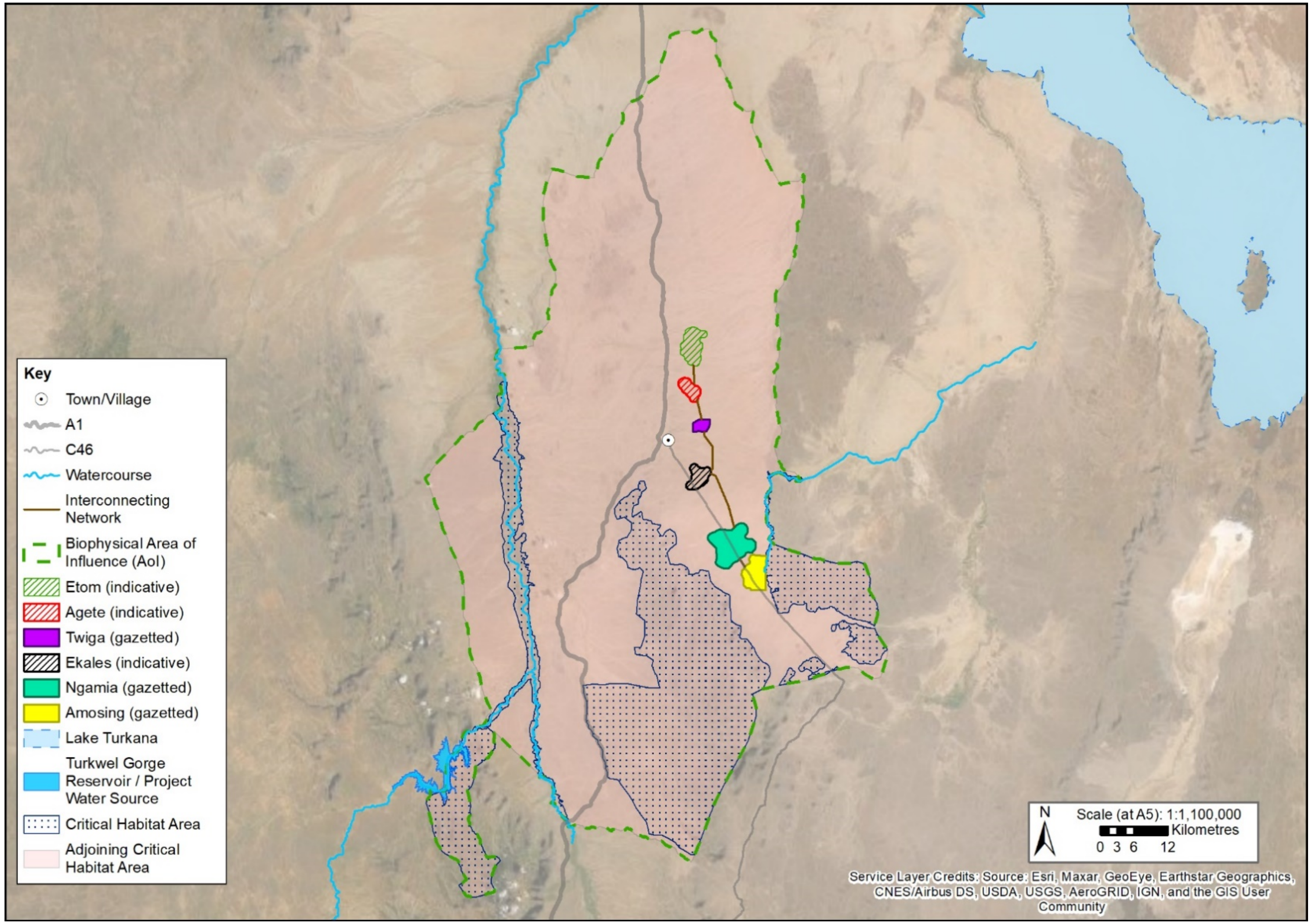

Figure 7.7-6: Critical Habitats for Leopard, Striped Hyaenas and Vultures Within the Project AoI[30]

[30] Adjoining Critical Habitat Area is the area adjacent to the critical habitat which will be used by vultures, leopards and striped hyaenas but which doesn't provide core habitat

7.7.9.1.2.7 *Turkana Toad*

The Turkana toad is a range restricted amphibian species that qualifies for critical habitat status based on IFC PS6 Criterion 2 (Annex I). Within the AoI this species has only been recorded in the vicinity of the Kalabata River and its critical habitat was mapped based on a combination of the biodiversity baseline records and historical records (Figure 7.7-7). Potential threats to this species during the construction phase include:

- Direct mortality due to increased vehicle traffic on roads and entrapment in open trenches;
- Loss of critical habitat along the Kalabata River associated with groundwater abstraction; and
- Attraction to accumulations of insects at lights during the night exposing the toad to increased predation.

The significance of potential impacts on the Turkana toad was rated as **Major** pre-mitigation. This is attributed to the very high level of receptor importance, limited knowledge on the distributional range and uncertainty regarding the impacts of groundwater abstraction on the ecology of the Kalabata River.

An additional Turkana toad survey was conducted in December 2019, but none were collected, despite comprehensive survey coverage along the Kalabata. It was concluded that the presence of the toad is likely to be seasonal in this area.

Baseline survey results indicate that the riparian vegetation along the Kalabata River represents critical habitat for the Turkana toad. Mitigation measures that will reduce the significance of impacts on the potential toad habitat on the Kalabata include the following:

The Operator Environmental Performance Plan will contain procedures to manage any encounters between the construction team and critical habitat triggering herpetofauna including:

- **Repeated Mitigation - Biodiversity 01 - Transport Management System**;
- **Repeated Mitigation - Biodiversity 03 - Population Influx (Construction)**;
- **Repeated Mitigation - Biodiversity 05 - Sensory disturbance**; and
- **Repeated Mitigation - Biodiversity 06 - measures relating to critical habitat triggering species**.
- In parallel with groundwater monitoring and mitigation (described in the water quantity chapter (Section 7.3), a herpetofauna survey (pitfall trapping and drift fence trapping), within the potentially affected area of the Kalabata catchment, will be undertaken (at least one wet season (May/June) survey before construction) to identify the presence (or otherwise) of the Turkana toad;
- Based on that data, critical habitat mapping will be revised, future biological monitoring will be evaluated, and sensitivities related to groundwater levels will be evaluated and included in consideration of action levels and associated water supply mitigations including the provision of bowser water from the Turkwel Gorge Reservoir;
- The EPC Biodiversity Supervisor will record notable wildlife sightings and also communicate security issues such as persecution of SoCC. The Biodiversity Supervisor will share records of SoCC sightings on a monthly basis with KWS;
- Water storage facilities used by the project will be designed to reduce ingress of amphibians;
- Should evidence of the Toad be collected during the aforementioned survey, the Operator Environmental Performance Plan will include procedures for Turkana toad surveys, which will entail a twice-yearly focussed survey throughout construction (pitfall trapping and drift fence trapping), including a wet season (May / June survey) at all wellpads and along the Kalabata riparian habitats within the area of influence of abstraction

wells used for construction water. This work will indicate whether no net loss or net gain outcomes for this species are being realised;

- If required, translocation procedures will be developed by the EPC Biodiversity Supervisor; and
- Reporting of population increases or decreases to KWS, and the associated management actions agreed with KWS as required.

Assuming trigger and control levels for mitigation can be established and monitoring plans as described above are maintained throughout the period of potential impact on the Turkana toad habitat from groundwater abstraction and until groundwater levels have recharged, the significance of the impact reduces to **Moderate.**

7.7.9.1.2.8 Herpetofaunal Species of Conservation Concern

The Kenyan sand boa, puff adder and rock monitor are SoCC that do not meet the IFC PS6 thresholds for critical habitat (Appendix A). Threats to these species are similar to those faced by the Turkana toad, with the addition of direct persecution of snakes. Mitigations committed for Turkana toad above are considered applicable to this group.

The significance of construction impacts on herpetofauna SoCC was rated as **Moderate** pre-mitigation and decreased to **Minor** post-mitigation.

7.7.9.1.2.9 Undescribed Beetle Species (Omophron sp)

During the biodiversity baseline a previously undescribed beetle species (*Omophron sp.*) was recorded in the Kalabata River. The specimen was deposited in the National Museum of Kenya in Nairobi and photographs of it were sent to taxonomic experts who confirmed the field identification. Based on the precautionary principle this species was assigned critical habitat status based on IFC PS6 Criterion 2 with the Kalabata River representing the only known distribution of this species (Figure 7.7-8). Threats to this species include loss of critical habitat due to abstraction of groundwater from the Kalabata and the resultant impacts on the vegetation communities. The significance of potential impacts on this species was rated as **Major** pre-mitigation (Table 7.7-4).

No additional specimens of the *Omophron* beetle were recorded in the Kalabata River during the December 2019 survey, despite comprehensive survey coverage of the habitat. It was concluded that the presence of the beetle (as with the Turkana toad) is seasonal.

Based on the baseline data, the vegetation community along the Kalabata River forms critical habitat for the *Omophron* beetle. Mitigation measures that will reduce the significance of impacts on the potential beetle's habitat along the Kalabata River include the following:

The Operator Environmental Performance Plan will contain procedures to manage any encounters between the construction team and critical habitat triggering Ground beetle including:

- **Repeated Mitigation - Biodiversity 04 - Re-vegetation and remediation**;
- **Repeated Mitigation - Biodiversity 05 - Sensory disturbance**; and
- **Repeated Mitigation - Biodiversity 06 - measures relating to critical habitat triggering species**.
- In parallel with groundwater monitoring and mitigation (described in the water quantity chapter (Section 7.3), a beetle survey within the potentially affected riparian area of the Kalabata catchment, will be undertaken (at least one wet season May/June survey before construction) to identify the presence (or otherwise) of the *Omophron* beetle. Additional taxonomic analysis will also be undertaken to confirm beetle conservation status. Based on that data, critical habitat mapping will be revised, future biological monitoring will be evaluated, and sensitivities related to groundwater levels will be evaluated and included

in consideration of action levels and associated water supply mitigations including the provision of bowser water from the Turkwel Gorge Reservoir;

- The EPC Biodiversity Supervisor will record notable wildlife sightings and also communicate security issues such as persecution of SoCC. The Biodiversity Supervisor will share records of SoCC sightings on a monthly basis with KWS;
- Should evidence of the *Omophron* beetle be collected during the aforementioned survey, the Operator Environmental Performance Plan will describe procedures for:
  - Continued monitoring of changes in humidity levels within the Kalabata riparian zone to establish baseline prior to commencement of construction;
  - Beetle survey at all wellpads and along the Kalabata riparian habitats within the area of influence of abstraction wells used for construction water will be repeated on a yearly basis in May/June throughout the period of groundwater abstraction during the construction phase; and
  - Reporting of population increases or decreases to KWS, and the associated management actions agreed KWS as required.

Assuming trigger and control levels for mitigation can be established and monitoring plans as described above are maintained throughout the period of potential impact on the *Omophron* beetle habitat from groundwater abstraction and until groundwater levels have recharged, the significance of the impact reduces to **Moderate.**

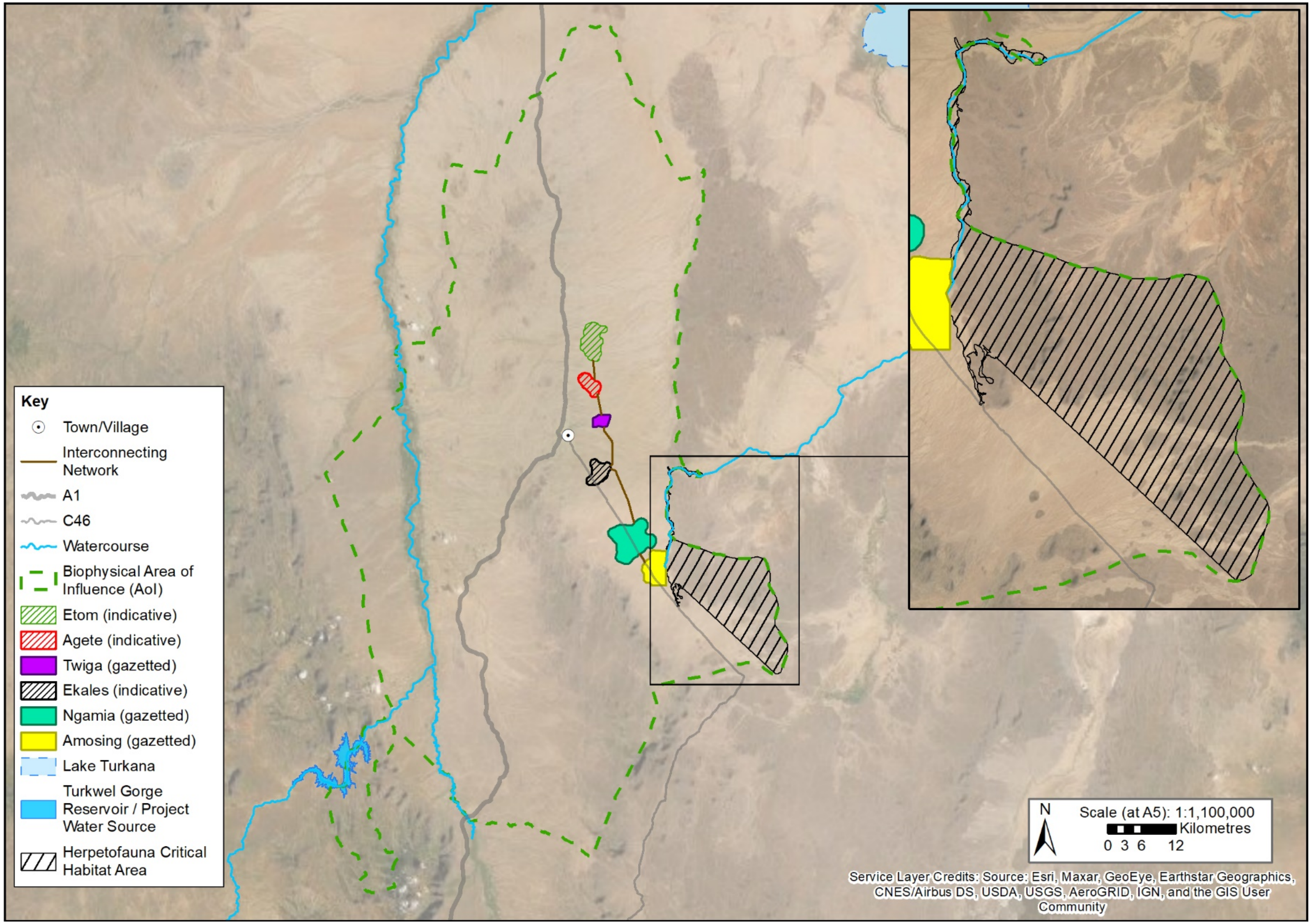

Figure 7.7-7: Map Showing Critical Habitat for the Turkana Toad Based on Records Collected During the Biodiversity Baseline as well as Historical Records

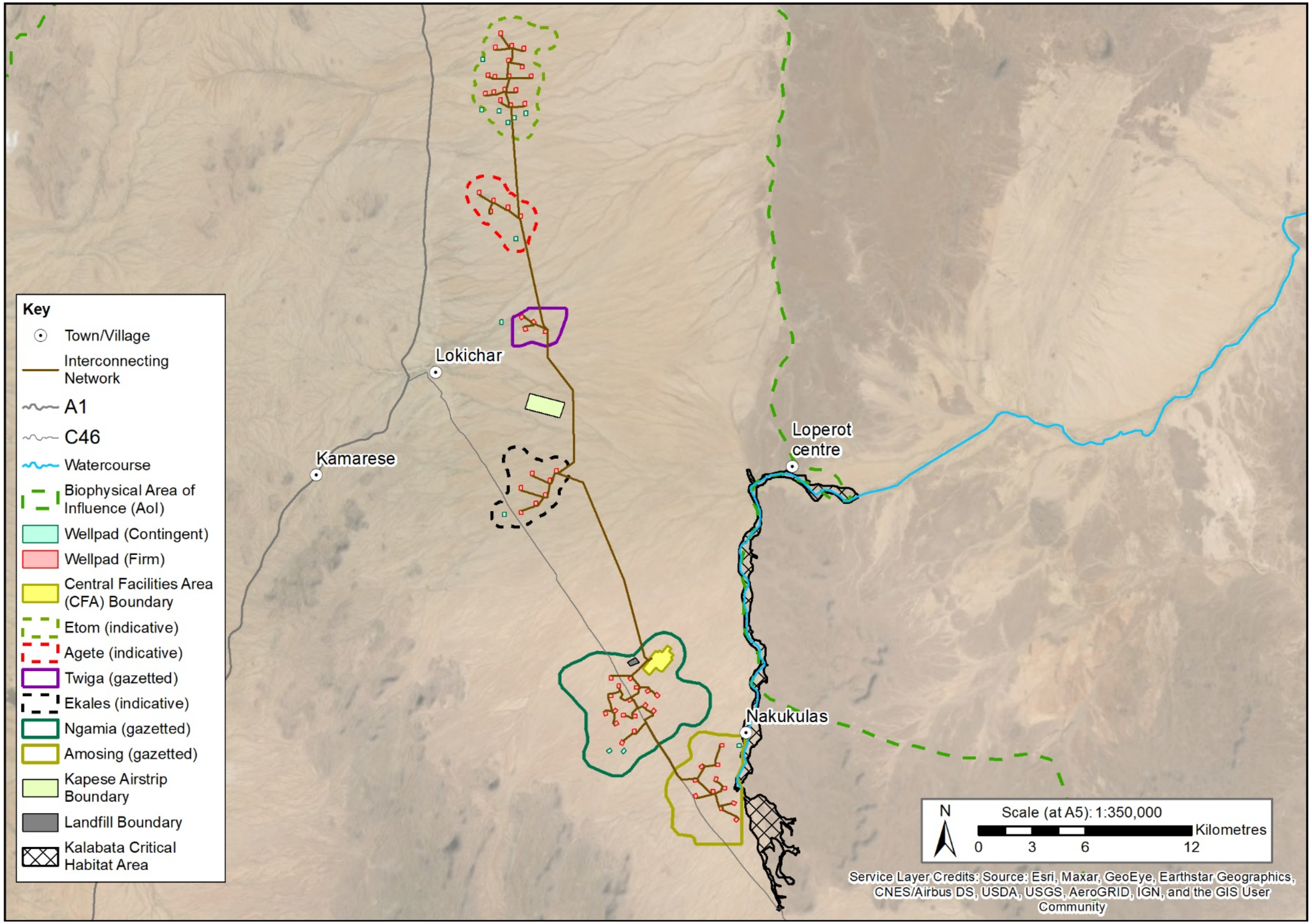

Figure 7.7-8: Critical Habitat of the Undescribed Beetle Species Recorded in the Kalabata River During the Biodiversity Baseline. The Critical Habitat Corresponds to the Riparian Vegetation Along the Kalabata River.

Table 7.7-4: Construction Phase Impact Assessment

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Rocky ridges habitats and associated species (Very High) - Rocky ridges between the upstream project area and the A1 road.	Project infrastructure is outside of the footprint of these habitats but, there is the potential for impacts due to the proximity of construction activities, including: ■ Sensory disturbance of fauna due to light and noise in the vicinity of the construction activities relating to the project.	Indirect – short term - low	Moderate	The Operator Environmental Performance Plan will include procedures to manage potential impacts on the rocky ridge habitats and associated species including: ■ **Repeated Mitigation - Biodiversity 01 - Transport Management System**. ■ **Repeated Mitigation - Biodiversity 05 - Sensory disturbance**.	Indirect - short term - low	Minor
Northern *Acacia-Commiphora* bushlands and thickets (High) - Northern *Acacia-Commiphora* bushlands and thickets associated	■ Land-take required for Project infrastructure; ■ Clearing of vegetation during construction;	Direct – long term - medium	Moderate	The Operator Environmental Performance Plan will include procedures to manage potential impacts on the Northern *Acacia-Commiphora* bushlands and thickets including:	Direct - long term - low	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
with the WWF Ecoregion (Drawing 6.9-3)	Increased human density in the vicinity of the Project area contributing to increased resource abstraction (e.g., charcoal production); and ▪ Introduction of alien invasive plant species.			▪ the appointment of the EPC Biodiversity Supervisor; and ▪ Procedures for contractor and staff environmental inductions on wildlife protection and biodiversity, and protocols for incident management. ▪ The Operator Environmental Performance Plan will include procedures to define the requirements for minimising land take and vegetation rehabilitation post construction; and ▪ Cordon off infrastructure areas during construction to keep livestock, wildlife and people out. ▪ **Repeated Mitigation - Biodiversity 01 - Transport Management System**. ▪ **Repeated Mitigation - Biodiversity 03 - Population Influx (Construction)**. ▪ **Repeated Mitigation - Biodiversity 02 - Invasive Species**.		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				■ **Repeated Mitigation - Biodiversity 04 - Re-vegetation and remediation**. Specifically, for borrow pits, for which locations are not yet fixed: ■ The Operator will obtain NEMA approval prior to commencing onsite activities. Borrow pits and quarries to be located more than 100 metres from watercourses to minimise storm water runoff into watercourse and mitigate potential conflicts; ■ Borrow Pit locations will have minimum negative impacts on access to water points, breeding, feeding and wild animals' paths; and ■ Prior to pit development, prepare a rehabilitation plan with details of final shape, method of achieving it, drainage, sediment control, soil reinstatement and revegetation measures.		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Leopard and striped hyaena (Very High) Rocky ridges to west, and east of Amosing.	■ Increased persecution; ■ HWC; and ■ Direct mortality due to increased vehicle traffic on roads (especially at night).	Direct – medium term - medium	Moderate	The Operator Environmental Performance Plan will contain procedures to manage any encounters between the construction team and Leopard, striped Hyaena and other mammal SoCC, including: ■ **Repeated Mitigation - Biodiversity 01 - Transport Management System**. ■ **Repeated Mitigation - Biodiversity 03 - Population Influx (Construction)**. ■ **Repeated Mitigation - Biodiversity 05 - Sensory disturbance**. ■ **Repeated Mitigation – Biodiversity 06 – Measures Relating to Critical Habitat Triggering Species (Construction)**	Direct - medium term - low	Minor
Mammal SoCC (Moderate) Rocky ridges to west, and east of Amosing and dispersed throughout the AoI.		Direct - medium term - medium	Moderate		Direct - medium term - low	Minor
Vultures (Very High) Distribution associated with: ■ Along rocky ridges – Figure 7.7-5.	■ Direct mortality due to infield OHTL construction;	Direct – short term – high	Major	■ The Operator Environmental Performance Plan will contain procedures to manage any encounters between the construction team and vultures and Bird SoCCs including:	Direct - short term - high	Moderate and Minor for Infield OHTL construction only as this mitigation

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
	■ Direct mortality due to OHTL construction; ■ Loss of critical habitat for vultures due to dewatering of Kalabata resulting in changes in vegetation and in particular the dieback of large roosting and nesting trees; ■ Sensory disturbance during construction; and ■ Increased persecution.			■ **Repeated Mitigation - Biodiversity 01 - Transport Management System**. ■ **Repeated Mitigation – Biodiversity 06 – Measures Relating to Critical Habitat Triggering Species (Construction)** ■ The EPC appointed Biodiversity Supervisor will undertake and manage the delivery of Bi-annual (wet and dry season) bird surveys in order to monitor SoCC bird species against baseline conditions. This will include the monitoring of flight diverters and review of other electrocution protection measures pertaining to bird safety (refer further below). Population increases or decreases would trigger management actions as required. The results of the bird monitoring will be formally shared with KWS. ■ The Operator will install bird flight diverters on top lines of the infield OHTL in areas where low-level migratory bird movements are considered likely, and in		delivery will be defined and delivered in accordance with the Operator Environmental Performance Plan.
Bird SoCC (High) (non-critical habitat trigger species).		Direct – long term - medium	Moderate		Direct - short term - low	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				other sensitive areas. For the purposes of this mitigation, this will be considered to comprise locations within or adjacent (i.e., within 1 km) of protected areas and identified critical habitat e.g., Amosing Wellpad. ■ The Operator will install protection on conductors, poles, jump wires and dead ends to minimise the risk of electrocution to roosting birds in all areas of the infield OHTL. ■ The Biodiversity Supervisor will liaise with an ornithologist experienced in powerline mitigation who will survey the proposed infield powerline route prior to operation of the powerlines, in order to give input to the placement and location of bird deterrent devices, appropriate spacing distances on poles and between wires, and provision of artificial safe perching sites, as necessary. ■ The installation of reflective bird diverters, such as reflective stainless-steel spheres of 70 mm diameter (e.g.,		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				Inotec NFD88) is recommended to increase visibility, particularly at dusk within the Amosing wellpad OHTL; ■ The spacing interval of bird deterrent devices, and location for installation, should be determined in consultation with the ornithologist; ■ Preferred perching space for birds on pole tops should be well clear of dangerous components; dangerous components should be sufficiently separated by space to ensure that the bird cannot touch them. This distance is recommended to be a minimum of 1.4 m for large raptors and cranes/storks, and 1.8 m for vultures. ■ Insulating coverings will be provisioned over energised parts and/or covering grounded parts with materials appropriate for providing incidental contact protection to birds. If upright insulators or horizontal disconnectors are present, these should be covered safely; and		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				■ Artificial bird 'safe perches' on poles will be provisioned to be positioned in consultation with the ornithologist.		
Turkana toad (Very High) Kalabata River – Figure 7.7-6	■ Direct mortality due to increased vehicle traffic on roads and entrapment in open trenches; ■ Attraction to accumulation of insects at lights exposing them to increased predation; ■ Loss of critical habitat due to dewatering of Kalabata resulting in changes in vegetation composition;	Direct – medium term - high	Major	The Operator Environmental Performance Plan will contain procedures to manage any encounters between the construction team and critical habitat triggering Herpetofauna including: ■ **Repeated Mitigation - Biodiversity 01 - Transport Management System**. ■ **Repeated Mitigation - Biodiversity 03 - Population Influx (Construction)**. ■ **Repeated Mitigation - Biodiversity 05 - Sensory disturbance**. ■ **Repeated Mitigation - Biodiversity 06 - measures relating to critical habitat triggering species**. ■ In parallel with groundwater monitoring and mitigation (described in the water quantity chapter (Section 7.3), A herpetofauna survey (pitfall trapping and drift fence trapping), within the	Direct - medium term - low	Moderate
Herpetofauna SoCC (non-critical habitat trigger species) (Medium)		Direct – short - low	Minor		Direct - short term - negligible	Negligible

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
	- Attraction to water storage facilities on wellpads (particularly relevant for Turkana toad); and - Direct mortality due to persecution (particularly relevant to snakes).			potentially affected area of the Kalabata catchment, will be undertaken (at least one June survey before construction) to identify the presence (or otherwise) of the Turkana toad. - Based on that data, critical habitat mapping will be revised, future biological monitoring will be evaluated, and sensitivities related to groundwater levels will be evaluated and included in consideration of action levels and associated water supply mitigations e.g., provision of bowser water. - The EPC Biodiversity Supervisor will record notable wildlife sightings and also communicate security issues such as persecution of SoCC. The Biodiversity Supervisor will share records of SoCC sightings on a monthly basis with KWS; - Water storage facilities used by the project will be designed to reduce ingress of amphibians;		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				Should evidence of the Toad be collected during the aforementioned survey, the Operator Environmental Performance Plan will describe procedures for: ■ Turkana toad surveys will include a twice-yearly focussed survey throughout construction (pitfall trapping and drift fence trapping), including a wet season (May / June survey) at all wellpads and along the Kalabata riparian habitats within the area of influence of abstraction wells used for construction water. This work will indicate whether no net loss or net gain outcomes for this species are being realised; ■ If required, translocation procedures will be developed by the EPC Biodiversity Supervisor; and ■ Reporting of population increases or decreases to KWS, and the associated management actions agreed KWS as required.		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Ground beetle (*Omophron* sp) (Very High) Kalabata River	Direct mortality due to: ▪ Loss or modification of habitats, ▪ Attraction to lights; and ▪ Entrapment in trenches. Loss of critical habitat due to dewatering of Kalabata resulting in changes in vegetation composition.	Direct – medium term - high	Major	The Operator Environmental Performance Plan will contain procedures to manage any encounters between the construction team and critical habitat triggering ground beetle including: ▪ **Repeated Mitigation - Biodiversity 04 - Re-vegetation and remediation**. ▪ **Repeated Mitigation - Biodiversity 05 - Sensory disturbance**. ▪ **Repeated Mitigation – Biodiversity 06 - measures relating to critical habitat triggering species**. ▪ In parallel with groundwater monitoring and mitigation (described in the water quantity chapter (Section 7.3), a beetle survey within the potentially affected riparian area of the Kalabata catchment, will be undertaken (at least one June survey before construction) to identify the presence (or otherwise) of the *Omophron* beetle. Based on that data, critical habitat mapping will be revised, future biological monitoring will be evaluated, and sensitivities related to	Direct - medium term - low	Moderate

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				groundwater levels will be evaluated and included in consideration of action levels and associated water supply mitigation e.g., provision of bowser water. ■ The EPC Biodiversity Supervisor will record notable wildlife sightings and also communicate security issues such as persecution of SoCC. The Biodiversity Supervisor will share records of SoCC sightings on a monthly basis with KWS. Should evidence of the *Omophron* beetle be collected during the aforementioned survey, the Operator Environmental Performance Plan will describe procedures for: ■ Continued monitoring of changes in humidity levels within the Kalabata riparian zone to establish baseline prior to commencement of construction ■ Beetle survey at all wellpads and along the Kalabata riparian habitats within the area of influence of abstraction wells used for construction water will be		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				repeated on a yearly basis in May/June throughout the period of groundwater abstraction during the construction phase. ■ Reporting of population increases or decreases to KWS, and the associated management actions agreed KWS as required.		

7.7.9.2 Operational Phase

The operational phase impact assessment with respect to biodiversity is presented in Table 7.7-5. As described in Section 7.2 (Air Quality) the impact magnitude for NO_x, NO_2 and SO_2 is low (with a resulting minor significance) the impact magnitude of eutrophication and nitrogen and acid deposition on plant species in the vicinity of the Project is also predicted to be low with a resulting minor significance. The distance between the Project footprint and sensitive habitats e.g., Rocky ridges indicates that operational air quality impacts can be scoped out of the biodiversity assessment.

7.7.9.2.1.1 Rocky Ridges

As the rocky ridge habitats are largely situated beyond the Project footprint, operational phase impacts are primarily indirect in nature and include:

- Operational transport noise; and
- Sensory disturbance (noise).

The significance of these impacts was rated as **Moderate** in the absence of mitigation (Table 7.7-5).

Mitigation measures will include:

- **Repeated Mitigation - Biodiversity 01 - Transport Management System**; and
- **Repeated Mitigation - Biodiversity 05 - Sensory disturbance**.

Implementation of the mitigation measures reduced the significance of these residual impacts to **Minor** (Table 7.7-5).

7.7.9.2.2 Species Receptors

7.7.9.2.2.1 Leopards and Striped Hyaena

Operational phase impacts on these species are largely indirect and associated with the expected influx of people into the AoI potentially resulting in direct mortality on roads and increased persecution by nomadic pastoralists. The significance of this impact was rated as **Moderate** pre-mitigation and **Minor** post mitigation (Table 7.7-5).

Mitigation measures will include:

- **Repeated Mitigation - Biodiversity 01 - Transport Management System**;
- **Repeated Mitigation - Biodiversity 03 - Population Influx (operation)**; and
- **Repeated Mitigation - Biodiversity 08 - measures relating to critical habitat triggering species (operations)**:
    - The Operator will continue to engage with the relevant authority (likely NEMA/KWS and/or NGOs) and offer monitoring (i.e., sharing of *ad hoc* observations and data captured by the Operator during operations) support to KWS;
    - The Operator will provide procedures for contractor and staff environmental inductions on wildlife protection and biodiversity, and protocols for incident management and SoCC species identification;
    - The Operator will provide detailed Wildlife rescue procedures relevant to operational infrastructure, including, protocol for hazardous and non- hazardous spill in line with the Operator Environmental Incident Reporting Procedure;

- The Operator will continue to offer SoCC monitoring support to KWS; and
- The Operator will continue to report notable wildlife sightings / and any potential security issues such as persecution of protected species to KWS.

7.7.9.2.2.2 Mammal Species of Conservation Concern

Potential impacts and mitigation measures for mammal SoCC mirror those for leopards and striped hyaenas. The significance of these impacts on mammal SoCC was rated as **Minor** prior to mitigation and remained **Minor** after mitigation (Table 7.7-5).

7.7.9.2.2.3 Vultures

Potential operational phase impacts on vultures include direct mortality associated with the:

- Infield and associated facility OHTL network which is situated in close proximity to the Kalabata critical habitat; and
- An emergency enclosed ground flare situated in the CPF.

The significance of operational phase impacts on vultures was rated as **Major** prior to mitigation (Table 7.7-5).

Mitigation measures will include:

- The Operator will maintain bird flight diverters throughout operations on top lines of the infield OHTL in areas where low-level migratory bird movements are considered likely, and in other sensitive areas. For the purposes of this mitigation, this will be considered to comprise locations within or adjacent (i.e., within 1 km) of protected areas and identified critical habitat. The Operator will maintain protection on conductors, poles, jump wires and dead ends, throughout operations, to minimise the risk of electrocution to roosting birds in all areas of the infield OHTL;
- The Biodiversity Supervisor will liaise with an ornithologist experienced in powerline mitigation who will survey the proposed infield powerline route prior to operation of the powerlines, in order to give input to the 'designing out' of electrocution risk, placement and location of bird deterrent devices, appropriate spacing distances on poles and between wires, and provision of artificial safe perching sites, as necessary.
- The installation of reflective bird diverters, such as reflective stainless-steel spheres of 70 mm diameter (e.g., Inotec NFD88) is recommended to increase visibility, particularly at dusk;
- The spacing interval of bird deterrent devices, and location for installation, should be determined in consultation with the ornithologist;
- Preferred perching space for birds on pole tops should be well clear of dangerous components; dangerous components should be sufficiently separated by space to ensure that the bird cannot touch them. This distance is recommended to be a minimum of 1.4 m for large raptors and cranes/storks, and 1.8 m for vultures.
- Insulating coverings will be provisioned over energised parts and/or covering grounded parts with materials appropriate for providing incidental contact protection to birds. If upright insulators or horizontal disconnectors are present, these should be covered safely;
- Adoption of appropriate waste management practice to avoid attracting vultures to waste management facilities;
- Artificial bird 'safe perches' on poles will be provisioned to be positioned in consultation with the ornithologist; and

- Implementation of a flare start-up routine that includes checking for the proximity of birds before emergency use, as long as this does not impede the emergency flaring requirement.

In addition, the following standard mitigations are applicable.

- **Repeated Mitigation - Biodiversity 01 - Transport Management System**; and
- **Repeated Mitigation - Biodiversity 08 - measures relating to critical habitat triggering species (operations)**.

Implementation of mitigation reduced the significance of this impact to a **Moderate** level (Table 7.7-5).

7.7.9.2.2.4 Bird Species of Conservation Concern

Impacts on bird SoCC mirror that of vultures. Mitigation measures committed to above are applicable.

Implementation of mitigation measures reduced the significance of impacts on these species from **Moderate** to **Minor** (Table 7.7-5).

7.7.9.2.2.5 Turkana Toad

Operational phase impacts on the Turkana toad include direct mortality due to increased vehicle traffic on roads and attraction to and entrapment in water storage facilities on well-pads. The significance of these impacts was rated as **Moderate** prior to mitigation and **Minor** after mitigation (Table 7.7-5).

Should evidence of SoCC be collected during the construction period, the Operator Environmental Performance Plan will include the following detail and provisions for mitigation:

- A Turkana toad operational monitoring programme to include a twice-yearly focussed survey (pitfall trapping and drift fence trapping during short and long wet seasons) at all wellpads and the CFA including a wet season (May / June survey). This work will indicate whether no net loss or net gain outcomes for this species are being realised;
- If required, translocation procedures developed during construction will be upheld by the Operator;
- Design of water storage facilities that prevent amphibian ingress; and
- Reporting of population increases or decreases to KWS, and the associated management actions agreed KWS as required. In addition, the following standard mitigations are applicable.
- **Repeated Mitigation - Biodiversity 01 - Transport Management System;** and
- **Repeated Mitigation - Biodiversity 08 - measures relating to critical habitat triggering species (operations)**

7.7.9.2.2.6 Herpetofauna Species of Conservation Concern

Operational phase impacts on herpetofauna SoCC mirror those on the Turkana toad with the addition of direct persecution of snakes by people. Mitigation measures detailed above are applicable the Operator Environmental Performance Plan will also define how snakes can be safely removed from Project related facilities.

7.7.9.2.2.7 Undescribed Beetle Species (Omophron sp)

Potential impacts on the undescribed beetle species include direct mortality due to:

- Loss and modification of habitats including the introduction of invasive species; and
- Attraction to lights.

Should evidence of the *Omophron* beetle be collected during the construction period, the Operator Environmental Performance Plan will include the following provisions:

- A Ground beetle monitoring programme at all wellpads and the CFA used for construction water will be repeated twice yearly focussed survey, including a wet season (May / June survey). This work will indicate whether no net loss or net gain outcomes for this species are being realised;
- Reporting of population increases or decreases to KWS, and the associated management actions agreed KWS as required. In addition, the following standard mitigations are applicable.
- **Repeated Mitigation - Biodiversity 02 - Invasive Species**;
- **Repeated Mitigation - Biodiversity 07 - Population Influx (Operations)**:
    - The Operator will maintain influx management procedures established during construction, which are presented in the Operator's Social Performance Plan and were agreed in coordination with Turkana and West Pokot Governments and the respective County Commissioners.
    - The Operator will work with National Government, County Government, the County Commissioner and key stakeholders to support the monitoring of population changes in key settlements (Lokichar, Nakukulas, Lokori). The Operator will work with the relevant county and national administrations to monitor growth and location of homesteads in the immediate areas surrounding Project facilities and enact actions to manage influx
    - The Operator will attend the Influx working group.
    - The Operator will implement the Local Content Development Plan and Workforce Training Strategy to reduce incentives for in-migration.

The Operator will train all employees and contractor workers in the Operator Code of Conduct, including worker rights and human rights, in line with the Operator's commitment to implement the UN Guiding Principles on Business and Human Rights and the Voluntary Principles on Security and Human Rights (Voluntary Principles).

- **Repeated Mitigation - Biodiversity 08 - measures relating to critical habitat triggering species (operations)**.

The significance of this impact was rated as **Moderate** prior to mitigation and **Minor** after mitigation (Table 7.7-5).

Table 7.7-5: Operational Phase Impact Assessment

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Rocky ridges habitats and associated species (Very High) - Rocky ridges between the upstream project area and the A1 road.	Project infrastructure is outside of the footprint of these habitats but, there is the potential for impacts due to the proximity of operations, including: ▪ Sensory disturbance of fauna due to light and noise in the vicinity of the project.	Indirect – medium term - low	Moderate	▪ **Repeated Mitigation - Biodiversity 01 - Transport Management System**; and ▪ **Repeated Mitigation - Biodiversity 05 - Sensory disturbance**.	Indirect - medium term - negligible	Minor
Leopard and striped hyaena (Very High) Rocky ridges to west, and east of Amosing.	▪ Presence of a Project RoW providing increased access resulting in increased utilisation of resources, increased human-leopard/hyaena conflict and increased poaching; and ▪ Direct mortality due to increased vehicle traffic	Indirect – medium term - low	Moderate	▪ **Repeated Mitigation - Biodiversity 01 - Transport Management System**; ▪ **Repeated Mitigation - Biodiversity 03 - Population Influx (Construction); and** ▪ **Repeated Mitigation - Biodiversity 08 - measures relating to critical habitat triggering species (operations).**	Direct - medium term - negligible	Minor
Mammal SoCC (Moderate) Rocky ridges to west, and		Indirect - medium term - low	Minor		Direct - medium term - negligible	Negligible

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
east of Amosing.	on roads (especially at night).					
Vultures (Very High) Distribution: ■ Figure 7.7-5.	■ Direct mortality due to OHTLs (including infield) and emergency flares.	Direct – long term - high	Major	■ **Repeated Mitigation - Biodiversity 01 - Transport Management System**; ■ **Repeated Mitigation - Biodiversity 08 - measures relating to critical habitat triggering species (operations)**; ■ The Operator will maintain bird flight diverters throughout operations on top lines of the infield OHTL in areas where low-level migratory bird movements are considered likely, and in other sensitive areas. For the purposes of this mitigation, this will be considered to comprise locations within or adjacent (i.e., within 1 km) of protected areas and identified critical habitat. The Operator will maintain protection on conductors, poles, jump wires and dead ends, throughout operations, to minimise the risk of electrocution of roosting birds via design in all areas of the infield OHTL; ■ The Biodiversity Supervisor will liaise with an ornithologist experienced in powerline	Direct - long term - low	Moderate
Bird SoCC (High) (non-critical habitat trigger species).		Direct – medium term - medium	Moderate		Direct - long term - low	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				mitigation who will survey the proposed infield powerline route prior to operation of the powerlines, in order to give input to the 'designing out' of electrocution risk , placement and location of bird deterrent devices, appropriate spacing distances on poles and between wires, and provision of artificial safe perching sites, as necessary. ■ The installation of reflective bird diverters, such as reflective stainless-steel spheres of 70 mm diameter (e.g., Inotec NFD88) is recommended to increase visibility, particularly at dusk; ■ The spacing interval of bird deterrent devices, and location for installation, should be determined in consultation with the ornithologist; ■ Preferred perching space for birds on pole tops should be well clear of dangerous components; dangerous components should be sufficiently separated by space to ensure that the bird cannot touch them. This distance is recommended to be a minimum of 1.4 m for large raptors and cranes/storks, and 1.8 m for vultures.		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				■ Insulating coverings will be provisioned over energised parts and/or covering grounded parts with materials appropriate for providing incidental contact protection to birds. If upright insulators or horizontal disconnectors are present, these should be covered safely; ■ Adoption of appropriate waste management practice to avoid attracting vultures to waste management facilities; ■ Artificial bird 'safe perches' on poles will be provisioned to be positioned in consultation with the ornithologist; and ■ Implementation of a flare start-up routine that includes checking for the proximity of birds before emergency use, as long as this does not impede the emergency flaring requirement.		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Turkana toad (Very High) Kalabata River – Figure 7.7-7	■ Direct mortality due to increased vehicle traffic on roads; ■ Attraction to water storage facilities on wellpads (particularly relevant for Turkana toad); and ■ Persecution (particularly relevant to snakes)	Direct – medium term - medium	Moderate	■ **Repeated Mitigation - Biodiversity 01 - Transport Management System**; ■ **Repeated Mitigation - Biodiversity 08 - measures relating to critical habitat triggering species (operations)**; ■ Should evidence of SoCC be collected during the construction period, the Operator Environmental Performance Plan will include the following detail and provisions: ■ A Turkana toad operational monitoring programme to include a twice-yearly focussed survey (pitfall trapping and drift fence trapping) at all wellpads and the CFA including a wet season (May / June survey). This work will indicate whether no net loss or net gain outcomes for this species are being realised and if alternative water supplies are required as mitigation e.g., provision of bowser water. ■ If required, translocation procedures developed during construction will be upheld by the Operator;	Direct - medium term - negligible	Minor
Herpetofauna SoCC (non-critical habitat trigger species) (Medium)		Direct – medium term - medium	Minor		Direct - medium term - negligible	Negligible

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				■ Design of water storage facilities that prevent amphibian ingress; and ■ Reporting of population increases or decreases to KWS, and the associated management actions agreed KWS as required.		
Ground beetle (Omophron sp) (Very High) Kalabata 7.7-8.	■ Direct mortality due to loss or modification of habitats including the introduction of invasive species; and ■ Habitat pressure from population influx.	Direct – medium term - medium	Moderate	■ **Repeated Mitigation - Biodiversity 02 - Invasive Species**. ■ **Repeated Mitigation - Biodiversity 07 - Population Influx (Operations)**. ■ **Repeated Mitigation - Biodiversity 08 - measures relating to critical habitat triggering species (operations)**. Should evidence of the *Omophron* beetle be collected during the construction period, the Operator Environmental Performance Plan will include the following detail and provisions: ■ A ground beetle monitoring programme at all wellpads and the CFA used for construction water will be repeated twice yearly focussed survey, including a wet season (May / June survey). This work will indicate whether no net loss or net gain	Direct - medium term - negligible	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				outcomes for this species are being realised and if alternative water supplies are required e.g., provision of bowser water; and ■ Reporting of population increases or decreases to KWS, and the associated management actions agreed KWS as required.		

7.7.9.3 Decommissioning

As the operational phase of the Project nears its end, a decommissioning plan will be developed for agreement with the appropriate authorities that will include measures to protect soil resources. The decommissioning plan will include general and specific mitigation measures for erosion and sediment control, topsoil conservation, and the preservation of soil quality.

When the Project is decommissioned, the following decommissioning philosophy will be adopted:

- All above ground infrastructure will be evaluated for dismantling, removal and rehabilitation. This will be undertaken in consultation with Affected Communities and County Government to identify any facilities than can be safely handed over for community use;
- All decommissioning waste will be handled, stored and managed through the good practice outlined in the Waste Management section of the Decommissioning Plan.

7.7.10 Summary of Mitigation

The Operator Environmental Performance Plan will set out the mitigations and management controls defined in the ESIA in a clear, implementable and auditable manner. Mitigations will cover the complete mitigation hierarchy from avoidance through minimisation through to biodiversity restoration.

The Operator Environmental Performance Plan will provide details of required actions, procedures for documentation and communication, plus a description of implementation and monitoring needs. The Operator Environmental Performance Plan will be structured to ensure adaptive management can be followed with monitoring results providing feedback to earlier stages in the Plan development process. Mitigations can be refined through adaptive management, additional consultation with stakeholders and additional input from local specialists who have already assisted with the production of the ESIA. The Operator Environmental Performance Plan will also identify additional conservation actions that can be delivered to benefit SoCC within the AoI.

7.7.10.1 Construction Phase

Construction phase mitigation measures that will be undertaken to reduce impacts, or reduce the potential for creating the impact, include the following that will be described in the Operator Environmental Performance Plan:

- Development of specific management procedures for the following:
  - Vultures;
  - Leopards and striped hyaenas;
  - Turkana toad;
  - Undescribed beetle (*Omophron* sp.);
  - Invasive plant species;
  - Wildlife rescue procedures for animals trapped in open trenches;
  - Groundwater abstraction and its impact related to trees in the Kalabata River;
  - Vegetation Rehabilitation Plan for construction footprint; and
  - Influx Management.
- Identification of the following environmentally significant areas on construction plans:
  - All critical habitats;

  - Protected areas and community conservancies.
- Environmental inductions to be updated to include reference to environmentally significant areas and SoCC;
- EPC contractor shall appoint a Biodiversity Supervisor to ensure compliance with relevant mitigation measures described in the Operator Environmental Performance Plan.

7.7.10.2 Operational Phase

Mitigation measures that will be undertaken during the operational phase in order to reduce impact magnitudes, or reduce the potential for creating the impact will be described within the Operator Environmental Performance Plan and they include the following mitigations detailed in Table 7.7-5:

- Biodiversity 01 - Transport Management System;
- Biodiversity 02 - Invasive Species;
- Biodiversity 03 - Population Influx (operation);
- Biodiversity 05 - Sensory disturbance;
- Biodiversity 07 - Population Influx (Operations); and
- Biodiversity 08 - Measures relating to critical habitat triggering species (operations).

Other species or habitat specific mitigations are defined and committed in Table 7.7-5.

7.7.11 Summary of Residual Impacts

The significance of impacts was assessed before and after implementation of mitigation measures. In most cases the significance of impacts was reduced to minor or negligible with the implementation of mitigation.

In some cases, the significance of residual impacts remains moderate. This is because even with mitigation there remains a risk that must be monitored under the Operator Environmental Performance Plan to ensure No Net Loss (NNL) of habitats that are considered to be natural. This is especially relevant for impacts associated with groundwater abstraction from the Kalabata riverbed during construction on the Turkana toad, *Omophron* beetle and vultures. In addittion, minor residual impacts are predicted for Leopard, and Striped Hyaena. As such, the application of the committed mitigation as described in Tables 7.7-4 and 7.7-5 and further defined within the Operator Environmental Performance Plan will need to be effectively delivered to assess the residual impacts of the project through an iterative process during construction and operation of the Project.

7.8 Ecosystem Services

7.8.1 Introduction

The Project aims to ensure that adverse environmental impacts on ecosystem services as a result of the Project's construction, operation, and decommissioning 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 Type I priority services as a result of the Project.

7.8.2 Area of Influence

The ecosystem services AoI is spatially defined as the area within which there is a demand for ecosystem services by communities/ beneficiaries (the Social AoI, see Section 6.12). These services are supplied by ecosystems within or surrounding the Project footprint (the Biophysical AoI).

7.8.3 Receptor Importance

In order to identify the importance of the receptors, the scale of relative importance presented in Table 7.8-1 has been used with reference to the information collated in the baseline to classify the selected receptors.

Table 7.8-1: Criteria for Determining Importance of Receptors

Category	Importance of the receptor
Very high	■ Ecosystem service is irreplaceable, beneficiaries are unlikely to be able to adapt to loss in the ecosystem service benefit. ■ The ecosystem service is critical to the livelihoods, health, safety and/or culture of the beneficiaries.
High	■ Ecosystem service is not readily substitutable, there is a low or limited likelihood beneficiaries can adapt to loss in the ecosystem service benefit. ■ The ecosystem service is important to the livelihoods, health, safety and/or culture of the beneficiaries.
Medium	■ Ecosystem service is substitutable or replaceable, there is a low dependency on it by beneficiaries and a moderate likelihood that affected beneficiaries can adapt to loss in the ecosystem service benefit. ■ The ecosystem service plays a role in the livelihoods, health, safety and culture of the beneficiaries.
Low	■ Ecosystem service is readily substitutable or replaceable at a local scale. There is a high likelihood that beneficiaries can adapt to loss in the ecosystem service benefit.

7.8.4 Magnitude of Impact

The characterisation of the magnitude of the impact considers the description of Project processes and how the Project could result in a change at each of the receptors. The potential for an impact to occur at a receptor has been determined using the understanding of the baseline environment and consideration of whether there is a feasible linkage between a source of the potential impact and each receptor. The magnitude of each potential impact has then been classified between 'negligible' and 'very high', as described in Table 7.8-2.

Each potential impact can be either adverse or beneficial to the receptor of interest and vary in its duration (i.e. can be long term, medium or short term and either permanent or temporary). For the purposes of this assessment the following durations apply:

- A short-term impact is defined as up to 66 months (the maximum anticipated construction period);
- A medium-term impact is defined as between 66 months and 25 years (anticipated duration of operations); and
- A long-term impact is defined as one that is predicted to last beyond the end of operational life of the project (>25 years).

A permanent impact is defined as a change to the baseline that would not reverse itself naturally. A temporary impact is defined as a change to the baseline conditions that would reverse naturally once the source of the impact is exhausted or has stopped.

Potential impacts are also assigned descriptors to identify whether the impact is direct or indirect. For the purposes of this assessment, a direct impact is one that occurs as a direct result of the Project and is likely to occur at the Project itself. Indirect impacts (or secondary/tertiary impacts) are those where a direct impact on one receptor has another knock-on impact on one or more other related receptor(s). Indirect impacts are likely to occur away from the Project, which in the case of this assessment applies largely as effects on ecosystems supplying services as a result of population influx.

Table 7.8-2: Criteria for Assessing Magnitude of Impact

Magnitude of Impact	Description Criteria	
	Adverse	Beneficial
High	Complete loss of a priority ecosystem service, loss of quality and integrity of the priority ecosystem service, severe damage to key characteristics, features or elements. 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 permanently cease to be supplied. Complete replacement and/or substitution of services is required. The demand for ecosystem services is noticeably elevated from baseline.	Large scale or major improvement to ecosystem service quality and supply, extensive restoration or enhancement.
Medium	Partial loss of a priority ecosystem service, but not adversely affecting the integrity, partial loss or damage to key characteristics, features or elements of the service. Where the impact affects the ecosystems in such a way that the system's capacity to supply priority services is moderately affected, such that the supply base of priority services is affected, or supply may temporarily cease. Replacement and/or substitution of services may be required.	Some benefit to key characteristics, features or parameters describing ecosystem service quality and supply.

Magnitude of Impact	Description Criteria	
	Adverse	**Beneficial**
	The demand for ecosystem services is elevated from baseline.	
Low	Some measurable change in/damage to attributes, quality or vulnerability of the priority ecosystem service. Minor loss of, or alteration to, key characteristics, features or elements. Where the impact affects the ecosystems in such a way that the system's capacity to supply priority services (i.e. the supply base) is slightly affected. The demand for ecosystem services is slightly elevated from baseline.	A minor increase in supply of services due to the project's activities.
Negligible	No significant predicted change from baseline. Supply of priority ecosystem services will not be significantly affected. Demand for priority ecosystem services will not increase	

7.8.5 Key Guidance 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;
- IPIECA (2016). Biodiversity and ecosystem services fundamentals. Guidance document for the oil and gas industry. prepared by the BES Fundamentals Task Force, under the auspices of the IPIECA-IOGP Biodiversity and Ecosystem Services Working Group, with assistance from Edward Pollard and The Biodiversity Consultancy;
- IPIECA (2011): Ecosystem services guidance – Biodiversity and ecosystem services guide and checklists. The International Petroleum Industry Environmental Conservation Association; and
- Secretariat of the Convention on Biological Diversity and the United Nations Environment Programme-World Conservation Monitoring Centre (2012). Best policy guidance for the integration of biodiversity and ecosystem services in standards. Montreal, Technical Series No. 73, 52 pages.

7.8.6 Receptors of Interest and Importance

The categories of importance of Type I priority ecosystem services receptors are presented in Table 7.8-3. Type II priority ecosystem services are typically not considered separately in the impact assessment, as they relate to Project *dependence* as opposed to Project *impact* (Type I); however, since all of the Type II priority ecosystem services overlap with Type I services (Fresh water, spiritual services (sacred trees) and educational and inspirational values), Project impacts on these are also considered.

Table 7.8-3: Receptors and Importance

Receptor	Importance	Comment
Grazing/browsing for livestock	High	The Turkana practise transhumance, a type of pastoralism or nomadism in which livestock are moved seasonally between fixed summer and winter pastures (Barrow, 1988). This way of life is almost entirely based on the availability of grazing/browsing resources for livestock.
Wild foods	Medium	Wild foods, particularly those obtained from various food plants, form an important dietary supplement for Turkana people, with over 53 species of plant actively harvested and processed. To a lesser extent, animal-derived wild foods including dik-dik meat and honey are obtained and used opportunistically.
Medicinal plants	High	Although dependence on medicinal plants has not been quantified in the ESIA or the social baseline, it is believed to be high, with most stakeholders interviewed making mention of the use of an array of species for various purposes; however, no specific areas or habitat types were identified as being of particular importance for the supply of medicinal plants during focus group meetings conducted as part of the ecosystem service prioritisation process.
Biomass fuel	Medium	Research in the Turkana region has shown that, typically, once all of the dead firewood within walking/carrying distance of permanent settlements has been collected, people tend to revert to harvesting live trees within walking/carrying distance of their homesteads, resulting in a radius of deforestation extending around permanent settlements (Amyunzu, 1991; Olang, 1982; Reid & Ellis, 1995.).
Biological raw materials: Wood and fibre	Medium	Various plant species are utilised in the construction of traditional homes, shelters and fencing. Wood from a range of tree species is used in the production of traditional carved sticks with curved heads, and *ekicholong* (Turkana seat/head rest), utensils, baskets.
Freshwater	High	Freshwater is obtained from the environment via rainfall, groundwater wells and hand-dug wells; as well as at points throughout the AoI provided by the Operator via tanked water supply.
Regulation of water flows	Medium	The AoI spans the Turkwel, Kalabata, Kerio, Turkwel Gorge Reservoir Basin and Malmalte River catchments. These hydrological systems regulate water run-off, influence groundwater recharge, and maintain the water storage potential of the landscape.

Receptor	Importance	Comment
Cultural sites (Sacred trees)	Very High	Cultural sites include the sacred trees (particularly *Maytenus* sp.) beneath which the men of the community and elders gather to discuss community issues, politics, marriages, community affairs. Such trees are vital to the Turkana way of life and play a pivotal role in cultural practices; as such they are considered irreplaceable.
Educational and inspirational values	High	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.

7.8.7 Sources of Impacts

The Project has the potential to cause impacts on priority ecosystem services

[31] during all of its phases, through changes in the physical landscape and socio-economic context. The Project Description (Chapter 6.0) has been reviewed, and key activities and sources of impacts relevant to priority ecosystem services are presented below.

The ecosystem services impact assessment has drawn on residual impact analysis results from other Project disciplines to ensure an aligned approach and avoid 'double-counting'. Where relevant, mitigation proposed elsewhere has been considered and built upon as deemed necessary. The following Project disciplines are relevant inputs to Ecosystem Services:

- Air Quality (Section 7.1);
- Noise and Vibration (Section 7.2);
- Water Quantity (Section 7.3);
- Water Quality (Section 7.4);
- Soils, Terrain, Geology and Seismicity (Section 7.5);
- Landscape and Visual (Section 7.6);
- Biodiversity (Section 7.7);
- Social (Section 7.9); and
- Cultural Heritage (Section 7.10).

Project impacts to ecosystem services are generally tied to land cover types and associated loss to the Project footprint (especially provisioning and regulating ecosystem services), or the presence of the Project in the landscape (cultural ecosystem services), which will be in effect for the lifetime of the Project. However, where potential impacts on ecosystem services are considered specific to a particular Project phase (for example,

[31] 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).

regulation of air quality is more likely to be affected during the operational phase of the Project), this is stated at the outset.

7.8.7.1 Construction Phase

Based on the Project Description and baseline ecosystem services conditions, there are aspects of the Project identified as having the potential to present sources of impact to ecosystem services during the construction phase. The potential sources of impact, and routes by which they could impact ecosystem services are as follows:

- Changes in land cover and associated reductions in the supply of ecosystem services (particularly the potential removal of sacred trees) due to the construction of Project roads connecting the CFA, well-pads, satellite camps and Kapese Camp; creation of new well-pads, and the expansion of existing well-pads and facilities.
- Deposition of dust on vegetation communities supplying wild foods and medicinal plants, generated by increased traffic and Project activities.
- Changes in surface water runoff and flooding regimes due to ongoing, non-rehabilitated construction works within floodplains, luggas or river channels, affecting ecosystems' capacity to regulate water flow and control erosion.
- Project water requirements – abstraction of groundwater during the early construction phase (months 1 to 22) could affect water availability for existing groundwater users (via availability of shallow groundwater, including in hand dug wells) and baseflow to luggas (as described in Section 7.4 Water Quantity).
- Population influx as people seek jobs during construction of the Project, and to provide commercial services to the increasing population in the vicinity of the Project, and the concurrent increase in demand for ecosystem services; this is likely to impact the quantity and quality of ecosystem service supply to existing beneficiaries; and
- The introduction and spread of invasive plants, pests and diseases.

7.8.7.2 Operational Phase

Based on the project description and baseline ecosystem services conditions, there are aspects of the Project identified as having the potential to present sources of impact to ecosystem services during the operational phase. The potential sources of impact and routes by which they could impact ecosystem services are as follows:

- The physical presence of the Project will lead to loss of land, change the land surface and landscape and will potentially interact with priority provisioning and cultural ecosystem services - these are 'direct impacts', which are likely to affect both beneficiaries within or adjacent to the Project footprint and beneficiaries from further afield who may travel to gather natural resources (e.g. wild foods, wood for fuel or construction) or avail of cultural heritage ecosystem services intrinsically linked with the landscape (e.g. *ere*).
- Influx of people near the water off-take points is likely to impact the quantity and quality of provisioning ecosystem service supply to existing beneficiaries.

7.8.7.3 Climate Change

Climate change is likely to introduce considerable uncertainty in agricultural practices. The beneficiaries of ecosystem services identified in this study are the most vulnerable to the impacts of current and predicted climate variability. The potential primary route by which climate change could impact ecosystems and their services is the loss of livelihood and food sources (livestock) for Turkana pastoralists due to drought (as already seen during the severe drought experienced between 2016-2017).

7.8.8 Incorporated Environmental Measures

The Project has been designed and planned to incorporate a range of incorporated environmental measures that provide measures to avoid potential impacts or reduce their magnitude, prior to the impact analysis being completed.

The measures presented in this section either relate to design measures or are widely accepted GIP.

7.8.8.1 Design Measures

The following measures are part of the Project design and reduce the potential impact of the Project on ecosystem services:

- Speed limits will be maintained and enforced – this will reduce noise and minimise disturbance to beneficiaries whose cultural identity and sense-of-place is linked to the largely undisturbed landscape setting, and minimise dust deposition on possible sources of medicinal and food plants adjacent to the internal road network;
- Untreated produced water will not be discharged to the environment;
- Internal road and well-pad drainage will be designed to maintain flows in luggas in line with the natural regime;
- There will be no discharge of hydrotest water from hydrotesting of in-field flow lines;
- All temporary land take associated with the construction of the Project facilities and roads will be rehabilitated and returned to communities following construction; and
- All abstractions from, or discharges to either groundwater or surface water will be within the volumes permitted under licence from NEMA.

7.8.8.2 Good Industry Practice

Project activities will consider the measures defined below, to reduce the potential for creating the impact.

This impact assessment and the mitigation proposed is in accordance with IFC PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (2012) (including accompanying guidance - Guidance Note 6 (IFC GN6, 2019)).

- A permitted water supply will be available onsite for dust/particulate matter suppression/mitigation, using non-potable water, where possible and deemed appropriate;
- Where practical directional lighting of site 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-place is linked to the largely undisturbed setting; and
- Education of staff about company environmental policies and procedures including ongoing training and auditing of effectiveness.

7.8.9 Impact Classification

As *Supporting* ecosystem services have no specific/direct beneficiaries, and impacts to these are captured within the *Provisioning, Regulating* and *Cultural* categories for this Project, they were not included in the prioritisation exercise and therefore are not included in the impact assessment.

Taking into account the baseline ecosystem services setting (Section 7.10), the relevant incorporated environmental measures (Section 7.8.8), and the potential sources of impact (Section 7.8.7) determined from the Project Description, the potential source-pathway-receptor impact linkages for the construction and the operational phases are presented in this section.

A discussion regarding feasible impact linkages during each of the Project phases is presented in each of the sub-sections below. Each discussion is followed by a table where the potential sources of impact and relevant additional mitigation applicable to each receptor are summarised.

Where mitigation measures are repeated for different receptors, they are stated as a numbered "Repeated mitigation" in the initial instance and referred back to thereafter.

7.8.9.1 Construction

The construction phase impact assessment is presented in Table 7.8-4. Construction phase impacts on ecosystem services comprise changes to the supply of ecosystem services from a particular ecosystem/habitat. These changes may occur as a result of the direct loss/increase in extent of that ecosystem/habitat due to land-take for the Project, or due to increased demand for ecosystem services as a result of population influx. It is considered that most of these construction phase impacts will extend throughout the operational life of the Project, until such a time as site rehabilitation and re-vegetation is well-established.

7.8.9.1.1 Grazing/Browsing Resources for Livestock

Potential impacts on this ecosystem service are chiefly related to the loss of available grazing and browsing resources for livestock in the Project footprint, together with population influx to the AoI and increased demand for livestock grazing resources. A potential change in supply of grazing/browsing resources by riparian vegetation growing in luggas that experience reduced baseflow within the radius of influence of groundwater abstraction during the early construction phase could also occur.

Areas that are currently used for grazing/browsing resources for livestock will be reduced in extent as a result of land-take for the Project footprint in the AoI. Increased demand for ecosystem services could occur in areas where influx may focus, such as the locations of tanked water supply points in the AoI. This will result in habitat degradation and exacerbate pressure on the supply of this ecosystem service, particularly during times of drought. The magnitude of the impact is considered medium, since the loss of land cover/ecosystems supplying grazing/browsing resources will be long-term as it will extend from construction into operations, affecting the supply base of this priority ecosystem service (but not resulting in a cessation of supply). Since the importance of the ecosystem service is high, an adverse impact of **Moderate** significance is predicted prior to mitigation.

To provide adequate mitigation of this potential impact, prior to construction the Operator will investigate existing grazing patterns and how they could be affected by the construction of the Project. The Operator will seek to minimise the use of land acquired for the Project through Land Use Management (**Repeated Mitigation – Ecosystem Services 01**). Sensitive areas that may be subject to grazing pressures because of Project activities will be identified and periodically assessed. This information will be used to design the RLRP with the objective of improving pastureland quality to mitigate the impacts caused by overgrazing.

The Operator will also develop influx management procedures to manage speculative influx through Influx Management (**Repeated Mitigation – Ecosystem Services 02**), the agreed procedures will be presented in the Social Performance Plan.

Additionally, the Operator will seek to identify any particularly vulnerable people affected by the Project as described in the RLRP and provide supplementary assistance to particularly vulnerable and marginalised households in line with IFC Performance Standards.

The RLRP and the CDPs will set out how the Operator will provide culturally appropriate livelihood restoration support aimed at improving livestock grazing livelihoods for users of communal land in Project affected areas. Livelihood restoration measures will be developed in consultation with affected communities, stakeholders, County Government and the GoK to ensure that they meet the needs of households and communities and fit with local priorities and other government support initiatives.

The implementation of these recommended mitigation measures will reduce the predicted impact magnitude to low; resulting in a residual impact of **Minor** significance.

Reduced baseflow in luggas in proximity to groundwater abstraction boreholes has the potential to negatively affect the growth of trees and shrubs in the riparian vegetation communities that supply grazing/browsing resources for livestock. This could further exacerbate pressure on the supply of this ecosystem service, particularly during times of drought when trees are more reliant on groundwater resources. The magnitude of the impact is considered low, since reduced baseflow will be short-term and seasonal, and will occur within a relatively small radius of influence. This reduction is in the context of wide availability of ecosystems providing grazing/browsing opportunities, resulting in slight changes in the riparian vegetation community's capacity to supply this ecosystem service. Since the importance of the ecosystem service is high, an adverse impact of **Minor** significance is predicted prior to mitigation.

To provide adequate mitigation of this potential impact, the Operator will carry out groundwater monitoring as described in the water quantity chapter, and in parallel, the Operator will carry out an additional biodiversity survey (**Repeated Mitigation – Water Quantity 04 - Biological Monitoring**) within the potentially affected area of the Kalabata catchment. The survey will inform the refinement of critical habitat mapping, evaluate the need for future biological monitoring, and evaluate sensitivities related to groundwater levels. These considerations will be included in the assessment of action levels and associated water supply mitigations required to avoid long-term stress to potential critical habitat (which also supplies this ecosystem service), e.g., targeted irrigation during the impacted period.

Taking into account the above mitigations, the predicted magnitude of residual impact on ecosystems supplying browsing/foraging resources for livestock in the Kalabata catchment in the area affected by the construction water abstraction, would be negligible. This results in a **Negligible** residual impact significance on the riparian vegetation communities associated with seasonal rivers/ephemeral streams/luggas supplying this ecosystem service.

7.8.9.1.2 Wild Foods

Exclusion of people from the fenced well-pads, CFA and CPF during construction and operation will reduce the extent of the area in which wild foods, such as fruits and honey, are supplied in the AoI. Although the extent of this effect will be minor in the context of the available alternative resources throughout the AoI, the demand for wild foods will shift to alternative supply areas, whose capacity to handle increased demand has not been quantified (neither has the current demand been quantified). This could therefore likely affect the condition of the ecosystems and their capacity to supply ecosystem services.

Increased numbers of livestock and people as a result of influx during Project construction and operation could stimulate increased demand for wild foods and in turn affect the quality and quantity of wild food sources available in the AoI and its vicinity.

The magnitude of the impact is considered medium, since the loss of land cover/ecosystems supplying wild foods will be long term, affecting the supply base of this priority ecosystem service (but not resulting in a cessation of supply). Since the importance of the ecosystem service is medium, an impact of **Minor** significance is predicted prior to mitigation.

To provide adequate mitigation, as part of the RLRP, the Operator will evaluate the productivity of wild foods within the construction footprint and the surrounding areas and identify any measures to maintain current wild food availability and, where possible, enhance productivity. Furthermore, the Operator will seek to minimise the use of land acquired for the Project (**Repeated Mitigation – Ecosystem Services 01**) and develop influx management procedures to manage speculative influx (**Repeated Mitigation – Ecosystem Services 02**), the agreed procedures will be presented in the Social Performance Plan.

Prior to implementation of resettlement and livelihood restoration activities, the Operator will also identify any particularly potentially vulnerable people affected by the Project who are dependent on wild foods as described in the RLRP and provide supplementary assistance to particularly vulnerable and marginalised households in line with IFC Performance Standards. (**Repeated Mitigation – Ecosystem Services 03**).

The magnitude of the impact may be reduced to low with the implementation of the required mitigation measures, resulting in a **Negligible** residual impact.

7.8.9.1.3 Medicinal Plants

Exclusion of people from the fenced well-pads, the CFA and CPF during construction and operation will limit their ability to gather medicinal plants in the AoI. Although the impact is associated with the construction phase, it will last for the operational lifetime of the Project. Improved access to new resource areas via the in-field roads could stimulate increased demand for medicinal plants in this area, which could affect the quantity and quality of the vegetation communities supplying the resources.

The magnitude of construction-phase impacts on this ecosystem service will be low in the context of the available alternative resources throughout the AoI and beyond; although the capacity of other ecosystems to sustainably supply this ecosystem service in the face of increased demand has not been established, it is unlikely that the shift would push the supply of this ecosystem service, or the ecosystems supplying it across a sustainability threshold. In addition, the demand for this service is not expected to be significantly elevated from baseline – based on the assumption that the requirement for medicinal plants is less frequent than that of say fuel wood, or wild foods. Impacts predicted prior to mitigation are assessed to be **Minor** significance.

To mitigate these potential impacts, as part of the RLRP, the Operator will evaluate the use and harvesting of medicinal plants within the construction footprint and the surrounding areas and will identify any measures to maintain current medicinal plant availability and, where possible, enhance productivity. The Operator will also seek to minimise the use of land acquired for the Project (**Repeated Mitigation – Ecosystem Services 01**) and develop influx management procedures to manage speculative influx (**Repeated Mitigation – Ecosystem Services 02**).

Prior to implementation of resettlement and livelihood restoration activities, the Operator will also identify any particularly potentially vulnerable people affected by the Project who are dependent on medicinal plants as described in the RLRP and provide supplementary assistance to particularly vulnerable and marginalised households in line with IFC Performance Standards. (**Repeated Mitigation – Ecosystem Services 03**).

The required mitigation measures will not change the impact magnitude (which is low prior to mitigation); the residual impact will remain of **Minor** significance.

7.8.9.1.4 Biomass Fuel

The reduction in the extent of ecosystems supplying tree species that provide wood for fuel and charcoal production as a result of Project construction is considered an adverse, medium-term, low magnitude impact. Although in the context of the wide extent of the ecosystems supplying those services in the AoI the impact may appear to be of low magnitude, research in the Turkana region suggests that once dead wood within walking/carrying distance of settlements has been used, trees within walking/carrying distance of homesteads are harvested for wood (Amyunzu, 1991; Oland, 1982; Reid & Ellis, 1995.). Influx of opportunity seekers may result in increased demand for firewood and charcoal, with subsequent effects on the quality and quantity of vegetation communities supplying that resource. This negative feedback loop further reduces the ecosystem's ability to supply this ecosystem service sustainably – an impact of medium magnitude. The receptor importance is medium, therefore impacts of **Minor** significance are predicted prior to the implementation of mitigation measures.

The Operator will develop influx management procedures to manage speculative influx (**Repeated Mitigation – Ecosystem Services 02)** and have a policy of "*zero tolerance*" for hunting, foraging, unpermitted use of natural resources within the Project AoI applicable to all employees and contractors, which will reduce the magnitude of the impact to low, resulting in a residual impact of **Negligible** significance.

7.8.9.1.5 Wood and Fibre for Construction and Crafts

The reduction in the extent of ecosystems supplying tree species that provide wood for construction of traditional homes and craft/utensil production as a result of Project construction, together with increased demand for those species as a result of population influx, and concomitant degradation of ecosystems supplying services due to increased livestock numbers, is considered an adverse, medium-term impact. The magnitude of the impact is considered low in the context of the wide extent of the ecosystems supplying those services in the AoI and their easy accessibility for beneficiaries (AoI, pastoralists). Although the impact is associated with the construction phase, it will last for the operational lifetime of the Project.

Although the extent of the reduction of supplying ecosystems will be low in the context of the available alternative resources throughout the AoI, the demand for wood will shift to alternative supply areas; resulting in a slightly elevated demand for that ecosystem service compared to baseline. The construction-phase impact on this ecosystem service is therefore considered low magnitude, with an overall impact of **Negligible** significance.

7.8.9.1.6 Freshwater Supply

Ten existing boreholes in South Lokichar will be used to supply the Project and the proposed Project water use will be within the limits already permitted for the existing facilities. Groundwater in the area is typically encountered at depths between 5 m and 40 m below ground level, from gravels beneath the surface sands (Section 7.5). Local beneficiaries (pastoralists and AoI 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).

The magnitude of the potential construction-phase impact on freshwater supply to the above-mentioned local beneficiaries will be high. The ecosystem service is of high importance, so the impact prior to mitigation is one of **Major** significance.

To mitigate these potential impacts, the Environmental Performance Plan will outline procedures to manage the consequences of water abstraction by the Project (See Section 7.3 for specific mitigations) and water availability during the period of impact. The permitting and contingency strategy will be disclosed and agreed with Turkana County Government.

The Operator will commit to continuity of water supply (see Section 7.3 for detailed monitoring and management commitments relating to water availability) and will provide temporary alternative water supplies to all water users throughout the period of impact.

Relating to reliance on water points, if Project activities and infrastructure lead to a need to relocate community water points, the Stakeholder Engagement Plan will describe how the Operator will engage with Turkana County Government, local stakeholders, and communities, to discuss and plan the relocation of community water tanks to suitable locations outside of affected land areas. See Section 7.3 (water quantity) and 7.9 (social) for further commitments relating to water availability.

These mitigation measures will reduce the impact magnitude to low, and the resultant residual impact is of **Minor** significance.

7.8.9.1.7 Cultural Sites

Cultural sites, such as sacred trees and ritual fire pits, and other forms of intangible cultural heritage within the AoI, such as the knowledge associated with traditional home construction and wooden utensil carving, and sourcing medicinal and food plants, are intrinsically linked with natural ecosystems. Direct losses of sacred trees arising from Project land take, and 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 ecosystem service.

During Project construction, no loss of sacred trees is expected to occur; however, there are 16 sacred trees[32] that could experience visual impacts, of which six (CH-043 near Twiga and CH-018 to CH-022) are near the interconnecting network RoW and could, based on the outcome of the air quality assessment (Section 7.10), be disturbed as a result of construction dust. There are also three ritual fire pits (CH-014, -015, and -016) that may be affected by construction dust and visual impacts. These impacts will occur on a local scale and will be short-term. The impact magnitude is considered low as the construction-phase disturbance of the sacred tree may temporarily restrict social functioning at a local scale and present a reputational risk to the Project and to the Operator. The sensitivity of this receptor is very high because sacred trees consist of particular individuals of certain species that are used for particular occasions over generations and are thus irreplaceable. Therefore, the impact significance is considered **Moderate**, prior to mitigation.

At locations where construction will occur, the Operator or the EPC contractor will engage stakeholders in affected areas to inform them where, when and for how long temporary works are taking place.

The Operator Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders of the construction activity dates and the potential for increased visual disturbance from dust and artificial lighting. Signage will be put in place to inform people where, when and for how long temporary dust generating works are taking place.

The Operator and their contractors will monitor grievances and improvements through the Operator Grievance Management Procedure. A residual **Moderate** impact significance is predicted.

7.8.9.1.8 Spiritual values

Loss in extent of all natural habitats providing this ecosystem service arising from Project land take and changes in the landscape setting (visual and noise impacts) of ecosystems that supply the service (e.g. as a result of mechanical noise during construction activity) are likely to affect the ability of local communities to benefit from this ecosystem service. The sensitivity of the receptor is high as it is irreplaceable and the impact magnitude, should it occur, is also considered medium at the ecosystem service. The impact significance is thus considered **Moderate**.

The Stakeholder Engagement Plan will detail how the Operator will complete an information campaign to inform local stakeholders of the construction activity dates and the potential for increased noise levels and construction activities. Community members will be encouraged through community participation to avoid the area where the construction activities are taking place. In addition, Cultural Awareness Training (**Repeated Mitigation – Ecosystem Services 04)** will be implemented for all site staff / contractors as part of the Project site induction

[32] CH-009, -018, -019, -020, -021, -022, -033, -034, -035, -036, -037, -038, -040, -042, -043, and -046

process for all field-based staff during construction. The training will be outlined with the Social Performance Plan and the Operator will monitor grievances and improvements through the Grievance Management Procedure (**Repeated Mitigation – Ecosystem Services 05**).

The changed landscape setting will however, remain the case for the duration of the Project, resulting in a residual impact of **Moderate** significance extending throughout the operation phase as well as during construction.

Table 7.8-4: Construction Phase Impact Assessment

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Grazing/browsing for livestock (High)	Changes in land cover and associated reduction in supply due to the construction of the infield roads new wellpads and the expansion of existing facilities, increased demand due to population influx and reduction in capacity to supply.	Direct/long term/medium	Moderate	Prior to construction, the Operator will investigate existing grazing patterns and how they could be affected by the construction of the Project. Sensitive areas that may be subject to grazing pressures because of Project activities will be identified and periodically assessed. This information will be used to design the RLRP with the objective of improving pastureland quality to mitigate the impacts caused by overgrazing. The Operator will identify any particularly potentially vulnerable people affected by the Project as described in the RLRP and provide supplementary assistance to particularly vulnerable and marginalised households in line with IFC Performance Standards. The RLRP and the CDPs will set out how the Operator will provide culturally appropriate livelihood restoration support aimed at improving livestock grazing livelihoods for users of communal land in Project Affected Areas. Livelihood restoration measures will be developed in consultation with affected communities, stakeholders, County Government and GoK to ensure that they meet the needs of households	Direct/long term/low	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				and communities and fit with local priorities and other government support initiatives. **Repeated Mitigation – Ecosystem Services 01 – Land Use Minimisation:** The Operator will minimise use of the land acquired by GoK such that only land required for Project Facilities is used exclusively by the Project, (i.e., with access restricted by security fencing). This will mean that existing land users will be able to continue use of gazetted land until and unless it is required. **Repeated Mitigation – Ecosystem Services 02 – Influx Management (construction):** The Operator will develop influx management procedures to manage speculative influx (and the emergence of informal settlements). Procedures will be developed in coordination with National and County Governments and the respective County Commissioners. Agreed procedures will be presented in the Social Performance Plan.		
Grazing/browsing for livestock (High)	Temporary reduction in water supply to ecosystems (riparian woodland) supplying browsing/grazing for	Direct/short term/low	Minor	The Operator will seek to minimise construction phase water demand as part of the detailed design process.	Direct/short term/negligible	Negligible

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
	livestock within the radius of influence of borehole abstraction.			**Repeated Mitigation – Water Quantity 04 - Biological Monitoring:** In parallel with groundwater monitoring, an additional biodiversity survey within the potentially affected area of the Kalabata catchment, will be undertaken (at least one June survey before construction) to identify the presence (or otherwise) of the Turkana toad and previously undescribed beetle. Based on that data, critical habitat mapping will be revised, future biological monitoring will be defined. Sensitivities related to groundwater levels will be evaluated and included in consideration of action levels and associated water supply mitigations to avoid long term stress of potential critical habitat (which also supplies this priority ecosystem service), e.g., targeted irrigation during the impacted period. The Operator will ensure continuity of water supply to water users affected by the abstraction of groundwater during the construction phase, and for the duration of the effect. The Operator will implement an abstraction strategy to minimise the effect on sensitive natural receptors i.e. critical habitat (which also supplies this priority		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				ecosystem service), by prioritising the wells used to provide construction water supply.		
Wild foods (Medium)	Reduced wild food plant availability due to reductions in woodland/ bush land cover that supports food plant/ animal species, increased demand due to population influx and reduction in capacity to supply. Reduced vegetation cover may limit wild bee's ability to produce honey.	Direct/ permanent/ medium	Minor	**Repeated Mitigation – Ecosystem Services 01 – Land Use Minimisation.** **Repeated Mitigation – Ecosystem Services 02 – Influx Management.** **Repeated Mitigation – Ecosystem Services 03 – Vulnerable People and Wild Food/ Medicinal Plants:** Prior to implementation of resettlement and livelihood restoration activities, the Operator will identify any particularly potentially vulnerable people affected by the Project, and who are dependent on wild foods/ medicinal plants, as described in the RLRP, and provide supplementary assistance to particularly vulnerable and marginalised households in line with IFC Performance Standards. As part of the RLRP, the Operator will evaluate the productivity of wild foods within the construction footprint and the surrounding areas and will identify any measures to maintain current wild	Direct/short term/low	Negligible

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				food availability and where possible, enhance productivity.		
Medicinal plants (High)	Reduced availability of traditional medicines due to reduction in woodland/ bush vegetation cover that supports plant species used for traditional medicine, increased demand due to population influx and reduction in capacity to supply.	Direct/ permanent/ low	Minor	**Repeated Mitigation – Ecosystem Services 01 – Land Use Minimisation.** **Repeated Mitigation – Ecosystem Services 02 – Influx Management.** **Repeated Mitigation – Ecosystem Services 03 – Vulnerable People and Wild Food/ Medicinal Plants.** As part of the RLRP, the Operator will evaluate the use and harvesting of medicinal plants within the construction footprint and the surrounding areas and will identify any measures to maintain current medicinal plant availability and, where possible, enhance productivity.	Direct/ permanent/ low	Minor
Biomass Fuel (medium)	Reduction in the extent of ecosystems supplying tree species that provide wood for fuel and charcoal production	Direct/medium-term/medium	Minor	**Repeated Mitigation – Ecosystem Services 02 – Influx Management.** The Operator will have a policy of "*zero tolerance*" for hunting, foraging, unpermitted use of natural resources within the Project AoI applicable to all employees and contractors.	Direct/medium-term/low	Negligible
Freshwater (High)	Availability and quality of fresh water for drinking may be compromised by	Direct/short term/high	Major	The Operator Environmental Performance Plan will include a section on water resources which will	Direct/short term/low	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
	abstraction from groundwater and/or reliance on water points			cover all procedures to manage the consequences of water abstraction by the Project (See Section 7.3 for specific mitigations) and water availability during the period of impact. The permitting and contingency strategy will be disclosed and agreed with Turkana County Government. The Operator will commit to continuity of water supply (see Section 7.3 for detailed monitoring and management commitments relating to water availability) and will provide temporary alternative water supplies to all affected water users throughout the period of impact. Relating to reliance on water points, if Project activities and infrastructure lead to a need to relocate community water points, the Stakeholder Engagement Plan will describe how the Operator will engage with Turkana County Government, local stakeholders and communities to discuss and plan the relocation of community water tanks to suitable locations outside of affected land areas. See Section 7.3 (water) and 7.9 (social) for further commitments relating to water availability.		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Cultural sites (Very High)	The loss or disturbance of cultural sites could occur.	Direct/ permanent/ high	Major	The Operator Social Performance Plan will describe the procedures for micro alignment of the interconnecting network and OHTL within the RoW to avoid direct impact to known graves, where feasible. The Operator Social Performance Plan will set out how the Operator will consult with affected communities and site guardians to agree procedures for demarcation (e.g., demarcation and communication of 'no go' sensitive locations and mapping and communication of cultural heritage 'constraints').The Social Performance Plan will present detailed steps for identifying previously unrecorded graves within the development footprint, prior to construction and set out requirements for protocols and training to be provided to all construction contractors to assist in grave identification and the implementation of the protocol. See Section 7.10 (cultural heritage) for further commitments relating to sacred sites, including graves.	Direct/long term/low	Moderate

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				Repeated Mitigation – Ecosystem Services 04 – Cultural Awareness Training: Cultural Awareness Training will be implemented for all site staff / contractors as part of the Project site induction process for all field-based staff during construction. The training will be outlined with the Social Performance Plan and include: - Specific local taboos / respectful behaviours with regard to sacred trees etc. - A calendar of culturally significant events. - Constraints mapping to highlight sensitive areas or no-go areas.		
Spiritual values (High)	Construction-phase changes in the visual, noise aesthetics of the landscape.	Direct/short term/medium	Moderate	The Stakeholder Engagement Plan will detail how the Operator will complete an information campaign to inform local stakeholders of the construction activity dates and the potential for increased noise levels and construction activities. Community members will be encouraged through community participation to avoid the area where the construction activities are taking place. **Repeated Mitigation – Ecosystem Services 04 – Cultural Awareness Training**	Direct/medium term/medium	Moderate

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				Repeated Mitigation – Ecosystem Services 05 – Grievance Management Procedure: The Operator will monitor grievances and improvements through the Grievance Management Procedure. Any complaints will be investigated and followed up to ensure a form of remediation is in place to prevent recurrence.		

7.8.9.2 Operational Phase

The operational phase impact assessment with respect to ecosystem services is presented in Table 7.8-5. Operational impacts on ecosystem services are limited to the presence of the Project in the landscape, although it is recognised that the impact of population influx assessed under the construction phase may extend to some degree throughout the operational lifetime of the Project.

7.8.9.2.1 Presence of the Project in the Landscape

7.8.9.2.2 Spiritual Values

Visual impacts on the setting of 16 sacred trees and 3 ritual fire pits from the long-term presence of the OHTL (Section 7.10.12) are predicted and will last for the duration of the Project. The impact is of low magnitude, resulting in an overall impact of **Moderate** significance. Various mitigation measures proposed in the landscape and visual assessment will assist in visually mitigating the impact of the Project's physical presence in the landscape, however full mitigation of the impact will only be possible when the facility is decommissioned and dismantled, and the resultant footprint areas rehabilitated.

7.8.9.2.3 Educational and Inspirational Values

The view of the landscape and its contribution to resident's sense of place may become diminished by the presence of the Project. The effect will extend to beneficiaries throughout the Project viewshed (Section 7.6).

The impact is of medium magnitude, resulting in an overall impact of **Moderate** significance. The Operator will provide Cultural Awareness Training which will continue to be implemented for all site staff/contractors as part of the Project site induction process for all staff during operation. The training will be outlined with the Social Performance Plan. **Repeated Mitigation – Ecosystem Services 04** (Grievance Management Procedure) will also apply to manage local concerns and improvements.

Full mitigation of the impact on beneficiaries' sense of place and belonging and heritage will however, only be possible when the facility is decommissioned and dismantled and the resultant footprint areas rehabilitated.

Table 7.8-5: Operational Phase Impact Assessment

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Grazing/browsing for livestock (High)	Influx of people and livestock to water off-take points	Direct/long term/ medium	Moderate	The Operator will develop influx management procedures to manage speculative influx occurring during Project operation. Procedures will be developed in coordination with County Governments and the respective County Commissioners. Agreed monitoring procedures will be presented in the Social Performance Plan. The Operator will maintain culturally appropriate livelihood restoration support aimed at improving livestock grazing livelihoods for users of communal land in Project affected areas during operation. The Operator will have a policy of "*zero tolerance*" for hunting, foraging, unpermitted use of natural resources within the Project AoI applicable to all employees and contractors. Livelihood restoration measures will continue to be developed in consultation with affected communities, stakeholders, County Government and National Government throughout the operation of the Project to ensure that they meet the needs of households and communities and fit with local priorities and other government support initiatives.	Direct/long term/medium	Moderate
Wild foods (Medium)	Influx of people and livestock to water off-take points	Direct/long term/ medium	Minor		Direct/long term/low	Minor
Medicinal plants (High)	Influx of people and livestock to water off-take points	Direct/long term/ low	Minor		Direct/long term/low	Minor
Biomass fuel (Medium)	Influx of people and livestock to water off-take points	Direct/long term/ low	Minor		Direct/long term/low	Minor
Wood and fibre (Medium)	Influx of people and livestock to water off-take points	Direct/long term/ low	Minor		Direct/long term/low	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				The Operator will minimise the use of land acquired by GoK such that only land required for Project Facilities is used exclusively by the Project, (i.e., with access restricted by security fencing). This will mean that existing land users will be able to continue use of gazetted land until and unless it is required. The Social Performance Plan will set out how the Operator will continue to consult with Project Affected Communities during project operation to identify areas of acute resource pressure and record issues as part of the Grievance Management Procedure. **Repeated Mitigation – Ecosystem Services 04 – Grievance Management Procedure.**		
Spiritual values (Very high)	Presence of Project in landscape	Direct/long term/ low	Moderate	The Stakeholder Engagement Plan will set out how the Operator will continue to consult with Project Affected Communities and site guardians to monitor the effectiveness of procedures in place to manage culturally sensitive locations. Cultural Awareness Training will continue to be implemented for all site staff / contractors as part of the Project site induction process during	Direct/long term/low	Moderate

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				operation. The training will be outlined with the Social Performance Plan. Full mitigation will only be possible when the facility is decommissioned and the site rehabilitated. **Repeated Mitigation – Ecosystem Services 04 – Grievance Management Procedure.**		
Educational and inspirational values (High)	Presence of Project in landscape, changes in the visual aesthetics and sense of place.	Direct/long term/ medium	Moderate	Cultural Awareness Training will continue to be implemented for all site staff / contractors as part of the Project site induction process for all field-based staff during operation. The training will be outlined with the Social Performance Plan. Full mitigation will only be possible when the facility is decommissioned and the site rehabilitated. **Repeated Mitigation – Ecosystem Services 04 – Grievance Management Procedure.**	Direct/long term/medium	Moderate

7.8.9.3 Decommissioning

A Decommissioning Plan will be developed five years prior to the planned 'End of Project', this plan will be communicated with relevant authorities at that time.

It is assumed that Project footprint will be returned to their original (baseline) condition during the decommissioning phase.

The predicted Project impacts on ecosystem services arise from land take by the Project footprint, influx and presence of the Project in the landscape. Therefore, at this stage, no potential decommissioning phase impacts or mitigations for priority ecosystem services are anticipated.

7.8.10 Summary of 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 the other specialist studies included in this ESIA 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-IOGP for oil and gas project impacts and dependencies (IPIECA, 2011). These mitigation measures follow the mitigation hierarchy (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 AoI are suitably accommodated.

IFC PS 6 requires clients to "*maintain the benefits from ecosystem services*" when designing and implementing projects, as well as to "*implement mitigation measures that aim to maintain the value and functionality of priority services"*. The overall goal is to mitigate project impacts on priority ecosystem services so that the benefits people derive from these services are maintained when the project is developed, operated and then decommissioned. Similarly, for services used and depended on by a project, the goal is to ensure that there will be a sustainable supply throughout the project's planned operational life and thereafter.

Recently published GIP guidance (IPIECA, 2016) recommends the adoption of six Biodiversity and Ecosystem Services (BES) management practices to address impacts, dependencies, risks and opportunities on ecosystem services (and biodiversity) in the oil and gas sector:

1) Build BES into governance and business processes;
2) Engage stakeholders and understand their expectations around BES;
3) Understand BES baselines;
4) Assess BES dependencies and potential impacts;
5) Mitigate and manage BES impacts and identify BES opportunities; and
6) Select, measure and report BES performance indicators.

As a current corporate member of IPIECA, the Operator is committed to achieving GIP, and as such fulfils the requirements of practices 1 and 6 through submission of annual sustainable development reports to the association. The ESIA process that is the subject of this report employs the other four management practises in its execution, the fifth of which is discussed in this section.

Mitigation measures provided include those from specialist studies that are specific to potential impacts on the supply of ecosystem services, and additional mitigation measures focussed on livelihood replacement and economic displacement, based on the commitments provided within the social impact assessment (Section 7.9) are also included. Further input from people/authorities providing potential sources of interventions (e.g. Ministry of Pastoralism), as well as additional studies to investigate supports for people whose (natural resource-based) livelihoods have been affected by influx will be necessary.

7.8.10.1 Avoidance

Avoidance measures include:

- Reuse existing or remnant road networks, where possible, should new access roads be required, in order to avoid impacts on ecosystem services arising from loss in extent of habitats supplying those services.
- The Operator will minimise use of the land acquired by GoK such that only land required for Project Facilities is used exclusively by the Project, (i.e., with access restricted by security fencing). This will mean that existing land users will be able to continue use of gazetted land until and unless it is required (this is set out as **Repeated Mitigation – Ecosystem Services 01 – Land Use Minimisation**).
- In cases where the Project or third-party contractors associated to the Project may significantly impact on cultural heritage features (such as sacred 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. The Operator are also committed to taking all possible measures to influence all third-party contractors working in the AoI to ensure the avoidance of impacts on such cultural heritage features.

7.8.10.2 Minimisation

7.8.10.2.1 Provisioning Services

- Influx management procedures will be developed to manage speculative influx occurring during Project operation. Procedures will be developed in coordination with County Administrations. Agreed monitoring procedures will be presented in the Social Performance Plan, which will address Project- associated in-migration effects on provisioning services.
- Economic displacement (e.g. loss of grazing/browsing resources) experienced by affected pastoralists will be addressed via the development of the RLRP. The Operator will develop influx management procedures to manage speculative influx (and the emergence of informal settlements). Procedures will be developed in coordination with County Administrations. Agreed procedures will be presented in the Social Performance Plan. This is set out as **Repeated Mitigation – Ecosystem Services 01 – Influx Management (construction)**.
- The RLRP and the CDPs will set out how the Operator will provide culturally appropriate livelihood restoration support aimed at improving livestock grazing livelihoods for users of communal land in Project Affected Areas. Livelihood restoration measures will be developed in consultation with affected communities, stakeholders, County Government and GoK to ensure that they meet the needs of households and communities and fit with local priorities and other government support initiatives.
- Prior to implementation of resettlement and livelihood restoration activities, the Operator will identify any particularly potentially vulnerable people affected by the Project, and who are dependent on wild foods/ medicinal plants, as described in the RLRP and provide supplementary assistance to particularly vulnerable and marginalised households in line with IFC Performance Standards (**Repeated Mitigation – Ecosystem Services 03 – Vulnerable People and Wild Food/Medicinal Plants**).
- The Operator will have a policy of "*zero tolerance*" for hunting, foraging, unpermitted use of natural resources within the Project AoI applicable to all employees and contractors Regulating Services
- Mitigation measures outlined in the water quantity and biodiversity assessments within this ESIA include the incorporation of engineered design features to ensure that water flows in impacted luggas are maintained. Mitigation measures should be applied as recommended.

7.8.10.2.2 Cultural Services

- Cultural Awareness Training (**Repeated Mitigation – Ecosystem Services 04**) will be implemented for all site staff / contractors as part of the Project site induction process for all field-based staff during construction. The training will be outlined with the Social Performance Plan and include:
  - Specific local taboos / respectful behaviours with regard to sacred trees etc.
  - A calendar of culturally significant events.
  - Constraints mapping to highlight sensitive areas or no-go areas.
- 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.
- The Operator will monitor grievances and improvements through the Grievance Management Procedure (**Repeated Mitigation – Ecosystem Services 05 – Grievance Management Procedure**). Any complaints will be investigated and followed up to ensure a form of remediation is in place to prevent recurrence.

7.8.10.3 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.

7.8.11 Summary of Residual Impacts

Two moderate residual impacts are predicted during construction, with all other residual impacts being minor or negligible. The moderate residual impact on spiritual values (sacred trees) arises as a result of the disturbed setting of affected sacred trees, even if the construction activities avoid removing those trees, as stipulated in the mitigation measures. Similarly, the moderate residual impact on educational and inspirational values relates to construction phase changes in the visual, noise aesthetics of the landscape, and the inability to mitigate these impacts until the Project ceases operation and the site is rehabilitated.

Two residual moderate impacts are also predicted during the operational phase. This is a result of visual impacts on the setting of sacred trees (spiritual values) and the wider landscape (educational and inspirational values) from the long-term presence of the OHTLs ultimately affecting beneficiaries' sense of place, heritage and cultural identity. As during construction, there is no additional feasible mitigation to reduce the impact magnitude until the Project ceases operation and the site is successfully rehabilitated.

7.9 Social

7.9.1 Introduction

Project impacts on PAP have been identified by social impact theme. Mitigation and management processes are set out, where necessary, to ensure that impacts are reduced and managed as far as practicable.

7.9.2 Area of Influence

The Social Area of Influence (AoI) for the Project (Figure 7.9-1) includes Turkana South Sub-county and three Locations of Turkana East Sub-county located in Turkana County and the areas of the Endugh, Kasei and Sekerr Wards, which are located in Pokot West, Pokot North and Pokot Central respectively, all located in West Pokot County.

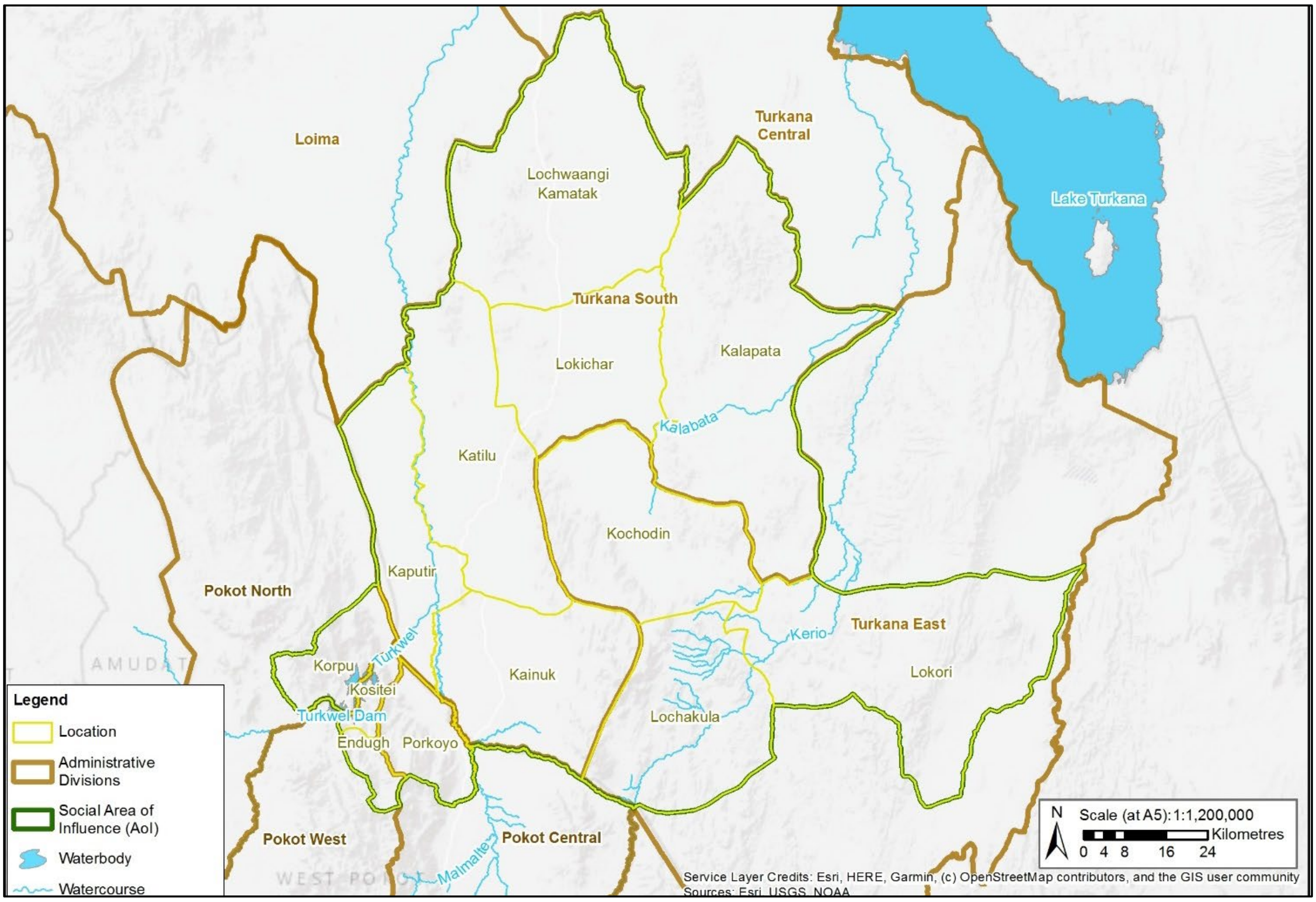

Figure 7.9-1: Project Area of Influence and Key Locations for Baseline Data Collection

For some social aspects, particularly related to community health and safety and social maladies, the influence of the Project extends to settlements along the transport corridor that will be used for the import of goods, however the AoI is focussed on the key geographical areas of in-field Project development.

7.9.3 Receptor Importance

For social impacts, PAP are the main receptor. These include individuals and households occupying traditional mobile settlements or permanent settlements, (types of settlements and homesteads are defined in Section 6.12) including non-organised groups and vulnerable households. Such groups might include the elderly and people with disabilities. These groups are discussed in the narrative associated to each impact and mitigation/management in some cases is focussed on these specific groups thereby considering their varying sensitivity to impacts. Unlike environmental receptors, social receptors will not additionally be classified by importance as this is considered equal for all receptors.

Occupational health and safety of the Operator and Contractor employees is not assessed specifically in this ESIA, as that is a matter for on-site occupational health and safety management, although some of the impacts assessed do have a wide-ranging context and, in particular in the Community Health and Safety section (Section 7.9.9.6), some commitments for occupational health provision are mentioned in the context of wider impacts and the Operator Philosophy on occupational health and safety is stated.

7.9.4 Significance of Impact

As explained in Section 7.3.8, the evaluation of social impacts will differ from the evaluation of environmental impacts. The significance of a social impact will be assessed against the four criteria presented in Table 7.9-1 below.

Table 7.9-1: 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 significantly change quality of life.	**Homestead** Quantifiable household or group of households **Local** Administrative unit or units within the AoI **Regional** AoI in Turkana and West Pokot Counties **National** Kenya **International** Beyond Kenya	**Short-term** up to 66 months (the maximum anticipated construction period) **Medium-term** between 66 months and 25 years (anticipated duration of operations) **Long-term** beyond the end of the operational life of the project (>25 years) **Permanent** Effect not reversible

For impact topics in Section 7.9.9.6 on Community Health and Safety, an additional criterion will be included. All impacts in this section will be assessed on Likelihood:

- Unlikely: likelihood is slight;
- Possible: likelihood is possible, i.e., less than 50% during the evaluated activity/period;
- Probable: likelihood is probable, i.e., more than 50% during the evaluated activity/period; and
- Definite: likelihood is certain.

Each social impact topic will be assessed to generate a significance rating of Negligible, Minor, Moderate or Major (Section 3.6).

7.9.5 Key Guidance and Standards

The Kenyan policy and legislation documents presented in Section 2.2 and the international guidance and standards presented in Section 2.3 are relevant to this assessment. The following are of particular relevance:

- The Constitution of Kenya (2010); applicable as it encompasses the rights of the Kenyan people which could be incumbered upon based on the Project impacts. This overarching legislation provides a foundation to measure against potential social impacts;

- The National Environment Policy (2013): aims to provide a better quality of life for present and future generations through the sustainable management and use of the environment and natural resources;
- The NEAP, (1994 revised in 2009): provides a framework for the implementation of the Environment Policy and realisation of the National Millennium Sustainable Goals and Vision 2030;
- Strategic Environmental and Social Assessment of the Petroleum Sector in Kenya (2017): presents an opportunity for the country to systematically address environmental and socio-economic management issues pertaining to oil and gas activities in the context of sustainable development;
- The National Land Policy: aims to guide the country towards efficient, sustainable and equitable use of land for prosperity and provides legal, administrative, institutional and technological framework for optimal utilisation and productivity of land related resources in a sustainable and desirable manner at national, county and community levels. It addresses critical issues of land administration, access to land, land use planning, restitution of historical injustices, environmental degradation, conflicts, unplanned proliferation of informal urban settlements, outdated legal framework, institutional framework and information management;
- Kenya Vision 2030 (2010): a national long-term development blue-print to create a globally competitive and prosperous nation with a high quality of life by 2030. It aims to transform Kenya into a newly industrialising, middle to high-income country and to provide a high quality of life to all its citizens by 2030 in a clean and secure environment;
- HIV/AIDs Control and Prevention Act, (2006): provides measures for the prevention, management and control of HIV and AIDS, and for the protection and promotion of public health and for the appropriate treatment, counselling, support and care of persons infected or at risk of HIV and AIDS infection, and for connected purposes. The act requires for HIV and AIDS education in the workplace for employees of private and informal sector;
- Labour Relations Act, (2007): consolidates the laws relating to trade unions and trade disputes, to provide for the registration, regulation, management and democratisation of trade unions and employers organisations and to promote sound labour relations through the protection and promotion of freedom of association;
- Environmental, Health and Safety General Guidelines, World Bank Group, 2007;
- Environmental, Health and Safety Guidelines for Onshore Oil and Gas Development, World Bank Group, 2015;
- IFC (2012) – Performance Standards on Environmental and Social Sustainability and accompanying Guidance Notes; and
- Life-Saving Rules, International Association of Oil & Gas Producers, Report 459, 2018.

7.9.6 Sources of Impacts

Potential sources of impact with a range of consequences which will occur throughout the life of the Project are set out below:

- The Project will consist of a multi-billion dollar investment, which will influence a range of socio-economic impacts through fees, taxes and royalty payments and profit sharing.
- The Project requires land for infrastructure. The key considerations related to the sources of impacts for the Project are land acquisition and changes to land use.

The NLC, on behalf of MoPM, will acquire gazetted "polygons" of land across the different oilfields. Within those polygons, the Project has identified a defined footprint (fenced sites and additional access roads) of approximately 1,500 hectares versus the predicted polygon land area of approximately 11,000 hectares. In order to minimise the impacts of land acquisition, land not required by the Project within the polygons will continue to be available for community use unless it requires fencing for safety purposes.

- Employment and procurement during construction and operation phases. It is estimated that the construction workforce will peak at approximately 2,400. The final manpower requirements will be determined during detailed design and construction tendering. Employment opportunities associated with the Project will consist of varying skill requirements, and will offer positions for unskilled, semi-skilled and skilled workers.
- Additional accommodation to house an increased workforce, including unskilled, semi-skilled and skilled workers (as detailed in Section 5.10).

  During the construction phase, additional temporary accommodation camps (e.g., construction camps, rig camp and drilling mini-camp) will be required. The main camps will be located at the CFA with satellite camps on the wellpads. These constitute a total of approximately 2,500 beds for the construction phase and approximately 500 beds will remain in the main permanent camp for the operational phase. For the operational phase, it is proposed that the CFA will act as the operations hub for the development. It is anticipated that most personnel will be housed in the main permanent camp.
- The transport of materials during construction and operation to the Project infrastructure areas will be undertaken by trucks along set access road routes. The movement of vehicles, especially in areas of relative insecurity, will require additional security measures. Security will also be continued and expanded to man guarded stations at well pads and other Project infrastructure.

Sources of impacts relating to environmental determinants of health are identified under the specific environmental technical areas in Chapter 7.0. Residual impacts from those technical assessments are addressed in the Community Health and Safety impact analysis (Section 7.9.9.6).

7.9.7 Incorporated Environmental Measures

The Project has been designed and planned to include a range of incorporated ("designed in") environmental measures that avoid potential impacts or reduce their magnitude, prior to the impact analysis being completed. The measures presented in this section either relate to design measures or are widely accepted Good Industry Practice (GIP).

7.9.7.1 Design Measures

Incorporated environmental design measures pertaining to social includes:

- The Project will make use of land that has previously been permitted and used by the Project for E&A well pads, thereby reducing the amount of additional undisturbed land where direct impacts to land use and cultural heritage assets can occur. Previous well pads were subject to permitting by the NEMA and by an internal Site Specific Assessment process undertaken by the Operator.

7.9.7.2 Good Industry Practice

The impact analysis also incorporates the corporate policies and procedures as designed by the Project proponent (the Operator). The Operator has designed and developed its own internal policies and procedures for operations in Kenya.

In addition, apart from the IFC PSs, there are GIP guidelines that have also been incorporated into this assessment. The following are relevant when assessing social, including health impacts:

- IFC (2007e) – Stakeholder Engagement: A Good Practice Guide for Companies Doing Business in Emerging Markets;
- IFC (2009) – Good Practice Note: Addressing Grievances from Project-Affected Communities: Guidance for Projects and Companies on Designing Grievance Mechanisms;
- WBG and EBRD (2009) – Workers' Accommodation: Processes and Standards;
- IFC (2014a) – ESMS Implementation Handbook;
- WBG (2017) – Good Practice Note: Managing Contractors' Environmental and Social Performance;
- Voluntary Principles on Security and Human Rights (VPSHR) (2000).

7.9.8 Impact Classification

Taking into account the baseline social setting (Section 6.12), the relevant incorporated measures (Section 7.9.7), and the potential sources of impact (Section 7.9.6) as determined from the Project description, the potential impact linkages are presented in this section.

The nature of social impacts is that some are experienced with greater intensity during construction than during the operations phase. Key differences between the construction and operations phase of the Project that will result in differences in social impacts include the following:

- The operational phase workforce is significantly less than the construction phase workforce;
- Workforce interaction with communities will reduce once construction is complete;
- There will be less procurement and less employment opportunities during the operations phase than during construction;
- Once constructed, certain infrastructure (e.g., flowlines) will have less impact on land use; and
- There will be less truck movement during operations.

Monitoring will be undertaken throughout the Project life to support the implementation of management and mitigation measures, to monitor their success and adapt such measures according to the findings of the Operator's committed monitoring measures through the Operator Social Performance Plan. This includes reviewing proposed operational mitigation measures at the end of construction.

A discussion regarding feasible impact linkages during each of the Project phases is presented in each of the sub-sections below, which are organised around social impact themes. Each theme initially identifies social impact topics that will be assessed and assigned a predicted significance rating. The impacts and associated mitigation commitments are then summarised in two impact assessment tables Table 7.9-5 for construction and Table 7.9-6 for operations.

7.9.9 Social Impact Themes

Impacts on PAP have been identified by social impact theme, each of which describe one or more impact "topics". The theme discussions in the following sections concentrate on impacts during construction, with the proposed construction mitigation measures presented within Table 7.9-5. Operations phase impacts are disaggregated in the narrative and proposed operations mitigation measures presented in Table 7.9-6.

Mitigation and management measures will be refined throughout the life of the Project based on monitoring outcomes. Operations phase social management and mitigation measures will be informed by the construction monitoring outcomes, although, it is unlikely that additional mitigation, not initiated during construction, will be required during operations.

Where mitigation measures are repeated for different receptors, they are stated as a numbered "Repeated mitigation" in the initial instance and referred back to thereafter.

Impacts and mitigation relating to gender and vulnerable groups (which include by definition (Section 6.12) female lead households and widows) are addressed throughout the social impact themes. During social baseline data gathering, there were focus group discussions with women, and with 'elders', who by definition in Turkana are older adults (seniors or elderly) and consultation meetings considered appropriate representation of various subgroups within communities. The assessment of various social themes (including employment, community health and safety and social maladies) point to specific mitigation relating to gender and vulnerable groups and the Operator Social Performance Plan will address issues related to the security of women and vulnerable people, issues related to their access to services (i.e., education and women's healthcare), and seek out opportunities for economic empowerment of underrepresented groups.

One critical mitigation commitment applicable to all impact topics is the Operator's continued stakeholder engagement work, as set out in the Project SEP presented in Annex II. This cross-cutting plan sets the Project's 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.

Stakeholder engagement serves as a tool to identify unforeseen impacts as soon as possible. The SEP highlights past engagement efforts prior to the beginning of the Project, the approach to stakeholder identification, the future engagement programme and the roles and responsibilities for implementing the SEP.

The final section of the SEP is a detailed description of the grievance mechanism, facilitated through the Operator's Grievance Management Procedure, a multi-tiered system for reviewing and resolving registered grievances. Implementation of the SEP and effective response to grievances is essential in managing all impact categories described below.

7.9.9.1 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.

7.9.9.2 Demographics

One impact topic has been identified in relation to demographics: Project-induced influx and in-migration. Population change, whether increasing or decreasing, can have both positive and negative outcomes. New in-migrants can increase economic opportunities and expand the demand for goods and services. However, unplanned and uncontrolled influx can overwhelm existing infrastructure and generate a series of indirect impacts. For the purpose of impact analysis, the direction of this impact is negative.

The terms influx and in-migration can be used interchangeably. The impact topic addresses the potential impacts of *Project-induced* influx and in-migration. This is distinct from other forms of migration that may take place from non-Project related dynamics.

7.9.9.2.1 Project-induced Influx and In-migration

Local population changes are complex and are difficult to measure in the AoI. Traditional movement of people, as related to pastoralism in Turkana and West Pokot Counties, makes it difficult to count the total population. Pastoralists move in search of favourable grazing conditions during dry and rainy seasons and this periodic movement can be influenced by a volatile security situation linked to banditry or cattle raiding.

While reliable baseline data was difficult to locate, the 2019 census data indicates a general trend of rural population moving into urban settlements. Turkana Central, Turkana East and Turkana South are the fastest growing Sub-counties in Turkana. Turkana East is growing at the fastest rate, increasing its population by over

50% in the last 10 years. This is in stark contrast to other areas of the County that have seen their populations decrease in the same period.

The key urban settlements in the AoI are the Sub-county centres of Lokichar in Turkana South and Lokori in Turkana East. Key informants generally describe a population that is increasing, but many noted that there has been a slow down or even a reversal, of influx after KJV scaled back operations in 2017. This suggests that this type of migration is closely linked to pull factors related to Project economic activity.

Project-induced influx is a cross-cutting topic that affects and can be affected by numerous social and environmental aspects of the Project. What may seem like standard administrative tasks, such as employee recruitment or where to accommodate workers, can have important effects on influx, particularly rapid uncontrolled influx.

Key sources of impact on influx and in-migration are economic opportunities (pull factors). Such opportunities include those derived from the direct workforce, which is expected to peak at approximately 2,400 workers during the construction phase. This workforce will be recruited and managed by contractors, but initial estimates are that Unskilled, Semi-skilled and Skilled requirements will be 15%, 25% and 60% respectively. Economic opportunities are also created from a multiplier effect in which increased salaried employment generates more wealth and demand for goods and services. This demand encourages new opportunities. Such opportunities observed in baseline research include the demand for accommodation, entertainment and food. The increase in required workforce and potential local procurement opportunities during construction has the potential to increase influx and in-migration. The reduction of the workforce and local procurement opportunities during operations should reduce migration of this type during the operations phase of the Project.

Growing economic opportunities are generally considered a positive outcome, however, rapid and uncontrolled influx of people seeking economic opportunities can create problems if not monitored and considered with a given location's ability to absorb the newcomers. These negative impacts can be felt through increased pressure on a location's infrastructure, including schools, hospitals and other public services. Beyond just the size and capacity of infrastructure, health can be affected by changes in the increased prevalence of diseases like TB and STIs (Section 7.9.9.6), and social maladies, such as commercial sex work and crime (Section 7.9.9.5). Outsiders can also influence community cohesion in instances where jealousy over jobs creates resentment and possibly conflict.

Outsider influence can also have indirect impacts on localised intangible cultural heritage (Section 7.10), particularly in areas where communities following traditional practices are increasingly pressed into contact with outsiders who may have different cultural norms. These impacts can be both positive and negative, resulting in either a bolstering of activity in response to outside influence or, a dilution of traditional practice.

Rural areas can experience a strain, as a result of rural to rural migration, on natural resources such as water supply, pastureland plants, and animals used by local people to maintain their livelihoods. In the AoI, this can impact on charcoal production or the collection of medicinal plants (Section 7.8) for example.

Not all 'pull' factors that drive influx are within the control of the Operator and its contractors, but the main elements that are governed by the Operator and need to be considered are worker recruitment, worker accommodation, the associated management of how workers (direct employees and contractors) interact with local populations, procurement of goods and services locally and social investment activities and projects. The Operator considerations must include:

- Worker recruitment, if not well defined and targeted, can create incentives for people to move, especially in places such as Turkana and West Pokot where there is relatively limited salaried employment compared to other parts of the country.

- Procurement of local goods and services can also create incentives for people to move to certain places especially within the Project AoI given the very limited economic opportunities in the wider Project vicinity.
- Social investment activities and projects also create the potential for economic opportunities and access to services such as water. The KJV has maintained an active effort to identify and support social investment projects in its area of operation since 2011. At least 87 projects have been initiated with many completed and handed over to the Government or partners to manage. The primary areas for these projects are in the fields of education, health and water. In the past, projects have been closely linked with agreements for land access, but many are simply a part of discretionary social investment. Like direct employment or other economic opportunities linked to a diversifying and expanding local economy, Project related social investment projects have and will continue to provide incentives for influx. The demand for services, particularly the provision of water, can be a strong motivating factor, especially in times of drought where livestock and people themselves are at risk. In this context, there is a risk that the Project can have an indirect and negative impact even when the initial objective was to assist a local population.
- In the Project AoI, the Sub-county centres of Lokichar and Lokori both report a general trend of rural-to-urban migration. This is linked to a concentration of economic opportunities in these centres. Both are likely to be settlements that will experience influx. Other settlements, particularly those closest to existing wellpads, such as Nakukulas in the Kochodin Location, are likely destinations as well, especially as this rural settlement has seen the most social investment. Overall, the Kochodin Location in Turkana East Sub-county and the Lokichar Location in Turkana South are the most probable areas that may be affected. Other major settlements along transport corridors may see increased Project activity, but this will not be of the same intensity as the aforementioned locations, which will host construction and operations accommodation.
- Other accommodation camps will be temporary in nature, creating only short-term business opportunities and therefore limited incentives for people to move into these rural areas.

In addition to the Project-related “pull” factors, recent insecurity in the border region between Turkana County and West Pokot County has led to pastoralist households moving towards areas containing Project related infrastructure. While this is a factor which the Project is unable to control, it will exacerbate Project-induced influx.

Project-induced influx and in-migration is assessed to be negative direction, as the benefits linked to a growing population are out-weighed by the negative risks associated with uncontrolled, possibly rapid, influx.

During construction, prior to any mitigation, the consequence is high and the geographic extent of the change can be expected to be local, affecting PAP hotspots close to the Project infrastructure, including areas of construction where services cannot support influx (on top of natural growth). Although the duration of the construction phase is short-term, the impact may not be reversible i.e., where migrants have established themselves in the area (and do not return home after the construction phase ceases). The impact significance of influx and in-migration for construction prior to mitigation is **Major (negative)**.

Implementation of the Operator Social Performance Plan during construction should result in a reduction of the risk of influx and its consequences during operations. This could lead to influx management measures being less resource intensive during the operations phase. There may be an initial influx during the first year of operation, when the Project may still attract newcomers. Over time, however, into the operations phases less people are likely to be attracted to the area. The consequence therefore is predicted to be moderate and the geographic extent of the change can be expected to be local, affecting PAP hotspots close to the operations Project infrastructure, with construction areas significantly reduced. The duration for the operational impact is medium-term. The impact significance for operations prior to mitigation is **Moderate (negative)**.

7.9.9.2.2 Mitigation (construction)

Mitigation for Project-induced influx during both construction and operations will be organised in four key areas:

- Monitoring;
- Reducing incentives for uncontrolled migration;
- Managing worker integration with local communities; and
- Engagement.

The Operator Social Performance Plan will present influx management procedures to be developed in coordination with key stakeholders prior to construction, and then maintained throughout operations. Any effort to monitor population movement will require consistent cooperation between the Operator and local authorities.

Prior to start of construction, the Operator will work with National Government, the County Administration and key stakeholders to support the monitoring of population changes in key settlements (Lokichar, Nakukulas, Lokori) to identify significant changes in population. While the 2019 data provides some indication of demographic trends, baseline efforts have been unsuccessful in identifying demographic data other than the census taken every 10 years. While numerous key informant interviews found that Location Chiefs regularly record population estimates and a list of administrative units within their jurisdiction, there is no clear and consistent method for monitoring population spikes. Similarly, there is no existing reporting format through which Location Chiefs or any other officials pass information to centralised authorities.

Also prior to construction, the Operator will develop a methodology to monitor growth of homesteads and physically monitor the quantity and locations of homesteads in the immediate areas surrounding Project facilities. This monitoring data will be gathered for up to 3 years and used to identify in-migration “hot spots” and thereby develop appropriate mitigation plans in response to changing circumstances. The Operator will determine the exceedance thresholds for action in order to reduce the impacts of population influx. For example, the Operator will work with TCG to identify locations for alternative water supply boreholes away from Project facilities to encourage households to move to other, less congested, locations.

Once identified, the Operator will make sure that monitoring indicators are collected at both ‘hot spots’, like the Lokichar and Kochodin locations that are to host the majority of the permanent infrastructure, and also key areas that are relatively less likely to see regular Project activities. The exact number of monitoring locations will be determined in consultation with key stakeholders and stated in the Operator Social Performance Plan (which will present influx management procedures for the Project). Engagement activities and meetings with key stakeholders will continue throughout operations as detailed in the SEP. However, the frequency of meetings, engagement and monitoring activities relating to population growth may reduce following construction.

The Operator will work with National Government, the County Administration and key stakeholders to establish and develop the terms of reference for an influx working group, which will be chaired by a representative of County Government and include representatives from National and County Government departments, and relevant CSOs. The Operator will sit as a member on this working group. The aim of the group will be to review, monitor and support actions to manage Project-induced influx.

All employees will adhere to the Operator Code Conduct (Repeated Mitigation: Social 01). This document sets the expectation for all who work for the Operator and their contractors. The Operator will train all employees and contractor workers in the Operator Code of Conduct, including worker rights and human rights, in line with the Operator commitment to implement the UN Guiding Principles on Business and Human Rights and the Voluntary Principles on Security and Human Rights (Voluntary Principles).

The Operator will work with Turkana County Administration to identify locations for alternative water supply boreholes away from Project facilities to encourage households to move to other, less congested, locations.

The Operator Local Content Development Plan and Workforce Training Strategy (Repeated Mitigation: Social 02) will provide the framework for local recruitment to reduce incentives for in-migration, which will be communicated broadly in the region. Key principles of the recruitment procedures are to avoid confusion around the hiring practice and being clear on what job and local content opportunities are available, making sure this matches with external expectations, including:

- No informal ("at the gate") recruitment; and
- Clear definitions and criteria will be established for hiring of "local" and "local-local" workers, including a verification process to confirm their residency status.

These key principles, communicated frequently, help to mitigate the impact of rumours. Unclear procedure and definitions can cause job-seekers to move or re-establish themselves in areas where they think that might increase their chances of securing employment. The communication of each principle will extend beyond the closest locations in Turkana and West Pokot Counties.

More specifically, the Recruitment Procedure outlined in the Local Content Development Plan and Workforce Training Strategy Communication (Repeated Mitigation: Social 02) details the framework for hiring of all employees, as well as roles and responsibilities in that process. The Operator will undertake a campaign to communicate the plan to stakeholders and describe the recruitment procedures to be followed. The campaign will focus efforts on priority groups and communities identified (in the Operator Local Content Development Plan) as coming from target communities for employment.

During construction, the Operator will also undertake advance planning and management of retrenchment and demobilisation of Project and contractor workers in line with Kenyan Labour Law and international good practice as set out in the Operator Contractor Demobilisation Plan (Repeated Mitigation: Social 03) to set out requirements including:

- Any Collective Redundancies will be undertaken within the framework of a Retrenchment Plan (as described in the Operator Social Performance Plan).
- At the time of hiring, the period of employment assignment and the conditions for hiring and layoff will be clearly explained to the new recruits and recorded in individual employment contract; and
- The Operator will establish company retrenchment procedures and contractor demobilisation procedures including returning workers to the place from where they were recruited or to their domicile.

The Operator Social Performance Plan will set out clear roles and responsibilities, especially as influx management is linked to disparate functions across the company and to contractors outside the company. the Operator will acknowledge that people may move towards the project not for direct employment but to take advantage of economic opportunities related to job growth and the presence of wage earners with disposable income. This in-migration is not predictable in volume, is based on what individuals perceive to be in their best interest and is not within the Operator's control. While the Operator can discourage job seekers that do not have a secure offer of employment, work with the contractors to disincentivise migration, the influx working group is in part, designed to address the impact of rapid uncontrolled migration, an indirect impact of the Project. The Operator's contributions to community development and investment may help address service capacity issues, and the counties could use project (tax) contributions to increase capacity in critical areas, however, monitoring and medium to long term planning, is required and the impacts of in-migration and Project-induced influx are unlikely to be fully mitigated.

7.9.9.2.3 Mitigation (operations)

During project operation, the Operator will maintain the influx management procedures established during construction (suitably revised for operations), which are presented in the Operator Social Performance Plan and were agreed in coordination with Turkana and West Pokot County Administrations. Furthermore, the Operator will work with National Government, County Administration and key stakeholders to support the monitoring of population changes in key settlements (Lokichar, Nakukulas, Lokori) and work with the relevant county and national administrations to monitor growth and location of homesteads in the immediate areas surrounding Project facilities and enact actions to manage influx during operation.

The Operator will attend the Influx Working Group and make efforts to reduce the incentives for influx through its recruitment procedures as specified in the Operator's Local Content Development Plan and Workforce Training Strategy Communication (Repeated Mitigation: Social 02) the Operator will undertake a campaign to communicate operational requirements through the Local Content Development Plan. All employees will adhere to the existing the Operator Code Conduct (Repeated Mitigation: Social 01).

7.9.9.2.4 Residual Impacts

Impacts related to Project induced influx and in-migration will be more significant during construction than in operations Influx management measures should be less resource intensive during the operations phase and informed by the influx management procedures established during construction. Residual impacts should be comparatively less during operations to those experienced during construction, but these will be experienced over a longer term. By implementing the mitigation commitments, Project-induced influx and in-migration is expected to be reduced to **Moderate (negative)** during construction and will remain **Moderate (negative)** during operation. Despite the mitigation measures described above, infrastructure and services are unlikely to adequately support both Project-induced influx as well as high natural (non-Project-related) growth over the long term. The issues around influx and migration will require regular monitoring and government commitments (to increase spending on infrastructure and services) and will likely remain moderate negative in impact.

7.9.9.3 Infrastructure and Services

There are current limitations to infrastructure and services in both Turkana and West Pokot Counties. In general, by nature of its location, climate, and relatively neglected history since independence, infrastructure and services are poor in terms of both capacity and quality.

The general lack of municipal waste facilities and waste management in both counties results in people illegally dumping waste in an uncontrolled manner. Increased pressure on existing poor waste and sanitation infrastructure due to in-migration is an indirect project impact. However, the Project itself will not increase pressure on waste facilities as it has a waste management strategy including relevant infrastructure to address the management of Project waste streams so no impact on municipal waste facilities and management is anticipated and this aspect is not assessed further in this impact assessment.

Education and health facilities are also limited, especially for those living as pastoralists. Health facilities are improving in Turkana especially in main settlements as a result of NGO activities and KJV contributions and education facilities are improving in West Pokot due to funding by Faith Based Organisations (FBOs), and NGOs. The Project's construction workforce is not expected to make use of local education or health services, due to the temporary nature of their employment. During operations, priority for employment will be given to those that already live in the area, those that are hired from further away will likely make use of services if they move to the area more permanently. The camp accommodation will have basic medical services.

It is a challenge to introduce new infrastructure and facilities in areas affected by a lack of security. The challenge of conflicts arising from competing for resources like water can affect new infrastructure development and lead to limited access and underutilisation of infrastructure in these areas

Access to water is generally inadequate in Turkana County due to the climate, lack of adequate water sources, and little utility infrastructure other than some NGO, KJV and Government installed water supply wells. In West Pokot County, a majority of the population use rivers/streams as a water source and can travel significant distance to access these sources. The Turkwel Gorge Reservoir is a major water resource in the area and is used mainly for hydro-electric power through KenGen. Communities utilise the water downstream from the dam for domestic use, watering livestock and other agricultural purposes.

The Project proposes utilising water from Turkwel Gorge Reservoir to meet the Project water demands. This is a potential impact to the users of the Turkwel Gorge Reservoir, which already has existing water demands. Availability of water is currently a contentious issue in Turkana and West Pokot Counties. Contention indirectly leads to conflict and competition for water resources. Analysis of this impact is presented in Section 7.3.

The Project will be responsible only for the interconnecting network of roads. National roads, specifically the C46 and A1 will be unaffected by the Project other than the transport of construction materials along communal roads causing wear and tear on existing road conditions as well as potential road accidents arising from increased vehicular movement. These are potential negative impacts during the construction and operational phases of the Project, although the expected vehicular movements during operations will be less than during construction.

Direct impacts to existing infrastructure are anticipated to be through the expansion of the Project infrastructure and footprint area. However, no existing social infrastructure is predicted to be directly impacted during the land acquisition process.

Indirect impacts linked to influx of people into the area can create pressure on existing infrastructure. These potential impacts are discussed in Section 7.9.9.2 of this report.

The impact on existing infrastructure in the AoI has a positive direction due to positive economic benefits of access to infrastructure (e.g., education services). The consequence is moderate and the geographic extent of the change can be expected to be local to the AoI, affecting PAP in Turkana and West Pokot Counties. The duration of the construction impact is short-term and the operational impact medium-term. The impact significance prior to mitigation or benefit enhancement for both construction and operations is **Minor (positive).**

There are no identified direct impacts linked to existing services, therefore this aspect is not assessed further in this impact assessment.

7.9.9.3.1 Mitigation (construction)

Measures to enhance benefits of the Project include the development of a Community Development Plan (CDP). Prior to construction, the Operator will work with National Government, County Administration and key stakeholders to agree on the terms of reference and projects for the Operator community investment, building on existing initiatives (including over 6,000 students supported through bursaries, textbook provision to approximately 30 schools, rehabilitation of 6 healthcare centres, provision of ambulances and medical equipment, road improvements and water reticulation projects).

Prior to construction, the Operator will coordinate with the respective County Administration and agree on the terms of reference and projects for the Operator community investment as part of the CDPs and aligned to County Integrated Development Plans. Although the focus will be on communities in Turkana County, there will be two CDPs (one for Turkana and one for West Pokot) which will clearly define all voluntary actions the Operator will take for social investment in community projects.

The CDP process will also provide a vehicle for community consultation and involvement in the management of the overall Project impacts and benefits.

Each CDP will incorporate agreements related to water access, impact management, benefits related to local content and shared infrastructure commitments, such as water and power (Figure 7.9-2). The specific content for each CDP will be negotiated based on the impacts and agreements will be based on priorities in the area and agreed with the communities.

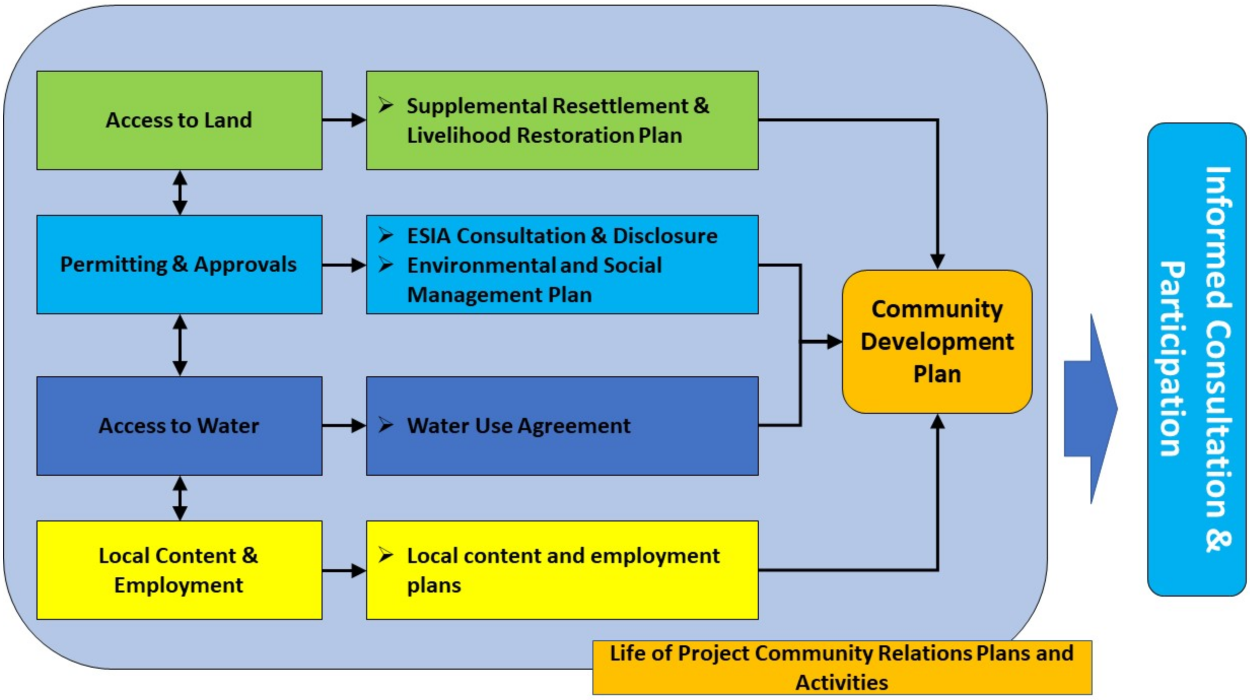

Figure 7.9-2: Community Development Plan Structure (Source: KJV 2021)

The CDP will be based on the following principles:

- Stakeholders self-determine their own development through a community-led consultative and transparent process;
- Management through a credible and representative forum using existing structures as much as possible; and
- Catchment areas (which will be defined in the CDP) will benefit more, but benefits will also be provided to the Project AoI.

The Operator will establish an engagement process to consider and agree social investment proposals and initiate CDP working groups, which will be headed by leadership at the County and Sub-county level, including representatives of government departments, private sector, NGOs and potentially religious institutions. The Operator will engage with this CDP working group to develop a transparent process, through which the Operator can communicate concepts and align annual budgets to be considered for social investment. The Operator CDP will provide clear guidelines for, and present how the Operator will support the development of the following:

- Required criteria to be met and structure of proposals for social investment projects, including how they supplement (and don't replace) existing initiatives that are provided by the County Government or National Government.
- Evidence of engagement with local stakeholders required for the Operator to consider social investment proposals.

- Definition of how the local community, including underrepresented groups, vulnerable and marginalised people, will benefit from social investment projects. The planned distribution of CDP projects throughout the local community should be documented to avoid inter-area competition.
- Definition of the “ownership“ model of proposed social investment projects, key performance indicators and success criteria.
- Method of tracking successful implementation and delivery of the investment projects.
- How performance will be communicated annually in sustainability reports and to County governments.
- Required methods of communication and mandatory information to be provided (e.g., period of funding, amount, project type) to local communities once investment projects have been agreed.
- Expected sustainability, governance, auditing and monitoring throughout the investment projects and required reporting format

The element of the CDP most related to infrastructure is the sustainable community water solutions programme. Within this programme the Operator will promote the development of sustainable community water solutions within the Project AoI, specifically focussing on the replacement of existing bowser-filled water points. Such sustainable community potable water solutions will comprise both groundwater sources and the development of closed reticulated systems connecting proximate communities that have accessed the roadside community water points. The Operator will work with the County Government and local institutions to connect community water points in the Kochodin Location. The source of water will be the Nakukulas 10 borehole, which has already been converted to a solar powered system and is being managed by the Kochodin Water Resources Users Association (KWRUA) and technical support through the TCG water services department. This system is now operated by KWRUA.

The Operator CDP Availability and Update (Repeated Mitigation: Social 04) will ensure that the Operator CDP will be publicly available and updated in timely fashion with agreed social investment projects. In the CDP, the Operator will present how investment projects distribute benefits transparently and fairly among affected communities, how the investment projects mitigate Project-induced in-migration

In addition, to mitigate potential construction impacts, through the Sustainable use of Community Offtakes (Repeated Mitigation: Social 05) the Operator commits to seeking opportunities to encourage sustainable use of community offtake water points on the water pipeline to discourage overgrazing at water off take points, via the Upstream Water Framework Agreement, and collaboratively address issues submitted through the Operator Grievance Management Procedure.

7.9.9.3.2 Mitigation (operations)

During project operation, the Operator will continue to coordinate with County Governments and the County Commissioners, in line with the CDP and aligned to the County Integrated Development Plan. The Operator will communicate social investment projects annually in sustainability reports and continue to meet sustainability, governance, auditing and monitoring requirements described in the CDP. During operation, The Operator CDP Availability and Update (Repeated Mitigation: Social 04) and the Sustainable use of Community Offtakes (Repeated Mitigation: Social 05) will continue to be implemented.

7.9.9.3.3 Residual Impacts

Given the above considerations related to benefit enhancement, transparent communication and assuming the CDP is successfully implemented throughout the life of the project the residual impacts during both construction and operation are expected to be **Moderate (positive).**

7.9.9.4 Economics, Employment and Livelihoods

The following five impact topics have been identified in relation to economics, employment and livelihoods. Livelihoods is considered in this section in the context of salaried employment, whereas impacts on sectors of livelihoods such as pastoralism are considered in the Section 7.9.9.5 on land:

- Taxes and payments;
- Direct employment;
- Contractor (indirect) employment opportunities;
- Business opportunities and local content; and
- Inflation.

7.9.9.4.1 Taxes and other payments

Taxes and other payments to National and County governments can be assumed to be a positive influence on the continuation of economic growth that Kenya has experienced since the early 2000s. Key areas that have driven growth include increased free primary education, improved health services and infrastructure developments, which should all be enhanced further by an increase in government revenue.

Kenya has achieved an average of 5.4% growth in GDP over the last five years, even if there are some signs of a slowdown linked to drought conditions on agriculture, decreased credit and political uncertainty. A stronger tax base serves to positively influence national economic indicators. COVID-19 has had a negative impact on growth, difficult to measure with any precision as the situation is still unfolding. However, in June 2021, the World Bank approved $750 million of development policy financing to support Kenya's recovery efforts and improve public investment spending, with priorities on supporting the healthcare sector.

Kenya has shown improvement in its overall business environment, being listed as one of the top ten improved countries in the World Bank's annual report, *Doing Business*, partly due to improvements in its tax system in such a way to simplify and improve the process.

The key source of impact is the direct link between an overall multi-billion dollar investment and tax revenue. 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 7.9-2 presents all payments made by TKBV in Kenya from 2014 to 2018 (as the Operator). In Kenya, all payments are at the corporate level.

Table 7.9-2: Transparency Disclosure 2018: Kenya (all figures $000)

Year	Income taxes	Licence fees	Infrastructure Improvements	VAT	With-holding tax	PAYE & national insurance	Customs duties	Training allowance	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
2018	1	436	51	5	1,342	6,095	76	790	7,427

Source: TKBV Annual Report and Accounts 2014, 2015, 2016, 2017 and 2018.

Due to the cessation of field activities, additional payments made by the Project are not available at this time. Revenue from the Project will be subject to the terms of the Petroleum Act, which came into effect in March 2019. The formula currently provides for profit derived from the upstream petroleum operations to be shared between the contractor and the National government. From the National government share, 20% shall be given to the County government and 5% to local community, which is defined as people living in a Sub-county within which a petroleum resource is situated and are affected by the exploitation of that petroleum resource. The local community's share will be payable to a trust fund managed by a board of trustees established by the respective County Government in consultation with the local community. The County Government will legislate on the establishment of a board of trustees, as well as on the utilisation of the fund "for the benefit of present and future generations".

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, labour requirements, environmental regulation and conservation requirements in line with international standards.

Taxes and other payments are assessed to have a mixed direction, though overall are expected to result in benefits of a positive direction. The consequence has the potential to be high, and the geographic extent of the change can be expected to be national, increasing tax revenue for National, County and smaller administrative units, although the Operator will have no control over the continued distribution of tax benefits at a county and local level. The duration of the impact is short-term during construction and medium-term during operations. The impact significance prior to mitigation or benefit enhancement both during construction and operations is **Moderate (positive).**

The EU Accounting Directive (2013/34/EU) came into force in 2014 in the UK as the Reports on Payments to Governments Regulations. This UK regulation requires UK companies in the extractive sector to publicly disclose payments made to governments in countries where they operate. The Operator and UK-listed shareholders in the Operator will disclose payments in Annual Reports in accordance with applicable legal requirements (Taxes and Payments Repeated Mitigation: Social 06)

Measures to enhance benefits of the Project include the creation of a County-level board of trustees

[33] charged with overseeing government revenues, which will play an important role in the fair and equitable distribution of benefits related to the Project (Repeated Mitigation Social 06: Taxes and Payments). The Operator will include the board of trustees in on-going meetings with government officials related to key social management plans, including the Social Performance Plan and CDPs, which form the core framework for community-wide impact mitigation and benefit enhancement.

7.9.9.4.2 Residual Impacts

While transparency in tax payments will reduce the risk that payments to all levels of government can be misused, these commitments are legal requirements and therefore are not mitigation and will not change impact significance. Therefore, the residual impact significance remains **Moderate (positive)** for both construction and operations**.**

7.9.9.4.3 Employment

Employment opportunities related to the Project are all expected to be indirect or contractor employment. Details of the Operator HR management is discussed in the following impact topic.

[33] A County-level board of trustees is described in the Petroleum Act as the body that will oversee the utilisation of funds levied from oil and gas operations "*for the benefit of present and future generations*".

7.9.9.4.4 Contractor (Indirect) Employment Opportunities

Wage earners constitute only 6% of the population in Turkana County and 5% in West Pokot County. Both areas also have very high unemployment rates in great contrast to the rest of the country and reliable data is difficult given the large percentage of residents who are engaged in pastoralism, thereby working outside sectors that provide salaried employment.

Key issues for unemployment and low levels of salaried work are linked to inadequate skills/training for the local population, and also fewer employment opportunities.

The KJV has sought to maximise employment opportunities for Kenyans. Since 2013, they have maintained data on contract workers, including the number of expats, Kenyan nationals and Turkana workers given that the majority of the work to date has taken place in Turkana County. Analysis of that data indicates that there has been an average of 93% of the contractor workforce coming from Kenya and 61% coming from the host County of Turkana. At the peak of contractor employment in October 2014 when 3,842 people were employed, 90% of the contractor workforce was Kenyan and 62% from Turkana County.

Contractor employment in September 2019 was 814 with 98% from Kenya and 61% from Turkana. With the exception of two months in February and March of 2019, employment had not topped 1,000 workers since November 2017. Note that at the current time (June 2021), virtually all Project staff have been demobilised.

Available data does not disaggregate in such a way to show trends in gender, other demographic differences or skill level.

A key source of impact is the increase in direct contractor workforce, which is expected to peak at between 2,400 during the construction phase[34]. This workforce will be recruited and managed by a Contractor. It is estimated that Unskilled, Semi-skilled and Skilled requirements will be 15%, 25% and 60% respectively.

For the Project, workforce estimates are only preliminary. These figures are presented in a draft National Content Plan (2018) but are meant to be updated as part of an overarching Field Development Plan, which will contain a Local Content Plan. The updated documents will incorporate upstream, midstream and well engineering work streams to be completed after the tendering process for contractors.

Employment and new jobs, direct and indirect through contractors, are generally considered a positive impact. However, the overall direction of new employment opportunities is mixed. Job creation, particularly in areas of limited opportunities for salaried employment, 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.

The impact of contractor employment has a mixed direction. The consequence is high and the geographic extent of the change can be expected to be national, going beyond the AoI. The duration of the impact is short-term during construction and medium-term during operations. The impact significance prior to mitigation or benefit enhancement for both construction and operation phases is **Minor (positive).**

Measures to enhance benefits of the Project include management of the negative aspects of contractor employment, which is done through human resources management and procurement. The Operator will be cognisant of the fact that a substantial number of skilled and semi-skilled workers will not be from the host Counties or Kenya.

[34] Worker estimates are based on two scenarios, one being a base case with a peak workforce of 3,400 and the second based on an assumption that some components of the CPF will be modularised and arrive in Kenya partially constructed, thereby reducing the number of workers needed in-country. Lower end estimated with modularisation are at 2,700.

7.9.9.4.5 Mitigation (construction)

The Operator will develop a National Content Development Plan and a Local Content Development Plan, which will be issued to prospective EPC tenderers who will be required to prepare National and Local Content Development Plans to implement the Operator requirements.

The Operator National Content Development Plan and Local Content Development Plan will set out specific objectives, procedures and requirements related to contractor employment and procurement. These plans will set out the requirements relating to contractor employment for EPC bidders to include in their National Content Development Plans, including Key Performance Indicators (KPIs) for national and local content inclusion; the minimum requirements and expectations for contractor employment; procedures for the monitoring and audit of contractor managed construction and employment opportunities.

As part of the Operator Local Content Development Plan, the Operator will develop a Workforce Training Strategy and associated Implementation Plan, which will describe how the Operator, and their contractors will:

- Define how local residents from the Project AoI will be given preference for vocational training.
- Collaborate with selected training partners to develop a range of bridging / job-readiness training packages for potential local employees.
- Support existing technical and vocational training programmes to enhance the qualifications and training of local workers.
- Ensure all employment opportunities will be open to both men and women on an equal basis and how this will be tracked to determine if there are barriers to be addressed.
- Assist members of the local workforce, who are less qualified, with gaining access to existing technical and vocational training programmes (e.g., a programme available to support basic training, literacy, numeracy and Health and safety).

The Operator Local Content Development Plan will define the following, adherence to which will be mandatory for all contractors:

- There will be no informal (“at the gate”) recruitment;
- Procedures for the hiring of unskilled and low-skilled workers for local residents in the Project AoI, and for workers likely to travel to the project on a speculative basis in search of work.
- Definitions and criteria will be established for hiring of “local” and “local-local” workers.
- Procedures describing that there will be “*zero tolerance*” for any form of discrimination based on sex, gender, age, religion, ethnicity and disability.
- Procedures describing that there will be “*zero tolerance*” for hunting, foraging, unpermitted use of natural resources within the Project AoI
- All contractors will track and report quarterly Contractor Employment data by gender.
- Adoption of the Operator Grievance Management Procedure.

The Operator Local Content Development Plan and Workforce Training Strategy Communication (Repeated mitigation: Social 02) will apply.

The Operator will maintain a Human Rights Policy (Repeated Mitigation: Social 07) that will state its commitment to implement the UN Guiding Principles on Business and Human Rights and the Voluntary Principles on Security and Human Rights (Voluntary Principles). This Policy will be publicly disclosed and will be applicable to all who work for or on behalf of the Operator. The Operator Local Content Development Plan will also include details of how the Human Rights Policy will be implemented and monitored including explicit detail on the Operator and contractor's compliance with International Labour Organisation (ILO) Core Conventions, including child labour and forced labour.

The Operator Contractor Demobilisation Plan (Repeated Mitigation: Social 03) will also apply. The Project intends to avoid Collective Redundancies. Any Collective Redundancies will be undertaken within the framework of a Retrenchment Plan (as described in the Social Performance Plan). All worker terminations will be performed strictly according to Kenyan Labour Law and international good practice. The Operator will develop procedures to guide retrenchment of employees should this process be required and these will include the following minimum procedures to ensure appropriate termination practices:

- At the time of hiring, the period of employment assignment and the conditions for hiring and layoff will be clearly explained to the new recruits and recorded in individual employment contract;
- During regular meetings held with worker representatives, personnel management will share information on the Project's schedule and potential forthcoming layoffs (particularly for temporary construction jobs);
- All contractors will be expected to follow this policy and will be required to apply this guideline; and
- The Project (or the applicable contractor) is responsible for returning workers to the place from where they were recruited or to their domicile (the place of hire will be specified and transport service or cost of transportation will be covered).

To manage complaints, the Operator must ensure that contractors are committed to ensuring their workers use a grievance mechanism, which is to be copied by the contractor and provided to the Operator, or to utilise the Operator Community Grievance Management Procedure.

7.9.9.4.6 Mitigation (operations)

During project operation the Operator National Content Development Plan and Local Content Development Plan will maintain procedures and requirements related to contractor employment and procurement, Key Performance Indicators (KPIs) for national and local content inclusion and performance requirements, minimum requirements and expectations for contractor employment, monitoring and audit of contractor managed construction and employment opportunities.

The Operator Code of Conduct (Repeated Mitigation: Social 01) and Human Rights Policy (Repeated Mitigation: Social 07) will continue to be applicable.

7.9.9.4.7 Residual Impacts

Adherence to the Human Resource commitments described in the Operator Local Content Development Plan and Workforce Training (Repeated Mitigation: Social 02) by both the Operator and their contractors, together with efforts to communicate transparently, the impact of contractor employment is assessed to be positive. The residual impact significance prior to further mitigation or enhancement is **Moderate (positive)** for both construction and operations.

7.9.9.4.8 Business Opportunities and Local Content

The AoI is predominantly a pastoralist zone with 80% of the population relying on livestock to provide the main source of food and cash income. Self-employment, which is the remaining 20% of business activity, is limited to charcoal, weaving and brewing. There is some crop farming near rivers that allow for some small-scale agriculture, primarily at the household level.

There is limited infrastructure and limited capacities in the engineering fields in Turkana County. Regional firms are limited to small scale civil works such as grading roads, building classrooms or other amenities. Reasons for the limitations cited in previous studies are a lack of equipment, a lack of highly trained personnel, poor management systems, and low capital investment.

Similar to employment, the business opportunities created by the procurement of local content, goods and services are generally considered to be a positive social impact. However, a limited skills base and high standards for health and safety and quality assurance, limit the Project's overall ability to buy goods and services in the local and even regional economy. Also, in a similar way to contractor employment benefits, and business opportunities can have a negative impact without procedures for transparency. Even with such procedures, the high expectations among local residents create a dynamic where rumours about corruption can have detrimental effects.

There are no specific financial figures on the additional procurement related to the Project at this time. Capital expenditures were not completed at the ESIA stage but will be disclosed publicly on an annual basis by the Operator.

The impact of business opportunities has a mixed direction. The consequence is moderate and the geographic extent of the change can be expected to be national, going beyond the AoI. The duration of the impact is medium-term. The impact significance prior to mitigation or benefit enhancement is **Minor (positive)** during both construction and operations**.**

7.9.9.4.9 Mitigation (construction)

The Operator Local Content Development Plan will set out the specific objectives, procedures and requirements related to business opportunities and procurement, KPIs for national and local content inclusion and performance requirements, minimum requirements and expectations for suppliers and the monitoring and audit of (both the Operator and contractor managed) procurement. The Operator National Content Plan will seek to maximise national content, subject to acceptable price and quality. This will include:

- the Operator National and Local Content Principles;
- National content targets (in terms of value);
- Integration with existing national programmes and industry bodies to maximise national content;
- Minimum requirements and expectations for national content providers;
- Monitoring and audit of EPC activities and performance by the Operator;
- KPIs for national content inclusion and performance;
- Performance reporting to Government of Kenya; and
- Requirements for EPC bidders to include in their national content plans.

The Operator will work with the selected EPC contractor to develop and agree the EPC National and Local Content Implementation Plans. These plans will include:

- National and local content targets (in terms of value) for procurement of goods and services;
- Identification of specific action plans to maximise national and local content in identified key sectors;
- Plans for skills development and job readiness training with existing programmes and organisations;
- Procurement principles and procedures;

- The Operator and EPC policies and compliance requirements;
- Mechanism for monitoring changes in nation and local workforces through skills development and training opportunities;
- KPIs for national and local content inclusion and performance; and
- Performance monitoring, auditing and reporting.

The Operator will undertake a campaign to communicate the Local Content Development Plan to local suppliers and businesses, with its targets and methods described in the Stakeholder Engagement Plan. This communication campaign will explain local procurement opportunities and processes and how businesses can qualify for tendering processes. Specifically, The Operator Local Content Development Plan will describe how the Operator, and its contractors will:

- Collaborate with local businesses to assess and develop local business capacity;
- Set out commitments for local business capacity building, including assisting local businesses to gain access to existing technical and vocational training programmes;
- Ensure all procurement for the project will be transparent and on an equal basis; and
- Identify key performance indicators to monitor changes in business opportunities and local content performance.

7.9.9.4.10 Mitigation (operations)

During project operation the Operator Local Content Development Plan will be maintained with procedures and requirements related to business opportunities and procurement, KPIs for national and local content inclusion and performance requirements, minimum requirements and expectations for suppliers, monitoring and audit of the Operator and contractor managed procurement. The Operator will also undertake a campaign to communicate operational requirements for local suppliers and businesses prior to operations commencement. The communication campaign will explain local procurement opportunities and procedures to be followed.

Residual Impacts

Whilst the level of business opportunities may decrease in intensity during operations comparative to during construction, the operations phase is a much longer duration and therefore offers a longer period of potential benefits. Given the benefit enhancement commitments and efforts to communicate about business opportunities, the residual impact is **Moderate (positive)** during both construction and operations. .

7.9.9.4.11 Inflation

Research suggests that the arrival of oil operations in Turkana has had both positive and negative impacts on the local economy. Overall, the economic activity is seen as positive, however numerous people noted that increased demand for products has triggered inflation. This has affected goods and services, as well as the price of land. In some cases, it is reported that there has been a tenfold increase in private land prices in more urban settlements since oil has been discovered. Inflation is not easily attributable to one factor. While it is likely linked to oil exploration and appraisal activities, key informants also suggest it is linked to climate factors and poor infrastructure that can hamper the food delivery and increase transportation costs.

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.

During construction, impacts are short-term, but demand for local goods and services along with influx is likely to be more onerous due to the number of workers required. During operations, impacts are medium-term and demand for local goods and services and influx should decrease as the construction workforce reduces. Therefore, on balance, inflation is a negative impact and the consequence is assessed as moderate during construction and reduced to minor during operations. The effects of the impact will be most severe for those who are more vulnerable. The geographic extent of the change can be expected to be local, affecting those administrative units hosting Project workers on salaried employment. The impact significance prior to mitigation or benefit enhancement is **Moderate (negative)** for construction and **Minor (negative)** during operations**.**

The Operator Social Performance Plan will describe the strategy to use local and national suppliers and ensure the best market price is sought from suppliers to help manage local inflation. The Operator Social Performance Plan will also present methods for monitoring of local inflation and set out how information will be shared with County Government officials.

The Operator will work with government authorities to select a standard "*basket of goods*" to monitor prices periodically. The selection will include common staples such as meat and maize but should also include prices of accommodation and other services that may be affected by an increase in job and opportunity seekers. The monitoring will include areas in hotspot areas such as Lokichar and Kochodin that are expected to experience influx, but also "*control*" areas beyond the AoI, which will indicate whether price increases are different near the Project's activities or reflect other trends that may be affecting the entire region, such as drought.

The Operator will coordinate with NDMA to collect data similar, but supplementary, information to NDMA monthly surveys on socio-economic indicators throughout the construction period. Such monitoring will allow for comparisons between the County-wide averages on socio-economic indicators and those same indicators near Project activities.

The Operator will review data on a quarterly basis with the County Administration to identify local Project-induced price inflation. Residual impacts should be comparatively less during operations to those experienced for construction, but these will be experienced over a longer term. At the commencement of operations, the Operator will review inflation monitoring established during construction to inform ongoing management and mitigation for operations. Inflation monitoring will continue during the initial period of operations (3 years), thereafter alternative monitoring may be sought based on the review if considered necessary. The Operator will also continue to coordinate with NDMA to collect data similar, but supplementary, information to NDMA monthly surveys on socio-economic indicators throughout the operational period.

With careful monitoring and the commitment to act if there is substantial evidence of inflation, the residual impact is **Minor (negative)** during construction and operations**.**

7.9.9.5 Land Use and Ownership

Taking into account the baseline for land use (Section 6.12.2.6) and the planned Project land use and activities described in the Project description, this section presents a summary of the Project land requirements, the land acquisition process and the potential impacts relating to land use and ownership on receptors for the construction and the operational phases.

Summary of Project Land Requirements

The land requirements for the Project are shown in Table 7.9-3. The surface areas of the Project facilities, land restrictions in the field areas and locations of occupied homesteads identified in the recent (November 2018, July 2019 and April 2021) land baseline surveys are shown in Section 6.12.

Table 7.9-3: Project Estimated Land Requirements

Land Requirements	Land Area (hectares)	Lease Agreement	Land Use Restrictions	Gazettement Status
61 Firm and 12 contingent Wellpads	550	Long term Lease (approximately 25 years)	Long term restriction (land fenced off). No pastoral grazing or settlement access	Land falls within the gazetted polygons
CFA area long-term area for operations (long term lease).	250	Long term Lease (approximately 25 years)	Long term restriction (land fenced off). No pastoral grazing or settlement access	Land falls within the gazetted polygons
Landfill area within Ngamia field	50	Long term Lease (approximately 25 years)	Long term restriction (land fenced off). No pastoral grazing or settlement access	Land falls within the gazetted polygons
Interconnecting Network /linear infrastructure falling within gazetted polygons (oil gathering network, infield roads, infield OHTL)	650	Infield power lines & flowlines - Wayleave* Infield Roads - Easement **	Temporary restriction during construction, no pastoral grazing or settlement access (30 m width, with an additional 10 m for OHTL). Post-construction pastoral grazing will be permitted but no permanent settlement permitted (10 m width).	Land falls within the gazetted polygons
TOTAL	**1500**			

**Way leave - an agreement between a land-owner and the Project, permitting the Project to access land in the RoW to carry out works. Does not exclude pastoralist activities, but will restrict permanent residence on the land.*

***Easement - a right that the Project will hold over land owned by somebody else, e.g., for a Project road to pass across land owned by someone else.*

7.9.9.5.1 Approach to Project Land Access

Land acquisition for the Project will be undertaken in line with Production Sharing Contracts (PSC) between the KJV and GoK, which specify that land will be acquired by GoK (through provisions set out in national legislation) and then made available to KJV through long term lease agreements. A Government-led approach to securing land access is therefore being followed, in compliance with Kenyan legislation and with the NLC playing the lead role in land acquisition.

All land areas planned to be used for the construction and operation of Project facilities will be acquired by the NLC on behalf of the MoPM who will provide land access to the Operator as part of the licence agreement.

The Operator will ensure that land acquisition for the Project meets applicable international standards, notably IFC PS5: *Land Acquisition and Involuntary Resettlement*. IFC PS7: *Indigenous People* also sets requirements for Free Prior and Informed Consent (FPIC) in circumstances where Project impacts (such as land access) occur on PAP who are deemed to meet the criteria for Indigenous People.

IFC PS5 states that when land acquisition is the responsibility of government, the Project should collaborate with the responsible government agency, to the extent permitted, to achieve outcomes that are consistent with IFC PS5. In the case of land acquisition resulting in physical displacement, if government processes do not fulfil all requirements of IFC PS5, the Project is required to prepare a Supplemental Resettlement Plan (covering resettlement and livelihood restoration) and undertake supplementary activities to meet IFC PS5 requirements. Figure 7.9-1 presents the statutory land acquisition process and supplemental activities to be undertaken by the Project to meet IFC requirements.

An initial land application for specific coordinates for the land components (Twiga, Ngamia and Amosing wellpads and the CFA) was submitted by KJV to GoK in August 2018 and gazetted by GoK in February 2019. The final application comprising the CFA, all wellpads, landfill area, interconnecting infrastructure and the make-up water pipeline (which will be covered under a separate ESIA) was submitted in August 2019. These polygons will be classified as land for dual use i.e., Project and community use, but it is only the specific land requirements (defined footprint) which are to be restricted for Project only use and thereby leased to KJV. The Operator will work with MoPM and TCG to ensure that permanent households are not established within close proximity of Project facilities on land acquired by MoPM for the Project. However, the community will be able to continue to travel though and graze animals in the gazetted polygons, other than very near the Project footprint - therefore, physical and economic displacement will only affect people that are using an area directly on or near the Project footprint or, temporarily (through the encouragement of avoidance), within those areas defined in Section 7.2 as being within the high magnitude noise impact area during construction. Land acquisition and access will be prior to construction and during. No additional land acquisition is planned during operation.

Figure 7.9-3: Overview of Statutory Process and Supplemental Project Activities (Source: KJV 2021)

7.9.9.5.2 Summary of Impacts

The following potential impacts topics arising from land access relating to the Project have been identified and are described in more detail below:

- Long term loss of Community Land;
- Temporary restriction on land use, notably pastoral grazing and settlement access, during construction due to direct physical works on land or indirect restrictions of land use relating to modelled air quality and increases in noise levels;
- Long term restrictions on the construction of new settlements and access to long-term homesteads, along the interconnection route wayleaves and easements (10 m wide);
- Loss of occupied homesteads (physical displacement);
- Loss of access to particular areas of land where households have previously located long-term or seasonal homesteads, typically near larger luggas and shade trees;
- Loss of household structures other than homesteads – e.g., animal shelters or dug water holes;
- Loss of business structures and impacts on businesses – e.g., shops;
- Temporary loss of access to or use of community water tanks;
- Increased travel/walking distances to community assets or community water tanks;
- Impacts on livelihoods due to loss of communal lands (economic displacement); and
- Impacts on graves.

These potential impacts are described below. A discussion for each impact includes brief baseline context, impact analysis narrative, significance rating prior to mitigation. Specific mitigation commitments to be implemented by the Project and the residual impact significance in relation to land use and land acquisition are described to follow. Impacts on vulnerable persons are addressed in each assessment of the above impacts.

7.9.9.5.3 Long Term Loss of Community Land

The NLC, on behalf of MoPM, has and will acquire Gazetted 'polygons' of land areas across the different oilfields totalling approximately 11,000 ha for dual use (Project and community use). However, only the 1,500 ha directly affected by the Project surface area or footprint will not be available for continued community use. The affected land in the AoI in Turkana is unregistered Community Land, which is recognised as being owned by the whole Turkana population. In order to minimise the impacts of land acquisition, land not required by the Project within the polygons will continue to be available for grazing.

Where land is no longer available for pastureland use, this will be factored into the Project's livelihood restoration activities. GoK will provide compensation for loss of land in line with Kenyan law and statutory processes. Any additional requirements to meet the IFC PS5 will be addressed as part of the Resettlement & Livelihood Restoration Plan (RLRP), presented in Annex II.

The compensation for Project use of community land will include compensation for land within the Project footprint occupied by existing facilities, such as existing wellpads, which until now and during the exploration and appraisal phase, have been subject to temporary lease agreements between KJV and TCG. Monetary compensation for land and assets, in accordance with the provisions of Kenyan law, will be the sole responsibility of GoK, including conducting associated activities such as asset surveys and valuations.

Long-term loss of community land is negative and has a high consequence. The geographic extent is local, affecting only the people that use the locations that require land acquisition and the duration is long-term. The unmitigated impact on livelihoods will be most felt during the construction phase when land is acquired. The unmitigated construction impact on communal land during construction is **Major (negative)** because of its importance to the Turkana communities' ways of life and the high sensitivity of Turkana communities to the loss of community land.

The livelihood restoration measures within the RLRP will be implemented and available to PAP, at the latest when displacement arises, and continue until livelihoods are restored, and if possible, improved to pre-displacement levels. The RLRP will set out:

- Procedures for Government-led land acquisition in line with national statutory land acquisition processes set out in Kenyan law. GoK will acquire the Project Land and act as landlord to the Project.
- The Project's timing and description of the supplemental activities and entitlements that will assist relocation of households, businesses and institutions and meet international standards (IFC Performance Standard 5).
- How the GoK data gathering processes, valuation methodologies, compensation rates, engagement processes with affected persons, businesses, institutions and communities, including agreement of statutory compensation by Project-affected households.
- How GoK compensation and the statutory 15% disturbance allowance equates to "full replacement cost".
- How the Operator will provide supplemental assistance, on a voluntary basis, to physically displaced households, businesses and institutions, who meet pre-agreed assistance criteria. This will include relocation assistance from Project affected areas including transport assistance, transitional support and additional assistance to particularly vulnerable households.
- The criteria for defining particularly vulnerable and marginalised households. The Operator will be responsible for identifying and providing supplementary assistance to vulnerable and marginalised households in line with IFC Performance Standards.
- The monitoring and evaluation process to assess the effectiveness of measures to restore livelihoods and the proposed independent auditing.

Prior to construction, the RLRP will be disclosed publicly and will be maintained throughout the construction process. In addition, the Operator will minimise use of the land acquired by GoK such that only land required for Project Facilities is used exclusively by the Project (i.e., with access restricted by security fencing). This will mean that existing land users will be able to continue use of gazetted land until and unless it is required.

Following GoK data gathering processes and prior to implementation of resettlement and livelihood restoration activities, the Operator will supplement data with additional baseline surveys as required to establish the socio-economic characteristics of affected households and identify particularly vulnerable persons. Additional engagement with particularly vulnerable people affected by the project will facilitate the definition of supplemental entitlements to assist relocation and ensure access to and effective delivery of livelihood restoration.

The Operator led supplementary activities will be carried out in a culturally appropriate way and in consultation with affected stakeholders. Supplementary entitlements will be recorded in a supplemental entitlements schedule to be provided to affected households, businesses and institutions separately to the statutory

Compensation and Awards Schedule provided by the GoK process. Final categorisation of supplemental entitlements will be disclosed publicly.

The Operator will establish a Livelihood Restoration Programme to support pastoralist livelihoods in the Project area which have been affected by the construction and operation of Project facilities. This will be focused on supporting existing programmes focused on regional pastureland management and animal husbandry to reduce pressures from over grazing.

The success of livelihood restoration and compensation will be closely monitored until successful completion. It is possible that impacts on livelihoods will extend into the operations phase if livelihood restoration measures are not implemented and available at the time of displacement, or not successful. With successful implementation of all committed mitigation in the form of the RLRP the residual impact significance relating to loss of community land is rated as **Minor (negative).**

7.9.9.5.4 Temporary Restriction on Land Use, Notably Pastoral Grazing and Settlement Access, During Construction

During the construction phase some land will be fenced temporarily for safety. Temporary restriction on land use (pastoral grazing and settlement) will apply to a 30 m wide RoW for the interconnection routes, with an additional 10 m for OHTLs. Although the July 2019 land use baseline identified one homestead on the interconnection routes, no homesteads were recorded in the April / May 2021 survey that could be subject to physical displacement.

PAP will be compensated in line with Kenyan law and any additional measures to meet IFC PS5 requirements will be addressed as part of the RLRP. Local communities using land areas affected by temporary restrictions on grazing and settlement will be able to access similar land areas nearby.

The temporary restriction on land use (pastoral grazing) is only considered to be an impact during construction and will not extend into operations as long as livelihood restoration programmes have been successfully implemented. Temporary restriction on land use is negative with a high consequence. The geographic extent is at the household level and the duration is short-term. The unmitigated impact is rated as **Major (negative)** because there will be temporary loss of grazing land. The residual impact significance during construction assuming successful implementation of the RLRP is rated as **Minor (negative)**.

7.9.9.5.5 Loss of Occupied Homesteads (Physical Displacement)

Physical displacement will occur if a household is occupying a homestead structure at time of the NLC land and asset survey and is required to move away from an area affected by the permanent footprint of a new Project facility or other areas temporarily affected by the construction phase. This is expected to only apply to occupied long-term and short-term seasonal homesteads, or very recently built unoccupied homesteads in a good state of repair since Turkana people do not re-use shelters that they have vacated unless they have been very recently built and in good repair. Physical displacement would not apply to very short-term migratory homestead structures, since these tend only to be used for two or three days and would be vacated in a few days in any case.

Even if a household is affected by physical displacement, the extent of the impact could be relatively limited since nomadic pastoralists in the Project area frequently move the location of their homesteads, either to access better grazing elsewhere, or to avoid pests or disease associated with dung build-up in animal shelters next to the homestead.

In recent years, the number of homesteads in the Project area has varied according to factors such as seasonal rains which affects quality of grazing, and the security situation vis a vis the risk of livestock raiding. The location of occupied homesteads has also varied from year to year. It is notable that the April / May 2021 KJV survey identified significantly more households within the gazetted area than the previous surveys. It is therefore difficult to predict the exact number of occupied homesteads that would be affected by physical displacement at a future point in time (at the time of the NLC's land and asset survey). However, the numbers and distribution of occupied homesteads identified in the 2021 baseline surveys are indicative of the likely number of households that could be subject to physical displacement from occupied homesteads.

At this stage in the Project it is assumed that the households identified within each within the field areas will require relocation. The Operator, however, will do everything to minimise disruption to pastoralists and therefore will make efforts to only relocate pastoralists where absolutely necessary. It is currently estimated that up to 800 households may be subject to physical displacement, comprising:

- **Etom field**: Based on the results of the 2021 KJV survey up to ten short-term, seasonal households would be physically displaced from the Etom field area during the construction phase or the operational phase of the Project.
- **Agete field**: Based on the results of the 2021 KJV survey up to five short-term, seasonal households would be physically displaced from the Agete field area during the construction phase or the operational phase of the Project.
- **Twiga field:** Based on the locations of occupied households observed in the 2021 KJV surveys, one household would be physically displaced from the Twiga field area during the construction phase or the operational phase.
- **Ekales field:** Based on the results of the 2021 KJV survey up to 30 short-term, seasonal households would be physically displaced from the Ekales field area during the construction phase or the operational phase of the Project.
- **Ngamia field:** Based on the results of the 2021 KJV survey up to 580 households in the Ngamia field would be physically displaced, including 120 long-term homesteads.
- **Amosing field:** Based on the results of the 2021 KJV survey up to 170 households would be physically displaced including up to 20 long-term homesteads.
- **Interconnection routes outside of the six field areas:** no households are located on the interconnection route.

Households occupying homesteads subject to physical displacement will receive compensation in line with Kenyan law and any additional measures to meet IFC PS5 requirements will be addressed as part of the RLRP. As well as this statutory compensation and allowances, the Project will work with GoK and County Governments to provide physically displaced households with assistance in relocating from Project land areas. This assistance is planned to include transport assistance, provision of homestead construction materials (e.g., timber and tarpaulins) and additional assistance to vulnerable households, if required, for homestead construction. The relocation process will be managed to ensure that affected households have new homestead structures ready to move to before being required to relocate from Project land areas.

Physical displacement is a negative impact with high consequence of a permanent duration which is not reversible. The geographic extent is at the household level. The impact would be felt at the point of displacement which will be prior to and/or during construction when land acquisition and access is planned by the Project. Compensation will be provided prior to physical displacement with relevant resettlement assistance and livelihood restoration measures implemented post-displacement mostly during the construction phase. Some livelihood restoration measures for physically displaced households may continue, where necessary, into the operations phase until livelihoods are restored to a pre-displacement level and improved where possible.

The unmitigated impact during construction is rated as **Major (negative)** and **Moderate (negative)** during operations. The residual impact significance, with successful implementation of the RLRP, as previously described, is rated as **Minor (negative)** during construction. Some livelihoods mitigation measures will continue into the operations phase, for example, the Operator will continue monitoring and evaluation of the implementation of the RLRP to assess the effectiveness of measures to restore livelihoods and the Operator will complete or commission a completion audit (initially after a year, in line with IFC requirements) to confirm that livelihoods have been restored to pre-Project levels as a minimum. With these measures in place, the mitigated impact during operations will be reduced to **Negligible**.

7.9.9.5.6 Loss of Household Structures Other Than Homesteads

Other structures that may need to be replaced or moved include animal shelters/enclosures which Turkana people construct next to their homesteads – made of circles of branches and twigs cut from nearby trees and shrubs, in which goats and camels are typically kept overnight. These are temporary structures that are quick to construct. When the people leave a homestead, the animal shelters fall into disrepair and would not be re-used due to build-up of dung and risk of disease, animal ticks and other pests. Even when a household stays in an area for a longer period spanning wet and dry seasons, the household typically moves the homestead and animal shelters every few months to avoid risk of pest and disease associated with build-up of dung in the animal shelters next to the homesteads. Therefore, the extent of the impact of loss of a household's animal shelters would be limited.

Based on recent baselines, the loss of other household structures such as animal shelters would affect an estimated 80 to 100 households (70% of the estimated number of households subject to physical displacement and assuming that 30% of households currently occupying homesteads in the Project affected land areas do not also have animal shelters in these areas).

Other private physical assets which could potentially be affected by Project land access, include dug water holes, though these have not been observed in the proposed field areas in recent years due to the provision of community water tanks. These will also be subject to supplementary compensation if still in use. Affected owners of these structures will receive compensation in line with Kenyan law and supplementary entitlements to meet IFC PS5 requirements will be addressed as part of the RLRP.

Loss of structures other than homesteads is a negative impact with low consequence. The geographical extent is at the household level and the duration is long-term although would be felt and mitigation measures will be applied prior to displacement and into the construction phase. The unmitigated impact is rated as **Minor (negative)** for construction only. The residual impact significance during construction is rated as **Negligible** and would not extend into operations.

7.9.9.5.7 Loss of business structures

Only one potentially affected shop structure, in the Ngamia field, was identified in the November 2018 and July 2019 lands baselines on land areas within the Project footprint. One other shop structure was identified in the Amosing field but outside of the footprint area. It is therefore estimated that at the time of the NLC land and asset survey, there will be two affected shop businesses subject to displacement in all Project affected land areas.

Owners of a shop subject to displacement will receive compensation in line with Kenyan law and any additional measures to meet IFC PS5 requirements will be addressed as part of the RLRP as described above.

Loss of business structures is negative with a low consequence. The geographical extent is at the household level and the duration is long-term. Mitigation measures will be applied prior to displacement and as relevant continue during the construction phase. The unmitigated impact is rated as **Minor (negative)** for construction only. The residual impact significance during construction is rated as **Negligible** and would not extend into operations.

7.9.9.5.8 Potential Temporary Loss of Access to or Use of Community Water Tanks

Mapping of community water tanks within the Project footprint areas indicates a potential impact during the construction phase of disruption of community access to the two water tanks in the Ngamia field area, due to the location of these tanks in relation to construction activities.

If Project activities and infrastructure lead to a need to relocate community water points, the Stakeholder Engagement Plan will describe how the Operator will engage with Turkana County Administration, local stakeholders and communities to discuss and plan the relocation of community water tanks to suitable locations outside of affected land areas. Key elements of this approach will include:

- The Operator will ensure that equivalent water supplies will be provided to water users of existing community water points that require relocation.
- Prior to commencement of construction, the Operator will complete baseline surveys to establish the water requirements and ensure that alterative water supplies are appropriately sized to meet community water demand.
- The Operator will develop a monitoring and evaluation process to assess the effectiveness of measures to maintain water supplies and the triggers for action to take place if the measures have not been effective.
- The Operator will monitor households affected by the relocation of water points to ensure that affected water users are able to access the alternate water supply.

Loss of access to water tanks is a negative impact with moderate consequence. The geographical extent is local and will only affect Kapese and Kochodin Locations during construction and therefore has a short-term duration. The unmitigated impact is rated as **Moderate (negative)** for construction only. The residual impact significance during construction is rated as **Negligible** and would not extend into operations.

7.9.9.5.9 Increased Travel/Walking Distances to Community Assets or Water Tanks

Potential impact of increased travel/walking distances to community assets or water tanks, in the field areas and during construction of the interconnection routes. Depending on where physically displaced households relocate to, this could potentially apply to access to educational facilities or to community water tanks in the Ngamia and Amosing field areas.

The extent of this impact will only be known when it is known where physically displaced households relocate to, but it is expected that there will be suitable locations for homesteads nearby. As detailed above, if necessary, it is proposed that the Project will engage with PAP and authorities through the SEP to identify suitable alternative sources of water and suitable alternative locations for homesteads which have similar or better access to communal facilities.

Increased travel time is a negative impact with low consequence. The geographical extent is local and the duration is short-term, i.e., construction only. The unmitigated impact is rated as **Minor (negative)**. The residual impact significance is rated as **Negligible** and would not extend into operations.

7.9.9.5.10 Impacts on Livelihoods Due to Loss of Communal Land (Economic Displacement)

The majority of the Project footprint area (approximately 1,500 ha) is used for nomadic livestock grazing, 98% of the area lies in Turkana County and 2% in West Pokot. Grazing activities vary depending on seasonal rains. Wet season grazing typically takes place from April to June and November to December, and at other times of the year pastoralists take their livestock to dry season grazing areas generally located towards hills 10 km to 25 km west and south-west of the Project area.

Whilst all Turkana people are able to access community land in Turkana for grazing livestock, in practice it is the people who live in and around the Project area and the wider Locations and Sub-county areas who use the Project affected land on a regular or intermittent basis for livestock grazing.

The impact of Project land use on grazing livelihoods is expected to be minor in view of the large areas of available grazing land in and around the Project area. Furthermore, communities already access grazing areas outside in the Project affected areas, particularly during dry seasons when livestock are typically moved to dry season grazing areas towards the hills some 10 km to 25 km west and south-west of the Project area. Estimates of the economic value of livelihood contributions from livestock grazing on Project affected land areas indicate relatively low economic values.

Temporary disruption of livestock movement could potentially occur, e.g., due to construction of linear infrastructure such as buried flow lines, but in reality this impact is expected to be minimal since only limited stretches of land would be affected at any one time and animals could easily find alternative routes and mitigation will include livestock movement paths through the linear construction areas, at a safe distance.

There are large areas of similar grazing land surrounding Project affected areas which the community will be able to access. The local community already accesses this surrounding land for grazing livestock, pastoralists are not confined to particular places or routes to pasture. In this way, affected persons will be able to access alternative resources with equivalent livelihood-earning potential and accessibility.

As well as using land for livestock grazing, communities in the vicinity of the Project area use a variety of natural resources, including wood for fires and construction of homestead shelters, medicinal plants, food (wild fruits and roots). Land clearance for construction purposes will involve the loss of these resources in areas of the Project footprint. However, the actual level of impact on communities is expected to be low due to availability of similar natural resources across large areas of community land in the vicinity of the Project footprint. Furthermore, since linear infrastructure will not be fenced, it is not expected that significant restrictions on access to such resources will occur.

The RLRP sets out the procedures for Government-led land acquisition in line with national statutory land acquisition processes set out in Kenyan law. The GoK will acquire the Project Land and avail it to the Operator for the Project.

Supplementary to the RLRP, the Livelihood Restoration Support for Livestock Grazing (Repeated Mitigation:08) will seek to mitigate the impacts of land acquisition on livelihoods. The RLRP will set out the procedures for Government-led land acquisition in line with national statutory land acquisition processes set out in Kenyan law. More specifically, the RLRP and the CDPs will set out how the Operator will provide (and maintain during operations) culturally appropriate livelihood restoration support aimed at improving livestock grazing livelihoods for users of communal land in Project Affected Areas. Livelihood restoration measures will be developed in consultation with affected communities, stakeholders, County Administration and GoK to ensure that they meet the needs of households and communities and fit with local priorities and other government support initiatives.

Impacts on livelihoods and the implementation of the RLRP will be after land access but impacts will be felt from the point of displacement and during the construction phase, with impacts on livelihoods and livelihood restoration measures continuing into the operations phase (specifically Livelihood Restoration Support for Livestock Grazing, Repeated Mitigation Social: 08). Therefore, the duration is long-term and the unmitigated impact for construction and operations is rated as **Moderate (negative)**. Assuming successful implementation of the RLRP and CDP, as described above, the residual impact significance for both construction and operation is rated as **Negligible**.

7.9.9.5.11 Impacts on Graves

Graves are very important to Turkana communities and are located across the landscape (see further detail on locations in section 7.10) and not in specific communal burial areas. It is likely that some graves will be affected by the Project footprint's land requirements. Impacts, mitigation and management measures are described in detail in Section 7.10 and are therefore not repeated here, but the impact evaluation remains pertinent to Land Use and Ownership.

Impacts on graves is a negative impact with local consequence. The geographic extent is at the household and local community level and the duration is permanent. The impact would be felt, and mitigation measures will be applied during the construction phase. The unmitigated impact is rated as **Major (negative)** during the construction phase only. The residual impact significance (incorporating mitigation presented in Section 7.10) is rated as **Minor (negative)** and, assuming successful provision of compensation and relocation assistance for graves, would not extend into operations.

7.9.9.6 Community Health and Safety

Five impact categories have been identified in relation to community health and safety:

- STI, including HIV/AIDS;
- Vector Related Diseases;
- Communicable diseases, including COVID-19;
- Zoonotic diseases; and

Accidents and Injuries. The way in which EHAs identified in the Social baseline (Section 6.12) has been linked to each impact theme are described in Table 7.9-4.

Table 7.9-4: Linkage Between Impact themes and Environmental Health Areas

Impact themes	Impact	EHA
STI, including HIV/AIDS	Introduction and transmission of communicable diseases between Project workforce and PAP.	EHA 4
	An increase in the burden of disease along the Project's transport corridors as a result of Project drivers spreading communicable diseases.	EHA 4
Vector related diseases	Effects of environmental alteration on vector densities.	EHA 2
	Introduction of new vector related diseases and strains due to Project logistics.	EHA 2
Communicable diseases, including COVID-19	Introduction and transmission of communicable diseases between Project workforce and PAP.	EHA 1
	Outbreaks of infectious conditions within Project camps affecting the health of the local workforce and PAP.	EHA 1, 3
Zoonotic diseases	Increase transmission in zoonotic diseases as a result of Project activities (specifically the IWMF).	EHA 8
Accidents and injuries	Project logistics activities resulting in accidents affecting communities.	EHA 7
	Occupational health and safety incidents resulting in injuries in local workforce members.	EHA 7

Impact themes	Impact	EHA
	Project construction activities resulting in accidents affecting communities.	EHA 7
Environmental determinants of health	Impacts related to air quality.	EHA 9
	Impacts related to noise and vibration.	EHA 9
	Impacts related to water quality and quantity.	EHA 3, 9
Social maladies	Impacts related to Project employment (nutrition, non-communicable diseases, social cohesion, gender equality and others).	EHA 5, 6, 10
	Increase in gender-based violence, commercial sex work and transactional sex.	EHA 4, 10
Influx and migration	Influx resulting in the introduction of new diseases or higher disease transmission rates.	EHA 1, 2, 3, 4
	Increased risk of fire in informal settlements.	EHA 7
	Deterioration in environmental health conditions and lack of basic services that may increase the potential for communicable disease transmission due to overcrowding, poor hygiene and sanitary conditions.	EHA 1, 2, 3, 4
	Impacts related to food security and nutrition as a result of influx.	EHA 5
	Increase in zoonotic diseases as a result of influx.	EHA 8
	Influx potentially resulting in an increase in social ills, potentially leading to an increase in gender-based violence, crime, drug use and alcoholism, amongst others.	EHA 10
	Increased pressure on existing health services and increased uptake on traditional health practices.	EHA 1

While impacts and mitigation related to Occupational Health and Safety are not the remit of the ESIA, the philosophy on occupational health and safety is to ensure that activities under its responsibility cause no harm to its workforce and communities in its operational areas. High standards of practice are applied through a process of continual improvement of its management system and adoption of good international practices. Occupational health and safety throughout the project will be planned and managed in accordance with the requirements of the following as a minimum:

- All Kenyan laws and regulatory requirement relating to occupational health on industrial developments;
- Life-Saving Rules, International Association of Oil & Gas Producers, Report 459, 2018;
- Performance Standard 2: Labour and Working Conditions. International Finance Corporation, Performance Standards on Environmental and Social Sustainability, 2012;
- General Environmental. Health and Safety Guidelines, World Bank Group, 2007; and
- Environmental, Health and Safety Guidelines for Onshore Oil and Gas Development, World Bank Group, 2015.

The Operator will prepare:

- An Occupational Health & Safety Policy (either separate or integral with safety and/or environment) and an Occupational Health & Safety Plan. These will:
  - Address key safety and occupational health issues relevant to the facility's products and operations;
  - Guide the setting of objectives and targets;
  - Be endorsed by current management;
  - Be subject to regular review;
  - Be readily available to employees and contractors;
  - Establish the priority of safety and occupational health protection in relation to other business goals; and
  - Ensure that safety and occupational health/hygiene responsibilities and accountabilities are defined, designated, documented and communicated.
- An Occupational Health & Safety Improvement Action Plan for preventing injuries and occupational illnesses in its operations. This plan will:
  - Be integrated into operational planning and procedures, such that adequate resources are allocated and performance is monitored; and
  - Cover objectives, responsibilities, timing, priorities, deliverables and resources.
- A safe work system, based on risk assessment, for ensuring that effective controls and safe work procedures exist for all hazardous activities, including:
  - the safe handling and storage of hazardous substances and including emergency procedures;
  - ensuring that employees are trained and equipped to carry out their work according to the applicable safe work procedures, and that their competence has been tested;
  - ensuring that activities requiring technical certification are carried out only by suitably certified people;
  - ensuring the risks associated with transport operations are controlled in accordance with IOGP Guidelines;
  - practising emergency procedures; and
  - first-party auditing carried out by line management.

7.9.9.6.1 Sexually Transmitted Infections, Including HIV/AIDS

HIV/AIDS is among the top health challenges and priorities in Kenya and the AoI itself. According to baseline findings, the HIV prevalence in Turkana County has decreased from 7.6% (2013) to 3.2% (2017/18) and from 2.3% (2014) to 1.5% (2017/18) in West Pokot County. Despite this improvement, knowledge on the prevention of HIV transmission remains poor, with only 49.2% of women and 2.4% of men reporting that using a condom and limiting sexual contact to one uninfected partner were effective prevention methods. Stigma associated with a positive HIV status, limited access to treatment services and poor treatment adherence contributed to the challenges in managing HIV/AIDS in the area. High-risk populations included female commercial sex workers, adolescent girls and fishers around Lake Turkana.

Stakeholders noted several potential hotspots for HIV infection in the AoI, including the Kitale-Lodwar-Lokichogio transport corridor, as well as certain urban settlements, specifically Lodwar and Lokichar.

Commercial sex work activity, specifically in Lokichar, was reported to be on the increase with an influx of commercial sex workers from areas outside of the AoI noted as a particular concern.

The utilisation of a Project workforce that originates from areas where the burden of disease related to STIs and HIV is higher than in the AoI, may affect the existing burden of disease in the AoI. Even though it has been confirmed that the Project will implement a "*closed camp*" status for accommodation facilities, local, unskilled workers are typically hired locally to work in camps and on other Project sites, while residing in nearby communities, enabling some interaction between workforce and community members. As in other projects, it is customary that some of the facility-based work positions reserved for local, semi-skilled and unskilled workers, are to be filled by women, e.g. cleaners, food servers and administration personnel. These female workers will be especially vulnerable to transactional sex advances from male workers who reside inside the camp.

Similarly, it is expected that certain work crews will partake in construction and other Project-related activities outside of camps or facilities. If not managed, these work crew members may seek interaction and fraternisation with female community members. Adolescent girls and commercial sex workers are deemed to be at higher risk for this interaction.

Communities that are at higher risk for this impact include Lokichar, in proximity to Kapese Base camp, households in the Kochodin Location close to where the CFA will be constructed, as well as households and settlements in the Lokichar and Kochodin Locations that are located in proximity to the drilling mini-camps.

Further to the above, it is anticipated that the Project will require substantial logistical support during the construction phase, including the transport of materials from Mombasa Port as well as other hubs within Kenya. Research by the Kenyan NACC and the National AIDS and STI Control Programme (NASCOP), has recognised that transport workers (especially long-distance truck drivers) are a high-risk group (often referred to as 'core spreaders'), as they are known to have multiple sexual partners and to developing sexual networks along their transport corridors. Women, most commonly commercial sex workers, often target truck drivers as they are away from their usual family network and have disposable income, while the truck drivers (generally men) target women as a form of companionship and entertainment. These encounters are often transactional in nature, and commonly involve a sexual relationship. This will most likely take place at rest stops. The mobile nature of commercial sex workers, however, may result in the spread of disease beyond these areas.

This increase in burden of disease will impact negatively on the quality of life of the affected women, broader community and Project workers, affecting their future health status, need for medical intervention and, potentially, their future work potential and life expectancy. In addition to this, the increase in burden of disease will increase pressure on the existing health services, and the nature of HIV disease can cause significant social implications in affected communities.

This impact is considered to have a negative direction of high consequence based on the nature of the diseases, while the likelihood is definite, given the current baseline. The impact will affect those settlements in proximity to accommodation camps, where workforce members may be accommodated during construction as well as communities along the transport corridor from Mombasa and onwards to the Project site, resulting in the geographic extent of the impact being national. During operations there will be fewer work crews, contractors and vehicle movements (including to and from Mombasa) than during construction. However, due to the chronic nature of the diseases and the operations phase having a longer duration than the construction phase, the impact would be of **Major (negative)** significance throughout the life of the project if left unmitigated.

7.9.9.6.2 Mitigation (construction)

Mitigation measures specific to Sexually Transmitted Infections (Repeated Mitigation Social: 09) will be within the Operator Social Performance Plan and present procedures for the development, implementation and maintenance of mitigation measures relating to Community Health Safety and Security, including the establishment and maintenance of a Community Health Information System (CHIS). These procedures will include:

- Implementation of the Operator HIV Policy and Programme for all employees and requirements for Contractors to adhere to the Operator HIV Policy and Programme. The HIV Policy and Programme will address the workforce and contractors. The programme will specifically identify and recognise high-risk groups (e.g., local female workers and all Project associated drivers, including contractors) and develop specific control measures. Programme elements will include, but not be limited to:
  - Education and public campaigns;
  - Social marketing of condoms in the workplace;
  - Condom distribution;
  - STI screening;
  - Promotion of voluntary HIV testing; and
  - Support of enrolment in care and treatment programmes to promote prevention and treatment, where relevant.

  Where possible, HIV interventions in the workplace will be integrated with STI and tuberculosis management programmes.
- Development and implementation/ maintenance of the Operator "*95-95-95*" strategy, which sets targets for awareness, treatment and demonstrating performance in viral suppression. In this strategy, 95% of HIV infected people are aware and informed of their status. Of that group, 95% are on the appropriate treatment and 95% of those who are on treatment have achieved sustainable viral suppression. In this scenario, transmission of the disease is markedly reduced, as are Project associated impacts on community health. This reduction of risk is dependent, however, on successful and sustainable implementation of the strategy, requiring long-term commitment in terms of resources and funding and will require entering into a partnership with the NACC or NASCOP.
- Operation of all construction accommodation as "*closed camps*" and operations (worker accommodation) to reduce opportunities of transactional sexual activity between Project staff and PAP in local communities. Sufficient capacity in accommodation facilities will be planned for to ensure that all non-local Project-related staff are accommodated in camps and not in local communities, thus eliminating the need for local beds in Lokichar. The Operator or the contractor responsible for the Project camp will develop adequate entertainment and recreational facilities in Project camps and rest stops.
- The Operator will train all employees and contractor workers in the Operator Code of Conduct, which will prohibit sexual harassment by Project staff. Failure to comply with any aspect of the Code or related policies, standards or procedures may lead to disciplinary action up to and including dismissal and, in the case of contract staff or business partners, termination of contract. Where there is suspicion of, or an actual breach of the Code, an internal investigation may be initiated as per the existing procedures.
- Providing training to all drivers (including contractors) on pre-designated routes and ensuring transport rest stops will have been surveyed and approved by the Operator. The Operator will develop a Transport Management Plan (TMP), which will be adapted and maintained through operations. The TMP will identify designated rest stops will be identified for exclusive use by Project-related long-distance drivers. The selection of rest stops will include evaluation of existing services to limit the risk for potential influx in these areas. Service level agreements with rest stop service providers will be developed and implemented to maintain a specific accommodation standard that reduces the occurrence of social ills (e.g., commercial

sex workers, alcohol use, access control and transactional sex) and to provide adequate entertainment and recreational facilities in rest stops.

- KPIs relating to Community Health and Safety and how the Operator will monitor KPIs through the CHIS.
- Medical Fitness to Work requirements for all workers and contractors.

Prior to construction, the Operator will work with National Government, County Government, the County Commissioner and key stakeholders to agree on the terms of reference for the Operator investment in Community Health programmes as part of CDPs, aligned to County Integrated Development Plans. CDP Availability and Update (Repeated Mitigation: Social 04) will also apply. The Operator will build on existing social investment for specific Health Systems Strengthening activities in areas at higher risk for HIV transmission due to Project impacts.

Implementation of the aforementioned management plans and the CHIS activities during construction along with the reduced workforce, contractors and vehicle movements during operations should result in a reduction of the risk of STIs during operations. Monitoring will inform the ongoing management and mitigation programme for STIs and they will be adapted accordingly, the monitoring during construction will inform the operations phase management and mitigation programme. During operations, the Operator will continue providing social investment to specific Health Systems Strengthening activities in areas at higher risk for HIV transmission due to Project impacts and Sexually Transmitted Infections (Repeated Mitigation:09) will continue to apply.

With the 95-95-95 strategy successfully and sustainably implemented in the Project workforce and contractors that reside in accommodation camps, the residual risk may be substantially reduced as the consequence, duration and geographic distribution is likely to reduce even further, concluding in a residual impact of **Minor (negative)** significance during both construction and operations.

7.9.9.6.3 Vector Related Diseases

Malaria is an important health concern in the AoI with the burden of disease, and therefore risk, considered to be higher than is generally reported on malaria spatial distribution models.

According to the national malaria policy, the entire Turkana County is considered low risk for malaria and therefore, does not benefit from any mass targeted malaria control programmes. There are no mass distribution programmes of long-lasting insecticide treated nets at a community level and no facility-based issuance of these nets to high risk groups such as children and pregnant women. The absence of these measures increases the risk to populations in the event of a localised epidemic, as was observed in Loima Sub-county in 2017.

Assessment of the local health facilities in Lokichar, Katilu and Lokori, confirmed that malaria is among the top-five reasons for outpatient consultation. Rapid diagnostic test kits for malaria and treatment were generally available in public health facilities, with these provided to the public at no cost.

Arboviral diseases (arthropod borne viruses) are a risk in the Project AoI. These acute viral fevers (dengue, chikungunya, yellow fever and Rift Valley fever) are transmitted by a day-biting mosquito from the *Aedes* genus, which breeds mainly in human-made (artificial) containers. These diseases are often poorly recognised and documented due to limited awareness by health care providers and lack of diagnostic capability. Studies have documented a dengue antibody positivity rate of 12.5% nationally, with clustering around coastal and north-eastern regions of the country. Since 2015, there have been several outbreak reports of dengue and chikungunya in the north-eastern part of Kenya.

Alteration of the physical environment from Project construction activities, such as trenching, road building and dust suppression activities may lead to the formation of habitats that are conducive for the breeding of insect vectors (e.g., mosquitoes). The resultant increase in vector densities may cause increased biting rates associated with human/vector contact, which may potentially result in increased disease transmission (including malaria and arboviral diseases) in populations in proximity to these activities. Similar effects may also occur in Project facilities (e.g., camps, wellpads, laydown construction and salvage yards) where housekeeping, waste management and other activities may result in conditions that are conducive the collection of standing water, promoting the proliferation of vectors. While the potential effects are likely to be limited to a localised area in the camp and work area (and thus also pose a workplace risk), there is the potential for these conditions to spread into the surrounding communities.

The risk will be more intense in the construction phases as physical environmental changes and creation of vector breeding sites is likely to be greatest in this period. The risk will extend into operations on a lower scale. In theory this would lead to a lower impact during operations, however without monitoring information of the impact of project activities on vector related diseases and taking into account the duration of impacts will be longer at operations, the significance of impacts prior to mitigation between construction and operations should remain the same.

PAP include those communities and households in Lokichar and Kochodin Location, those in proximity to Project camps, CFA, wellpads, in-field roads and activities associated with the infield network construction in the Kochodin Location.

The transport and import of goods (especially tyres), packaging and equipment from arboviral endemic areas may also play a role as infected larvae or eggs can be transferred on ships from these areas (e.g., Asia) into Kenya. Importantly, mosquitoes that transmit dengue fever do not have to acquire it from a human host before they can transmit it. Eggs or larva can emerge with the virus with resultant transmission. There is thus the risk that supply chain management may introduce infected larvae and/or mosquitoes to the port locations, along the transport corridors and in the Project AoI. This has the potential to cause localised introduction of arbo-viral diseases, and while the risk will be higher in the construction phase, it may extend into operations, albeit at a lower potential significance.

The impact has a negative direction with an associated moderate consequence based on the acute nature of the relevant diseases. As the impact considers construction activities that will take place across a significant portion of the AoI, the geographic extent is considered to be regional with a medium-term duration, extending into operations. The likelihood is possible and results in an inherent impact with a **Moderate (negative)** significance for both construction and operations.

The Operator Social Performance Plan will present procedures for the development and implementation of mitigation measures relating to Community Health Safety and Security, including the establishment of a CHIS. These procedures will include:

- Establishment and implementation of Malaria Management procedures in alignment with the WHO ABCD principles with a focus on:
  - Source reduction and habitat control (primary controls);
  - Workforce education and awareness, bite prevention activities, chemoprophylaxis (secondary controls);
  - Information campaigns to encourage early medical care in the event of the development of suspicious symptoms (tertiary controls); and
  - Specific larval and source control measures to address potential arboviral diseases import at ports will be evaluated as part of the Malaria Management Plan.

- All construction camps will provide first aid / and first aiders and health clinics or paramedic services for workers.
- Establish and implement KPIs for Project related impacts under the CHIS, in collaboration with authorities in Turkana and West Pokot Counties
- The Operator will monitor KPIs through the CHIS

Prior to operations all procedures and objectives in the Operator Social Performance Plan relating to vector related diseases will be reviewed, in light of construction phase monitoring. Updated procedures will include:

- Updated KPIs relating to Community Health and Safety agreed in coordination with County Government and the DCCs
- Malaria Management procedures.
- All worker accommodation will provide first aid / and first aiders and health clinics or paramedic services for workers.
- The Operator will monitor KPIs through the CHIS.

The residual impact retains a negative direction, with a moderate consequence but with a local geographical extent and a medium-term duration. This reduction in risk results in a residual impact of **Minor (negative)** significance after mitigation through construction and operations.

7.9.9.6.4 Communicable Diseases

The COVID-19 pandemic, which has affected Kenya since March 2020, had resulted in a total of 100,586 cases, including 1,766 fatalities, as of 1 February 2021 (NDMA, 2021c). The NDMA (2021c) also report that COVID-19 has resulted in poor health-seeking behaviour, with fewer people visiting health facilities for treatment, and has disrupted the continuity of essential health and nutrition services, particularly in more remote regions. Whilst up-to-date information has been included where possible, the pandemic in ongoing and the situation is constantly evolving. As such, the full extent of the effect of COVID-19, and the longer-term implications, on community health are not yet fully understood.

Acute respiratory tract infections are prevalent in the entire Project AoI, with these conditions reported in the top five causes of morbidity and incidence rates in Turkana and West Pokot higher than national averages. Prevailing environmental conditions and poor housing were identified as the main predisposing factors. Tuberculosis contributes to this burden, with the number of bacteriologically confirmed cases showing an upward trend in both Counties, likely due to an increase in case detection efforts. As a result, TB was listed among the top ten health challenges in Turkana County. Multi-drug resistant TB is an emerging threat especially in Lodwar, Kakuma and Lokichar, with this representing a significant public health risk. There is currently no TB treatment centre in Lokichar, with the nearest centre at Katilu Sub-County Hospital or the Lodwar County Referral Hospital.

Measles remains an important disease of public health concern nationally, with sporadic outbreaks reported annually. Both Turkana and West Pokot Counties are prone to measles outbreaks owing to prevailing sub-optimal vaccine coverage compounded by the nomadic lifestyle and the significant movement of pastoralists. Measles vaccine coverage in Turkana County, is estimated at 72%, which is below the minimum recommended coverage of 90-95% required for herd immunity. West Pokot County reported immunisation coverage below the minimum threshold for all vaccines (85%), including measles at 58% and polio at 61%. Additionally, meningococcal meningitis is an outbreak risk as the north-western tip of Kenya lies within the African meningitis belt.

Faecal contamination of community-based water sources as a result of inadequate sanitation services and poor hygiene practices were noted as major challenges. It was estimated that only 16% of the population have adequate latrine facilities, with indiscriminate open defecation practice commonly. As a result, diarrhoeal diseases were reported as a major health concern in the AoI, including conditions such as cholera, typhoid fever, amoebiasis and dysentery. Cholera outbreaks were noted to occur periodically (every 9 to 10 years), with the most recent outbreak occurring from January to August 2018 in five sub-Counties: Loima, Turkana Central, Turkana South (Lokichar and Katilu), Turkana North and Turkana West. The length and magnitude of the outbreak that occurred in two waves was linked to the poor sanitation services and behaviours as well as the weak institutional outbreak response mechanisms in the Ministry of Health in the various Counties.

Sections of the Project workforce may originate from another area (within or external to Kenya) where the burden of communicable disease (relating to this impact topic), is appreciably higher than in the Project AoI. This may increase local transmission patterns in the Project workforce, which may, ultimately, spill into communities through various pathways.

A certain amount of interaction between the Project workforce and PAP is anticipated throughout the project life, even if a "*closed camp*" status is implemented at Project accommodation facilities. This can occur at the planned Lokichar local beds (as the housing of Project workforce members in local communities will potentially exacerbate the impact as interaction is more likely under these circumstances) or through interaction with the locally hired workforce (who reside in the local area and interact with the local community) and the incoming workforce.

This interaction may result in the spread of communicable diseases from the workforce to the community. This topic also considers the potential introduction of multidrug or extreme drug resistant disease strains (in the case of TB), diseases that do not commonly circulate in this environment (e.g., influenza), novel strains of disease into the AoI. The weak public health systems and poor healthcare seeking behaviour are also likely to play a role in this communicable disease risk and transmission. Potential delays in diagnosis, outbreak preparedness and response will potentially further enable disease transmission.

Multiple factors related to workforce, occupational health and camp management may also result in the outbreak of infectious diseases in Project camps. If appropriate measures to prevent and manage these outbreaks are not implemented, it is possible that outbreaks of infectious conditions may be transferred to PAP located in proximity to the camps through the previously described pathways.

Project activities have the potential to generate significant amounts of waste belonging to diverse waste streams. Specific waste streams, such as grey water, human excreta and medical waste may result in the transmission of infective conditions. The approach of centralised management of all Project waste at an IWMF located at the CFA and waste management protocols at all camps significantly reduces the risks associated with this potential impact.

The above impacts are expected to affect PAP that reside in communities close to Project infrastructure such as camps, wellpads and construction sites where interaction between community members and workforce may potentially occur. This includes communities and households in the Kochodin, Lokichar and Kochodin Locations. The potential impact is likely to be highest in the construction period due to the presence of a larger externally contracted and mobile workforce. In theory there would be a lower impact during operations due to the change in numbers, however without monitoring information of the impact on communicable diseases and taking into account the duration of impacts will be longer at operations, the significance of impacts between construction and operations remains the same.

This impact has a negative direction with a high consequence on human health and is expected to have a local distribution. The duration of the impact is expected to be medium term, i.e., throughout construction and operations and the impact probability is rated as probable, resulting in a pre-mitigation significance rating of **Major (negative)** for construction and operations**.** Therefore, this impact requires specific mitigation.

7.9.9.6.5 Mitigation (construction and operations)

The Operator and their contractors will plan for and provide sufficient capacity in accommodation facilities to prevent overcrowding and to ensure that all Project-related workers are accommodated in camps and not in local communities. The Operator Social Performance Plan will present procedures for the development and implementation of mitigation measures relating to Community Health Safety and Security, including the establishment of a CHIS. These procedures will include:

- Camp cleanliness and hygiene requirements to avoid the risk for disease outbreak and transmission.
- The operation of all construction accommodation as "*closed camps*".
- All camps will provide first aid / and first aiders and health clinics or paramedic services for workers, including provision for management of snake and scorpion bites.
- Maintain Medical Fitness to Work procedures for all workers and contractors.
- Establish and maintain effective waste management procedures, in line with procedures and performance monitoring in the Operator Environmental Performance Plan. As part of this plan, access to landfill areas will be restricted for the general public, discouraging scavenging or waste picking. Wastes from different waste streams will be disposed of via rotary kiln incineration.
- Align food hygiene programmes with good industry practice standards and monitor performance.
- Establish and implement an Infectious Disease Health Policy and Programme (particularly related to HIV and TB) and establish KPIs under the CHIS, in collaboration with authorities in Turkana and West Pokot Counties. This would consider the provision of immunisations for the relevant vaccine preventable diseases to all Project staff. Vaccine selection will be based on risk for travellers and at-risk occupations and include, but not be limited to:
  - Seasonal influenza;
  - Measles;
  - Polio;
  - Meningitis; and
  - Others as relevant to occupation or Project destination (e.g., Typhoid, Hepatitis A and B and Yellow fever) in alignment with the existing Global Travel Procedure.
- Establish and implement a Pandemic Preparedness Plan (to include Covid).
- Monitor KPIs through a CHIS.

Prior to construction, the Operator will coordinate with the respective County Administrations and the DCCs and agree on the terms of reference and projects for the Operator investment in Community Health programmes as part of the CDPs, aligned to County Integrated Development Plans. CDP Availability and Update (Repeated Mitigation: Social 04) will also apply during construction. The Operator will provide social investment to specific Health Systems Strengthening activities in areas at higher risk for Communicable disease transmission due to Project impacts. Project-interventions during operations for the management of communicable diseases are anticipated to reduce given the lower numbers of workforce.

Monitoring will inform the ongoing management and mitigation programme for vector related diseases and they will be adapted accordingly. Furthermore, prior to operations all procedures and objectives relating to Community Health Safety and Security in the Operator Social Performance Plan will be reviewed, in light of construction phase monitoring and the Operator Code of Conduct (Repeated Mitigation: Social 01) will continue to apply.

Effective mitigation implemented during construction and maintained throughout operations will reduce the consequence to minor and should also reduce the duration to short-term. As the probability is reduced to unlikely, the residual impact is rated as having a **Minor (negative)** significance during both construction and operations.

7.9.9.6.6 Zoonotic Diseases

Rabies is endemic nationally, with the most common mode of transmission through the bite or saliva of infected animals. No reported cases of rabies have been notified in the Project AoI from 2016 to 2018, but the disease remains a considerable risk as evidence from secondary data shows multiple incidents of dog bites.

Viral haemorrhagic fever is a general term for a severe viral illness, sometimes associated with bleeding and multi-organ failure, but associated with high mortality rates. This includes diseases such as Ebola, Marburg and Crimean-Congo fever. While no cases of viral haemorrhagic fever have been registered in Kenya to date, the risk remains linked to global movement of populations as witnessed with the recent (2014 to 2016) Ebola outbreak in West Africa and the current Ebola outbreak in the north-eastern area of Democratic Republic of Congo. Brucellosis and echinococcosis (dog tape worm infection) are the commonest zoonotic diseases in the AoI.

Garbage and general domestic waste generated by Project facilities require effective management to ensure proper hygienic conditions. Rodents and other wild animals may be attracted to areas where food is prepared, stored or disposed of. This may result in the increase of the rodent population in Project facilities but also at landfill sites. Increased populations of rodents may cause an increased risk for transmission of diseases associated with poor sanitation, but they may also act as an attractor for predators, including snakes, feral dogs and other animals. Interaction between these predators and the community at landfill sites and other at-risk localities may increase the risk for bites or injuries.

This impact also considers the local transport corridors and construction sites if food packs are provided to workforce members and not properly disposed of. It should be noted that an increased number of wildlife in camp areas may also have a negative impact on workforce health for similar reasons.

At risk PAP include residents and households that reside in proximity to accommodation camps where waste may be temporarily stored, prior to transport to the IWMF, as well as those in proximity to the engineered landfill to be constructed outside of the CFA. The risk associated with this impact topic will be higher during the construction phase of the Project. It will extend into operations but on a lower scale due to a decrease in Project staff and activities. Therefore in theory there would be a lower impact during operations due to the change in numbers, however the landfill will be maintained through operations and taking into account the duration of impacts will be longer at operations, the significance of impacts between construction and operations remains the same.

The impact on human health has a negative direction and will have a high consequence over the medium term, i.e., throughout construction and operations. Its geographic distribution is local and probability rating is possible. The overall significance prior to mitigation is **Moderate (negative)** for construction and operations.

Mitigation specific to Zoonotic Diseases (Repeated Mitigation: Social 10) will be included within the Operator Environmental Performance Plan and will set out requirements and include procedures for the implementation (maintenance during operations) of Pest Control procedures for the landfill and other Project facilities.

Following effective mitigation implemented during construction and maintained throughout operations, it is anticipated that the consequence will be reduced to low with a reduction in duration to short-term. The geographic distribution remains local while probability is reduced to unlikely. The residual impact will have a **Negligible** significance for construction and operations.

7.9.9.6.7 Community Accidents and Injuries

The national rise in road traffic accidents has been attributed to increased use of motorised transport (including motorbikes), poorly regulated public transport, driving while under the influence of substances, speeding and poor utilisation of safety equipment such as seat belts and helmets. Safety gear and seatbelts are not routinely worn, increasing the severity of injuries. During the period from 2015 to 2018, Turkana County recorded 33 cases of severe head injuries related to road traffic accidents. Poor road conditions were regarded as contributing factor, but this may also play a role in limiting severe injuries as speeding was not always possible on poor road surfaces.

Emergency medical services in Turkana have shown some improvement in capacity with the number of ambulances increasing from two in 2013 to thirteen in 2018. Despite this increase in capacity, stakeholders believed that this was still inadequate to serve the needs of the County. Importantly, ambulances are generally used to transport patients between facilities and they rarely respond to pre-hospital incidents as primary responders.

The Project requires substantial logistical support. This increase in the quantity of road traffic on existing roads (notably the C46 and A1) as well as the infield access roads (to be constructed by the Project), may increase road traffic and pedestrian-vehicle accidents more notably during construction, but also into operations, resulting in an increase in morbidity and mortality amongst community members, with children noted as an especially vulnerable group.

Unskilled or semi-skilled workers, especially those from the rural communities, are unlikely to have had exposure to work conditions and safety standards associated with a Project of this nature and magnitude. This will be most evident during the construction phase and appropriate health and safety standards will need to be introduced to reduce incidents and accidents to as low as reasonably practicable. This approach will be maintained during operations. Although the local unskilled workers may not necessarily be utilised in all high-risk activities and numbers required will reduce during operations, the risk for involvement in occupational incidents resulting in injury and mortality remains.

Similarly, community members may gain access to Project construction sites and other facilities, resulting in injuries from accidental interaction with mobile construction equipment, falling into excavation pits or from interaction with construction materials or other Project infrastructure.

At risk PAP include those who reside in communities alongside transport corridors and infield access roads, as well as those in proximity to construction sites. The risk associated with this potential impact will be highest during construction due to the increased number of activities and work sites. It may, however, extend into operations but generally limited to permanent Project infrastructure and to a lesser degree, transport corridors and access roads.

The impact is considered to have a negative direction on human health and safety, associated with a high consequence over a short-term duration during construction and a medium consequence over a medium-term duration during operations. The difference is due to a reduced number of sources of impacts from construction sites and activities and reduced numbers of project traffic during operations. Despite the extensive geographic distribution of the Project's logistics activities, the impact will likely only affect specific individuals within communities along major transport routes, those in proximity to access roads and those in proximity to construction sites, resulting in a national distribution when all transport corridors are considered. As the likelihood of this impact occurring is probable, this impact is rated to have a **Major (negative)** significance during construction and **Moderate (negative)** during operations.

The mitigation measures specified within the Operator Code of Conduct (Repeated Mitigation: Social 01) will apply while the Operator Social Performance Plan will set out additional requirements for transport management to mitigate impacts relating to Community Health Safety and Security. The transport management system will include the following requirements:

- Minimum safety and equipment standards for Project vehicles including maintenance in accordance with Manufacturer recommendations and through regular scheduled maintenance.
- The Operator will conduct regular safety audits of all project vehicles, and rectifying actions should any non-conformance be identified.
- All drivers of Project vehicles will be required to hold a valid driver's licence.
- All drivers will meet the Operator driver standards and international standards as set out in IOGP Land Transport Safety Recommended Practice 365. A training needs assessment of Contractor drivers will be undertaken by the Operator and the Contractor and a training plan will be agreed with the Operator and implemented as required.
- All vehicles will be fitted with inward and outward facing cameras to monitor driver performance and external hazards.
- Audible reversing alarms and other safety devices shall be fitted and maintained in good working order on all contractor vehicles.
- Project speed limits to be established and complied with by all Project vehicles.
- Signage will be installed, in coordination with County Government, to draw driver's attention to specific hazards along approved routes.
- Night-time driving will be prohibited unless specifically authorised.
- Off-road driving will be prohibited.
- the Operator will provide guidelines for wet weather driving and training to all drivers.
- A Journey Management Plan will be prepared by the Contractor for all heavy vehicle convoy journeys, submitted to, and approved by, the Operator prior to each convoy.
- the Operator will survey all transport routes and develop a Hazard Identification and Mitigation booklet for the principal routes. All significant hazards are detailed in the book including a photograph and mitigation measure, e.g., reduction in speed. Coordinates for hazards will be linked with vehicle GPS systems to provide driver with advanced warning of approaching hazards.
- the Operator will ensure all drivers and co-drivers are provided with the Hazard Identification and Mitigation booklet and trained in how to use it.

Additionally, the Operator will develop and implement a Community Safety Outreach Programme to inform local communities of vehicle related hazards along Project in-field transport routes. In particular, schools along transport routes have been identified by the Operator and will be engaged as part of a Schools Safety Outreach Programme, led by the Operator. The Project Emergency Response Plan, developed by the Operator, will identify procedures in the event of an incident and set out how to manage and minimise any consequences of a road traffic accident.

The Operator will monitor key performance indicators relating to traffic management and potential effects, grievances and improvements through the Operator Grievance Management Procedure and the CHIS into the operations phase. At commencement of operations, the Operator will revisit the Community Safety Outreach Programme to inform local communities of vehicle related hazards along Project in-field transport routes. In particular, schools along transport routes have been identified by the Operator and will be engaged as part of a Schools Safety Outreach Programme, led by the Operator.

Implementation of mitigation measures will result in a negative impact with high consequence, short term duration, local distribution and a probability rated as unlikely during construction and the same evaluation except it will be medium-term during operations. This results in a reduced residual impact of **Moderate** (negative) significance during construction and the significance being maintained at **Moderate** (negative) during operations due to the high consequence.

7.9.9.7 Environmental Determinants of Health

The purpose of this section is to cross-reference key environmental determinants of health and highlight the linkages with community health. Unlike the previous impact topics, no additional mitigation measures will be added. All mitigation measures are included in the environmental sections, but linkage between the environment and social impacts are described here.

Air quality

Potential impacts related to air quality may occur during both the construction and operational phases of the Project. Project-related activities may generate oxides of Sulphur (SO_x) and NO_x as well as dust deposition. This may potentially result in negative health impacts as fine particulates may have the potential to impact human health. This is, however, largely dependent on particle characteristics, particularly particle size and chemical composition and the duration, frequency and magnitude of exposure.

The potential of particles to be inhaled and deposited in the lung is a function of the aerodynamic characteristics of particles in flow streams. When the particle size is smaller than $PM_{2.5}$, the particles are respirable and may penetrate deep into the lungs causing serious health problems including respiratory tract irritation, chronic bronchitis, or asthma exacerbation.

Potential PAP at risk from these impacts are those that reside in settlements adjacent to construction sites, permanent Project infrastructure and unsealed access roads as well as transient individuals, although it is expected that exposure in the latter cohort would be less due to a shorter exposure period. Children, the elderly and those with existing chronic lung conditions such as asthma and chronic obstructive pulmonary disease will be at higher risk.

Modelling performed as part of the air quality impact analysis has shown that the potential for impacts related to NOx, NO_2, SO_2 and CO exposure are minor during the Project timeframe, while the potential for impacts as a result of PM_{10} and $PM_{2.5}$ particulate matter exposure during the same period, is Moderate for permanent receptors and Major for transient receptors.

As part of the Project impact mitigation, the Operator will implement management measures as per the Air Quality section (Section 7.1) of the ESIA.

Noise and Vibration

Evidence from epidemiological studies have demonstrated that environmental noise is associated with an increased incidence of arterial hypertension, myocardial infarction, and cerebro-vascular accidents (stroke). Both observational and experimental studies indicate that, in particular, night-time noise can cause disruptions of sleep structure, vegetative arousals (e.g., increases of blood pressure and heart rate) and increases in stress hormone levels.

As part of the Project impact mitigation, the Operator will implement management measures as per the Noise and Vibration section (Section 7.2) of the ESIA.

Water Quality and Quantity

Multiple Project-related activities may potentially impact on the quality and quantity of water sources available to PAP in the AoI. A decrease in the availability of safe water may lead to an increase in water and sanitation related diseases in an area that is already deemed to be water-stressed and where sanitation related diseases were reported as a major health concern by stakeholders.

As part of the Project impact mitigation, the Operator will implement management measures as per the Water quantity and quality sections (Section 7.4 and 7.5) of the ESIA.

7.9.9.8 Education

One impact topic has been identified in relation to education: changes in access to education. This impact topic considers primarily indirect impacts on access to education since there are no expected direct impacts on education through displacement.

7.9.9.8.1 Change in Access to Education

There are numerous challenges to the education context in both Turkana and West Pokot Counties. High dropout rates and low enrolment numbers of young girls in schools have been associated with early marriage and the pastoral lifestyle. This is an ongoing challenge and the Project may have an indirect impact due to availability of economic opportunities in the AoI, which could indirectly affect this continual marginalisation of young females.

Another challenge is the low enrolment in schools of children from pastoral livelihood families in both Turkana and West Pokot Counties. The ministry in Turkana and West Pokot have taken initiatives to address this lack of access to education by providing teachers who would travel with the mobile family units.

The Project has the potential to indirectly impact pastoral movements and disturb this livelihood. This may have a positive effect of driving pastoralists to remain in permanent settlements thus their children would then have access to school facilities. It has been noted from Key Informant Interviews that the attendance and enrolment of children in school is low during times of conflict and instability.

Anticipated Project-induced in-migration would also have an indirect impact on access to education for PAP. Influx in urban areas has the potential to increase pressure on already limited education facilities. Key Informant interviews noted that children have to travel long distances to schools. It was also stated that teachers are moving into other sectors of employment where they are offered better salaries and benefits.

The impact to education is the change in access to education for PAP. There is no expected direct impact on any school building due to the placement of Project infrastructure and loss of land triggered by the Project. However, changes can be anticipated indirectly. Such changes can be both positive and negative.

In general, new investment, employment and business opportunities create more opportunities that create incentives for more diverse and skilled students. The opportunities create incentives for gaining new technical and business skills which is a positive outcome. However, the limitation in available educational infrastructure can make this a negative impact. Currently there are only 32 secondary schools in Turkana County and 142 in West Pokot County which is a limitation for students to continue their education. There is also a limited access to technical colleges and vocational training programmes. These new economic opportunities would create a need for more secondary schools and technical colleges which would allow for children to further their education into a skilled service or technical vocation.

The full extent and nature of the impacts of the COVID-19 pandemic on the provision of education in Kenya are not yet fully understood, with new information becoming available as the situation evolves. The NDMA reported that schools re-opened nationwide in January 2021, among concerns that prolonged closures were contributing to increased teen pregnancies, poor nutrition and permanent dropouts (NDMA, 2021c). In both Turkana and West Pokot, difficulties in accessing e-learning due to lack of equipment, connectivity or understanding was highlighted as a particular constraint on education during the COVID-19 pandemic (NDMA, 2021a; NDMA, 2021c). The NDMA (2021b) also report that disruption to education as a result of COVID-19 has resulted in increased gender-based violence, child labour and substance abuse among students in West Pokot.

Increased employment opportunities generated by the Project provide some with added income and the ability to support children in school. Similarly, increased business opportunities linked to local content also can increase household income. While these trends are positive, both can also have negative impacts. While salaried employment provides more income, it can also increase domestic work within the household and cause incentives to keep some children out of school to take on a bigger share of these domestic tasks.

As local businesses grow and multiply, there can also be incentives for children to leave school and seek work to increase household income. This dynamic was observed in some parts of the AoI where gold mining was noted as a factor in keeping children from going to school. It was observed that short-term income is valued over the longer-term benefit of education.

Indirect impacts caused by Project influx can have an influence on the number of students seeking an education. These indirect impacts are further discussed in Section 7.9.9.2. Potential indirect impacts associated with security that could affect children's attendance and enrolment in schools in conflict areas will be discussed in Section 7.9.9.8. The changes to access of education have a mixed direction and it is difficult to predict. The consequence is moderate, and the geographic extent of the change can be expected to be regional, affecting PAP in Turkana and West Pokot Counties. The duration of the impact is medium-term, i.e., throughout construction and operations. The impact significance prior to mitigation or benefit enhancement is **Minor (positive**) during construction and operations**.**

Since 2011, The KJV planned and undertook approximately 56 social investment initiatives related to education in Turkana. These projects range from building new school infrastructure, maintaining existing school infrastructure, including classrooms, dormitories, and latrines benefiting approximately 30 schools.

Many of the projects have been undertaken in the context of land access during the Exploration and Appraisal phase, while others are linked to discretionary social investment. Such social investment extends to the County centre in Lodwar where projects have sought to support the development of technical skills at the Lodwar Vocational Training Centre.

As of May 2018, 6,000 primary and secondary students had received support through bursaries, 200 received scholarships for vocational training and 30 specific schools had received either infrastructure or equipment. Some initiatives have targeted girls. As of June 2019, enrolment at the Uhuru Girls High School had increased from 360 in 2015 to 580, partially due to the increased student accommodation that increased the capacity for girls to attend school.

Based on previous social investment related to education, the Operator will develop a strategy for future social investment in education for PAP to manage potential negative impacts. Specifically, the Operator will develop a monitoring and evaluation process to assess the effectiveness of measures to maintain access to education and the triggers for action to take place if the measures have not been effective. The Operator will review and maintain a strategy for future social investment in education for project affected people throughout the operations phase.

If the strategy is developed to be more comprehensive and measurable, the changes to access of education will have a residual impact of **Moderate (positive)** starting during construction but continuing throughout operations.

7.9.9.9 Social Maladies

7.9.9.9.1 Crime, Commercial Sex Work and Other Nuisances from Growth

Social determinants of health are the conditions in which people are born, grow, live, work and age, including the health system. These circumstances are shaped by the distribution of money, power and resources.

Education is a key determinant to support and may uplift the health status and wellbeing of an individual in a society, and indeed entire communities. Literacy levels in the Project AoI are amongst the lowest nationally, with nearly two-thirds of women (64%) and over a third of men (35%) in Turkana County having no formal education.

Substance abuse, particularly alcoholism, was reported as an emerging health challenge in Turkana County. The trend is increasing particularly in urban areas and peri-urban informal settlements. Use of illicit drugs such as marijuana was reported in Lodwar town and Lokichar urban settlement.

Commercial sex activity was reported in Lodwar, Lokichar and Lokori and was linked to the economic development in these areas. Teenage pregnancies were largely attributed to early marriages, with most girls in the area married at the age of 14 to17 years. As a result, educational attainment was low in this group and was noted to be a contributing factor to poor health education and poor awareness of health issues. In addition to this, women were perceived as marginalised in many aspects including education, employment opportunities and decision-making capabilities.

It is generally recognised that women are primarily impacted by domestic gender-based violence which creates both a health and psychological burden. It also recognised that in many societies, women are socialised to accept, tolerate and even rationalise the practice. Data shows that in 2018, Turkana and West Pokot Counties recorded 439 cases and 477 cases of sexual violence, respectively. Violent behaviour was reported as common in general society, with this reflected in the high rates of violence-related injuries as well as gender-based domestic and sexual violence. Ethnic animosity and substance abuse were reported as contributing factors.

The lack of general employment opportunities in the AoI and the subjective expectation that the Project will support significant employment opportunities and economic development, has the potential to create social disharmony especially towards the Project, if these expectations are not realised. This may result in negative perceptions of well-being within communities or sections in the communities who may not directly or indirectly benefit from the Project.

Although a proportion of the Project workforce will be recruited from the local communities during the construction phase, this will only provide employment for a period of three years. While this will be the period in which the local communities can benefit the most from direct employment; the skill sets and experience in the community will limit their potential for employment in senior roles. In the operations phase, there will be a smaller workforce, that requires a small number of local workers (estimated at 200 persons) to be utilised in semiskilled and unskilled roles.

Therefore, while local communities will benefit from local employment, employment opportunities are of short duration and will be markedly reduced in the operational phase. The benefits derived from this will likely be outweighed by potential negative impacts. Project employment may result in negative health consequences, including:

- Employment of community members for a short period, with a resultant alteration from subsistence livelihood to earning a paid wage. This may change traditional practices, especially in men who may not want to return to subsistence livelihoods once the employment opportunities cease.
- Development of a cash economy that may erode community cohesion and traditional bonds, which are an essential element in mutual help structures and local culture. Project induced in-migration (PIIM) may also influence these traditional structures and also create supply and demand of products and services with escalating inflation, especially during construction.
- The development of a cash economy may also limit informal trading and bartering, which may limit access to certain sectors of the community to the local economy.
- Increased financial gains obtained by men from Project employment may not necessarily translate into benefits for other members of the household and may increase the incidence of social ills amongst local workforce members (e.g., substance abuse, transactional sex and commercial sex work) and result in an increase in gender-based domestic violence in AoI communities.
- As a result of predominantly male employment in unskilled labour positions, marginalisation of women may lead to an increase in transactional or commercial sex as a means to support and augment livelihoods.
- In addition to this, improper financial management by the male heads of households may result in a decrease in food security and result in worsening malnutrition, specifically in those households who are dependent on procuring basic foodstuffs rather than partaking in subsistence livelihood activities.
- The impacts related to social maladies will be further exacerbated by PIIM and the erosion of existing social structures.
- Due to the short-term duration of the Project's construction phase, it is unlikely that socio-economic conditions in the AoI will sustainably improve as a direct result of Project employment to the extent that NCD will develop in local communities. The impact of employment as it relates to NCDs is therefore considered to be negligible during construction and not rated. However, this may change if the socio-economic circumstances in the AoI improve through, for example, payment of royalties with NCDs having the potential to surpass communicable disease in the overall burden of disease in future.

In addition to the impacts related to Project employment, there will also be the expectation that the Project will support a full range of social development and community investment programmes, irrespective of the role that the County and National government should play in this role. The local communities do not necessarily have insight into the actual scale and planned activities of the Project, which will potentially support these false expectations.

The impact has negative direction, moderate consequence over the short term, regional distribution with a peak during construction. As the likelihood of this impact is probable, it concludes as an impact with **Moderate (negative)** significance during both construction and operations and requires specific mitigation throughout the project life.

Prior to construction, the Operator will work with National Government, County Government, the County Commissioner and key stakeholders to agree on the terms of reference and projects for the Operator investment to support information programmes that seek to identify and provide support for key social maladies (e.g., gender-based violence, drug and alcohol abuse). Such programmes will be aligned to County Integrated Development Plans.

In addition to the Operator Code of Conduct (Repeated Mitigation: Social 01). The Operator Social Performance Plan will set out the specific requirements relating to mitigation of Social Maladies. These will include:

- Influx management procedures to manage speculative influx. Procedures will be developed in coordination with the respective County Administration.
- Establishing KPIs relating to Social Maladies relating to the Project in coordination with the respective County Administration.
- Monitoring of KPIs through the CHIS.

Through project operation, the Operator will continue to support the engagement process with National Government, County Administration and key stakeholders to consider and agree social investment proposals established during construction, to maintain a transparent process, through which the Operator can communicate concepts and annual budgets to be considered for social investment to support information programmes that seek to identify and provide support for key social maladies (e.g., gender-based violence, drug and alcohol abuse) and the Social Performance Plan will continue to set out requirements for the ongoing implementation of mitigation measures relating to Social Maladies.

The results in a residual rating during construction of **Minor (negative),** reducing to **Negligible** significance for operations, if programmes and policies are successfully implemented and maintained.

7.9.9.10 Social Capital and Conflict

Two impact categories have been identified in relation to social capital and conflict:

- Inter-ethnic conflict; and
- Community cohesion within Turkana and West Pokot Counties.

7.9.9.10.1 Inter-Ethnic Conflict

Turkana and neighbouring pastoralist Counties in Kenya have well-known histories of conflict and violence, often associated with cattle raiding. While this conflict preceded the arrival of current oil-related activities, it forms the backdrop for the Project.

During initial ESIA fieldwork in July 2016, there were indications of relative calm in comparison to previous years. During a period from March to October 2016 security monitoring registered few violence incidents. From November 2016, there was an increase in violent incidents and this trend has steadied. The overall situation is variable, but not dangerous as the period around 2015. The 10 years leading up to 2015 has seen a gradual shift in patterns of livestock raiding and attacks. While cattle raids still occur, the commercialisation of livestock theft, in which individuals, and not communities, benefit from raiding, emerged. Politicians, businessmen and other elites are alleged to be supporting and profiting from commercialised raiding, something that is believed to be eroding the authority of Traditional Leaders.

A total of 106 security incidents have been registered in Turkana and West Pokot during the reporting period August 2018 – July 2019 with incidents in Turkana accounting for 85% of these.

In the past, inter-ethnic conflict has been linked to cattle raiding and more recently the practice has been linked to naturally occurring changes such as climate change and periodic drought. However, with the launch of the Project, private sector activities are likely to draw more attention and blame for violence.

The source of potential impact for this topic is the transport of materials during construction and operation to the Project infrastructure areas which will be undertaken by trucks along set access road routes. Depending on the security status at the time, these vehicles will move through areas of relative insecurity and may require additional security measures from the Police. On-site security will also be continued and expanded to guarded stations at wellpads and other Project infrastructure.

The Project has the potential to impact upon any conflict in complex ways that are difficult to attribute to single reasons and track. There have been numerous potential triggers for renewed violence identified, 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.

Although the National Police are responsible for security outside of the fenceline, the impact of the project on inter-ethnic conflict is negative by direction and the consequence is high. The geographic extent of change is predicted to be at least regional (beyond Turkana and West Pokot) and potentially national and the duration is medium-term, i.e., throughout construction and operations. The overall impact significance prior to mitigation is **Major** (negative) for construction and operations.

The Operator will develop and maintain a Human Rights Policy (Repeated Mitigation: Social 07) that will state its commitment to implement the UN Guiding Principles on Business and Human Rights and the Voluntary Principles on Security and Human Rights (Voluntary Principles). This Policy will be publicly disclosed and will be applicable to all who work for or on behalf of the Operator. The Operator Local Content Development Plan will also include details of how the Human Rights Policy will be implemented and monitored including explicit detail on the Operator and contractor's compliance with International Labour Organisation (ILO) Core Conventions, including child labour and forced labour.

Project Oil Kenya will develop a Voluntary Principles Implementation Guideline throughout the life of the Project. The Implementation Guideline will frame the approach to realising its commitment and will focus on seven key themes related to respecting human rights:

- Identification and management of security and human rights risks;
- Managing the Relationship with Public Security Forces;
- Managing Private Security;
- Stakeholder Management;
- Management System Integration of the voluntary principles; and
- Assurance.

Specific measures within the Operator Social Performance Plan will also present requirements for mitigation relating to Inter Ethnic Conflict and Security (Repeated Mitigation: Social 11). These will include the following commitments:

- All transportation activities will be undertaken under the advice of the Police. If the Police advise that security escorts are required to support the movement of vehicles, security will be provided by the Police and will be under the control of the Police at all times. The Operator will liaise with the National Police Forces on at least a weekly basis to obtain briefings on regular monitoring by the Police of security incidents, including vandalism, crime, cattle raiding and inter-communal clashes. This liaison will help ensure close coordination between the Operator and Police forces to identify, manage and minimise risks to the Project from insecurity and also identify opportunities for the Project to identify and minimise sources of potential grievance and insecurity as an inadvertent consequence of its activities.
- The Operator will maintain an Incident Reporting System for monitoring of security incidents.
- The Operator will complete risk assessments to identify potential impacts and risks to communities and identify opportunities for the Project to minimise sources of potential grievance and insecurity as an inadvertent consequence of its activities.

- The Operator will employ a suitably licenced and experienced security company, working to recognised international standards, to provide and manage trained guards for access control and security within its fenced locations.
- If the National Police advise that security escorts are required to support the movement of vehicles, security will be provided by the Police and will be under the control of the Police at all times.
- All guards engaged by Project Oil Kenya will be un-armed.
- The Operator will engage the National Police Force in line with Kenyan regulatory requirements to ensure the criteria on which security services are deployed are clearly understood.
- The Critical Infrastructure Protection Unit was established in 2015 as an arm of the Administration Police with responsibility for the management of threats to critical national infrastructure, which includes the Operator facilities. All security outside of fenced locations will be provided by the Kenyan Police force and they will not be under the control or direction of the Operator.
- The Operator will establish and maintain security training for all employees, contractors and visitors during induction and orientation process. All employees and visitors receive specific security briefing as part of their induction, including:
  - An overview of local security risks and controls;
  - Personal security responsibilities and reporting requirements;
  - Detail of relevant response actions for security incidents; and
  - Refresher training is provided to all employees at least annually throughout the project 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 the Operator facilities are informed as much as possible about the security risks. Following the construction phase, all commitments will be monitored with on-going engagement (to pick up qualitative and unanticipated changes) and adapted as necessary for operations. If accompanied by the engagement commitments relating to the implementation of the CDPs, the residual impact is expected to be **Minor (negative)** for both construction and operations.

7.9.9.10.2 Community Cohesion Within Turkana and West Pokot County

There are no quantitative baseline indicators to assess community cohesion. The impact topic is important, however, as any Project of this size will inevitably change community cohesion when large-scale industry is introduced to a rural environment that has largely relied only on subsistence pastoralism and household, small-scale agriculture.

The impact topic is also important given the high expectations about community benefits. Even at the earliest stages, fieldwork highlighted common beliefs of unfairness and that a given community had not benefitted as much as the neighbouring one. Misunderstandings about employment and why many jobs are given to skilled workers from outside the AoI can create jealously that has the potential to create community conflict. Many research interviews confirmed 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 AoI with a persistent view that jobs will be allocated in exchange for land access and other Project related impacts. This more transactional approach, used in early exploration and appraisal stages of the Project, will not be scalable.

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 and West Pokot. This has and will continue to lead to grievances and to an overall deterioration of community cohesion which need comprehensive management and engagement during construction, which should be adapted and maintained at an appropriate level through operations based on monitoring and engagement outcomes.

The impact on community cohesion is negative by direction and the consequence is moderate. The geographic extent of change is local and the duration is medium-term, i.e., throughout construction and operations. The overall impact significance prior to mitigation is **Moderate (negative)** for both construction and operations

The impact related to community cohesion is linked to high expectations. There is no one solution that can address these expectations and any solutions used will need to adapt as PAP expectations change.

To mitigate potential impacts, the Operator Social Performance Plan will set out measures on Community Cohesion within Turkana and West Pokot County (Repeated Mitigation: Social 12) with requirements to work with National Government, County Administration and key stakeholders relating to community cohesion, which can inform management of influx, social maladies, security and community health and safety.

Additionally, the Operator Stakeholder Engagement Plan will be used to coordinate messaging on project employment, recruitment and hiring procedures and will describe how the Operator will maintain regular community engagement outreach to address rumour and other misunderstandings identified through regular engagement. The Operator Community Liaison teams will comprise experienced qualified staff, who are well trained in community relations and maintain links with traditional leadership throughout the project affected areas and maintain a comprehensive understanding of key cultural sensitivities.

While difficult to predict, the engagement commitments described above, if implemented comprehensively at construction and maintained at an appropriate level throughout operations, are expected to minimise the chance of this negative impact occurring making the residual impact **Minor (negative)** for both construction and operations**.**

7.9.9.11 Construction Impact Assessment

The construction phase impact assessment pre-mitigation and post mitigation impact evaluations linked to the preceding text are presented in Table 7.9-5.

Table 7.9-5: Construction Impact Assessment

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
Project-induced influx and in-migration	Economic opportunities linked to a multi-billion investment Indirect effect of increased salaried employment and procurement.	Major (negative)	■ The Operator Social Performance Plan will present influx management procedures to manage speculative influx (emergence of informal settlements) occurring. Procedures will be developed in coordination with Turkana and West Pokot County Administrations. ■ Prior to start of construction, the Operator will work with National Government, County Administration and key stakeholders to support the monitoring of population changes in key settlements (Lokichar, Nakukulas, Lokori) to identify significant changes in population. ■ Prior to start of construction, the Operator will also develop a methodology to monitor growth of homesteads and physically monitor numbers and location of homesteads in the immediate areas surrounding Project facilities. Monitoring data will be gathered for up to 3 years and used to identify in-migration "hot spots" and develop appropriate mitigation options. The Operator will determine thresholds for action should they be exceeded to reduce the impacts of population influx. The Operator Social Performance Plan will link the approach to in-migration management with other social performance activities relating to Community Health, Local Content and Security. ■ The Operator will work with National Government, County Administration and key stakeholders to establish and develop the terms of reference for an Influx working group, which will be chaired by a representative of county government and will include representatives from National and County government departments, and relevant CSOs. The Operator will sit as a member on the working group. The aim of the group will be to review, monitor and support actions to manage Project-induced influx. ■ The Operator will work with Turkana County Administration to identify locations for alternative water supply boreholes away from Project facilities to encourage households to move to other, less congested, locations. ■ The Operator Local Content Development Plan and Workforce Training Strategy will provide the framework for local recruitment to reduce incentives for in-migration, which will be communicated broadly in the region. Key principles and contractor requirements include: ▪ No informal ("at the gate") recruitment; and	Moderate (negative)

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
			▪ Clear definitions and criteria will be established for hiring of "local" and "local-local" workers, including a verification process to confirm their residency status. ■ **Repeated Mitigation – Social 01 – The Operator Code of Conduct:** The Operator will train all employees and contractor workers in the Operator Code of Conduct, including worker rights and human rights, in line with the Operator commitment to implement the UN Guiding Principles on Business and Human Rights and the Voluntary Principles on Security and Human Rights (Voluntary Principles) ■ **Repeated Mitigation – Social 02 – The Operator Local Content Development Plan and Workforce Training Strategy Communication:** The Operator will undertake a campaign to communicate the Operator Local Content Development Plan and Workforce Training Strategy to stakeholders. This will explain local employment and local content opportunities. It will also describe the recruitment procedures to be followed. The campaign will focus efforts on priority groups and communities identified in the Operator Local Content Development Plan as coming from target communities for employment. ■ **Repeated Mitigation – Social 03 – Contractor Demobilisation:** The Operator will undertake advance planning and management of retrenchment and demobilisation of Project and contractor workers in line with Kenyan Labour Law and international good practice. The Operator Contractor Demobilisation Plan will set out contractor demobilisation requirements including: ▪ Any Collective Redundancies will be undertaken within the framework of a Retrenchment Plan (as described in the Operator Social Performance Plan).	

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
			▪ At the time of hiring, the period of employment assignment and the conditions for hiring and layoff will be clearly explained to the new recruits and recorded in individual employment contract; and ▪ The Operator will establish company retrenchment procedures and contractor demobilisation procedures including returning workers to the place from where they were recruited or to their domicile.	
Infrastructure and Services	Additional infrastructure and activities	Minor (positive)	■ Prior to construction, the Operator will work with National Government, County Administration and key stakeholders to agree on the terms of reference and projects for the Operator community investment, building on existing initiatives, as part of the CDP, aligned to County Integrated Development Plans. Although the focus will be on communities in Turkana County, there will be two CDPs (one for Turkana and one for West Pokot) which will clearly define all voluntary actions the Operator take for social investment in community projects. ■ The Operator will establish an engagement process to consider and agree social investment proposals. The Operator will instigate CDP working groups, which will be headed by leadership at the County and Sub-county level, including representatives of government departments, private sector, NGOs and potentially religious institutions. The Operator will engage with this CDP working group to develop a transparent process, through which the Operator can communicate concepts and align annual budgets to be considered for social investment. The Operator CDPs will provide clear guidelines for, and present how the Operator will support the development of the following: ▪ Required criteria to be met and structure of proposals for social investment projects, including how they supplement (and don't replace) existing initiatives that are provided by the County Administration or National Government. ▪ Evidence of engagement with local stakeholders required for the Operator to consider social investment proposals. ▪ Definition of how the local community, including underrepresented groups, vulnerable and marginalised people, will benefit from social investment projects.	Moderate (positive)

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
			The planned distribution of CDP projects throughout the local community should be documented to avoid inter-area competition. ▪ Definition of the "ownership" model of proposed social investment projects, key performance indicators and success criteria. ▪ Method of tracking successful implementation and delivery of the investment projects. ▪ How performance will be communicated annually in sustainability reports and to County governments. ▪ Required methods of communication and mandatory information to be provided (e.g., period of funding, amount, project type) to local communities once investment projects have been agreed. ▪ Expected sustainability, governance, auditing and monitoring throughout the investment projects and required reporting format. ■ **Repeated Mitigation – Social 04 – The Operator CDP Availability and Update:** The Operator CDP will be publicly available and updated in timely fashion with agreed social investment projects. In the CDP, the Operator will present how investment projects distribute benefits transparently and fairly among affected communities, how the investment projects mitigate Project-induced in-migration. ■ **Repeated Mitigation – Social 05 – Sustainable use of Community Offtakes:** ■ The Operator commit to seek opportunities to encourage sustainable use of community offtake water points on the water pipeline to discourage overgrazing at water off take points, via the Upstream Water Framework Agreement, and collaboratively address issues submitted through the Operator Grievance Management Procedure.	
Taxes and payments	Tax and other payments linked to Project	Moderate (positive)	■ **Repeated Mitigation – Social 06 – Taxes and Payments**	Moderate (positive)

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
			■ The Operator will conduct periodic engagement on the Operator Social Performance Plan, including the CDPs, with relevant County-level board of trustees[35].	
Contractor employment	Contractor managed construction and employment opportunities	Minor (positive)	■ The Operator will develop a National Content Development Plan and a Local Content Development Plan, which will be issued to prospective EPC tenderers who will be required to prepare Contractor National and Local Content Development Plans to implement the Operator requirements. ■ The Operator National Content Development Plan and Local Content Development Plan will set out specific objectives, procedures and requirements related to contractor employment and procurement, KPIs for national and local content inclusion and performance requirements, minimum requirements and expectations for contractor employment, monitoring and audit of contractor managed construction and employment opportunities and requirements relating to contractor employment for EPC bidders to include in their National Content Development Plans. ■ As part of the Operator Local Content Development Plan, the Operator will develop a Workforce Training Strategy and associated Implementation Plan, which will describe how the Operator, and their contractors will: ▪ Define how local residents from the Project AoI will be given preference for vocational training; ▪ Collaborate with selected training partners to develop a range of bridging /job-readiness training packages for potential local employees;	Moderate (positive)

[35] A County-level board of trustees is described in the Petroleum Act as the body that will oversee the utilisation of funds levied from oil and gas operations "*for the benefit of present and future generations*".

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
			▪ Support existing technical and vocational training programmes to enhance the qualifications and training of local workers; ▪ Ensure all employment opportunities will be open to both men and women on an equal basis and how this will be tracked to determine if there are barriers to be addressed; and ▪ Assist members of the local workforce, who are less qualified, with gaining access to existing technical and vocational training programmes (e.g., a programme available to support basic training, literacy, numeracy and Health and safety). ■ The Operator Local Content Development Plan will define the following, adherence to which will be mandatory for all contractors: ▪ There will be no informal ("at the gate") recruitment; ▪ Procedures for the hiring of unskilled and low-skilled workers for local residents in the Project AoI, and for workers likely to travel to the project on a speculative basis in search of work; ▪ Definitions and criteria will be established for hiring of "local" and "local-local" workers; ▪ Procedures describing that there will be "*zero tolerance*" for any form of discrimination based on sex, gender, age, religion, ethnicity and disability; ▪ Procedures describing that there will be "*zero tolerance*" for hunting, foraging, unpermitted use of natural resources within the Project AOI; ▪ All contractors will track and report quarterly Contractor Employment data by gender; and	

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
			▪ Adoption of the Operator Grievance Management Procedure. ■ **Repeated Mitigation – Social 02 – the Operator Local Content Development Plan and Workforce Training Strategy Communication** ■ **Repeated Mitigation – Social 03 – Contractor Demobilisation** ■ **Repeated Mitigation – Social 07 – Human Rights Policy:** The Operator will develop (maintain during operations) a Human Rights Policy that will state its commitment to implement the UN Guiding Principles on Business and Human Rights and the Voluntary Principles on Security and Human Rights (Voluntary Principles). This Policy will be publicly disclosed and will be applicable to all who work for or on behalf of the Operator. The Operator Local Content Development Plan will include details of how the Human Rights Policy will be implemented and monitored including explicit detail on the Operator and contractor's compliance with ILO Core Conventions, including child labour and forced labour.	
Business opportunities and local content	Procurement opportunities linked to the Project	Minor (positive)	■ The Operator Local Content Development Plan will set out specific objectives, procedures and requirements related to business opportunities and procurement, KPIs for national and local content inclusion and performance requirements, minimum requirements and expectations for suppliers, monitoring and audit of the Operator and contractor managed procurement. The Operator will also set out requirements relating to procurement for EPC bidders and will be included in their Local Content Development Plans. ■ The Operator will undertake a campaign to communicate the Operator Local Content Development Plan to local suppliers and businesses. Targets and methods will be described in the Stakeholder Engagement Plan. The communication campaign will explain local procurement opportunities and how to qualify for tendering processes,	Moderate (positive)

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
			including procurement opportunities with contractors and length of contracts. It will also describe the procurement procedures to be followed. ■ The Operator Local Content Development Plan will describe how the Operator, and its contractors will: ▪ collaborate with local businesses to assess and develop local business capacity. ▪ set out commitments for local business capacity building, including assisting local businesses to gain access to existing technical and vocational training programmes. ▪ ensure all procurement for the project will be transparent and on an equal basis. ■ Identify key performance indicators to monitor changes in business opportunities and local content performance.	
Inflation	Indirect effect of increased salaried employment and procurement, plus in-migration and increased demand on goods and services	Moderate (negative)	■ The Operator Social Performance Plan will describe the strategy to use local and national suppliers and ensure a best market price is sought from suppliers to help manage local inflation. The Plan will also present methods for monitoring of local inflation and set out how information will be shared with County Government officials. ■ The Operator will coordinate with NDMA to collect data similar, but supplementary, information to NDMA monthly surveys on socio-economic indicators throughout the construction period. ■ The Operator will review data on a quarterly basis with County Administration to identify local Project-induced price inflation.	Minor (negative)
Long term loss of community land	Land acquisition to develop the facilities required for the Project	Major (negative)	■ The RLRP will set out: ▪ Procedures for Government-led land acquisition in line with national statutory land acquisition processes set out in Kenyan law. GoK will acquire the Project Land and act as landlord to the Project.	Minor (negative)
Temporary restriction on	Temporary land restrictions on	Major (negative)		Minor (negative)

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
land use, notably pastoral grazing and settlement access, during construction	land use to develop the facilities required for the Project		▪ The Project's timing and description of the supplemental activities and entitlements that will assist relocation of households, businesses and institutions and meet international standards (IFC Performance Standard 5). ▪ How the GoK data gathering processes, valuation methodologies, compensation rates, engagement processes with affected persons, businesses, institutions and communities, including agreement of statutory compensation by Project-affected households. ▪ How GoK compensation and the statutory 15% disturbance allowance equates to "full replacement cost". ▪ How the Operator will provide supplemental assistance, on a voluntary basis, to physically displaced households, businesses and institutions, who meet pre-agreed assistance criteria. This will include relocation assistance from Project affected areas including transport assistance, transitional support and additional assistance to particularly vulnerable households. ▪ The criteria for defining particularly vulnerable and marginalised households. The Operator will be responsible for identifying and providing supplementary assistance to vulnerable and marginalised households in line with IFC Performance Standards. ▪ The monitoring and evaluation process to assess the effectiveness of measures to restore livelihoods and the proposed independent auditing. ■ Prior to construction, the RLRP will be disclosed publicly and will be maintained throughout the construction process. ■ The Operator will minimise use of the land acquired by GoK such that only land required for Project Facilities is used exclusively by the Project, (i.e., with access restricted by security fencing). This will mean that existing land users will be able to continue use of gazetted land until and unless it is required. ■ Following GoK data gathering processes and prior to implementation of resettlement and livelihood restoration activities, the Operator will supplement data with additional baseline surveys as required to establish the socio-economic characteristics of affected households and identify particularly vulnerable persons. Additional engagement with particularly vulnerable people affected by the project will facilitate the definition of	Negligible
Loss of occupied homesteads (physical displacement)	Land acquisition to develop the facilities required for the Project	Major (negative)		Minor (negative)
Loss of household structures other than homesteads, e.g., animal shelters or dug water holes	Land acquisition to develop the facilities required for the Project	Minor (negative)		Negligible
Loss of business structures - shops	Land acquisition to develop the facilities required for the Project	Minor (negative)		Negligible

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
			supplemental entitlements to assist relocation and ensure access to and effective delivery of livelihood restoration. The Operator led supplementary activities will be carried out in a culturally appropriate way and in consultation with affected stakeholders. Supplementary entitlements will be recorded in a supplemental entitlements schedule to be provided to affected households, businesses and institutions separately to the statutory Compensation and Awards Schedule provided by the GoK process. Final categorisation of supplemental entitlements will be disclosed publicly.	
Loss of access to or use of TCG-operated community water points within the project affected area	Land acquisition to develop the facilities required for the Project	Moderate (negative)	■ If Project activities and infrastructure lead to a need to relocate community water points, the Stakeholder Engagement Plan will describe how the Operator will engage with County Government, local stakeholders and communities to discuss and plan the relocation of community water tanks to suitable locations. Key elements of this approach will include: ▪ The Operator will ensure that equivalent water supplies will be provided to water users of existing community water points that require relocation. ▪ Prior to FID, the Operator will complete baseline surveys to establish the water requirements and ensure that alterative water supplies are appropriately sized to meet community water demand. ▪ The Operator will develop a monitoring and evaluation process to assess the effectiveness of measures to maintain water supplies and the triggers for action to take place if the measures have not been effective. ■ The Operator will monitor households affected by the relocation of water points to ensure that affected water users are able to access the alternate water supply.	Minor (negative)
Increased travel / walking distances to community water points	Land acquisition to develop the facilities required for the Project	Minor (negative)		Negligible
Impacts on livelihoods due to loss of communal land (economic displacement)	Land acquisition to develop the facilities required for the Project	Moderate (negative)	■ The RLRP sets out the procedures for Government-led land acquisition in line with national statutory land acquisition processes set out in Kenyan law. GoK will acquire the Project Land and avail it to the Operator for the Project. ■ **Repeated Mitigation – Social 08 – Livelihood Restoration Support for Livestock Grazing** ■ The RLRP and the CDPs will set out how the Operator will provide (maintain during operations) culturally appropriate livelihood restoration support aimed at improving	Negligible

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
			livestock grazing livelihoods for users of communal land in Project Affected Areas. Livelihood restoration measures will be developed in consultation with affected communities, stakeholders, County Administration and GoK to ensure that they meet the needs of households and communities and fit with local priorities and other government support initiatives	
Impacts on Graves	Land acquisition to develop the facilities required for the Project	Major (negative)	■ Section 7.10 describes mitigation and management measures for impacts on graves in detail.	Minor (negative)
Sexually transmitted infections	Introduction of outside workforce, financial incentives for vulnerable persons, and transport for Project construction	Major (negative)	■ **Repeated Mitigation – Social 09 –Sexually Transmitted Infections:** The Operator Social Performance Plan will present procedures for the development, implementation and maintenance of mitigation measures relating to Community Health Safety and Security, including the establishment and maintenance of a CHIS. These procedures will include: ▪ Implementation of the Operator HIV Policy and Programme for all employees and requirements for Contractors to adhere to the Operator HIV Policy and Programme. ▪ Development and implementation/ maintenance of the Operator "*95-95-95*" strategy, which sets targets for awareness, treatment and demonstrating performance in viral suppression. ▪ Operation of all construction accommodation as "*closed camps*". ▪ The Operator will train all employees and contractor workers in the Operator Code of Conduct. ▪ Providing training to all drivers (including contractors) on pre-designated routes and ensuring transport rest stops will have been surveyed and approved by the Operator. ▪ KPIs relating to Community Health and Safety and how the Operator will monitor KPIs through the CHIS.	Minor (negative)

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
			- Medical Fitness to Work requirements for all workers and contractors. ■ Prior to construction, the Operator will work with National Government, County Administration, key stakeholders to agree on the terms of reference for the Operator investment in Community Health programmes as part of the CDPs, aligned to County Integrated Development Plans. The Operator will build on existing social investment for specific Health Systems Strengthening activities in areas at higher risk for HIV transmission due to Project impacts. ■ **Repeated Mitigation – Social 04 – The Operator CDP Availability and Update**	
Vector related diseases	Alteration of the physical environment	Moderate (negative)	■ The Operator Social Performance Plan will present procedures for the development and implementation of mitigation measures relating to Community Health Safety and Security, including the establishment of a CHIS. These procedures will include: - Establishment and implementation of Malaria Management procedures. - All construction camps will provide first aid / and first aiders and health clinics or paramedic services for workers. - Establish and implement KPIs for Project related impacts under the CHIS, in collaboration with authorities in Turkana and West Pokot Counties - The Operator will monitor KPIs through the CHIS	Minor (negative)
Communicable diseases	Introduction of outside workforce and transport for Project construction	Major (negative)	■ The Operator and their contractors will plan for and provide sufficient capacity in accommodation facilities to prevent overcrowding and to ensure that all Project-related workers are accommodated in camps and not in local communities. The Operator Social Performance Plan will present procedures for the development and implementation of mitigation measures relating to Community Health Safety and Security, including the establishment of a CHIS. These procedures will include: - Camp cleanliness and hygiene requirements. - The operation of all construction accommodation as "*closed camps*"	Minor (negative)

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
			▪ All construction camps will provide first aid / and first aiders and health clinics or paramedic services for workers, including provision for management of snake and scorpion bites. ▪ Repeated Mitigation – Social – the Operator Code of Conduct ▪ Maintain Medical Fitness to Work procedures for all workers and contractors ▪ Establish and maintain effective waste management procedures, in line with procedures and performance monitoring in the Operator Environmental Performance Plan ▪ Align food hygiene programmes with good industry practice standards and monitor performance. ▪ Establish and implement an Infectious Disease Health Policy and Programme (particularly related to HIV and TB) and establish KPIs under the CHIS, in collaboration with authorities in Turkana and West Pokot Counties. ▪ Establish and implement a Pandemic Preparedness Plan (including Covid). ▪ Monitor KPIs through a CHIS. ■ Prior to construction, the Operator will coordinate with the respective County Administrations and agree on the terms of reference and projects for the Operator investment in Community Health programmes as part of the CDPs, aligned to County Integrated Development Plans. the Operator will provide social investment to specific Health Systems Strengthening activities in areas at higher risk for Communicable disease transmission due to Project impacts. ▪ **Repeated Mitigation – Social 04 – the Operator CDP Availability and Update.**	
Zoonotic diseases	Waste from Project activities	Moderate (negative)	■ **Repeated Mitigation – Social 10 - Zoonotic Diseases:** The Operator Environmental Performance Plan will set out requirements and include procedures for the implementation (maintenance during operations) of Pest Control procedures for the landfill and other Project facilities	Negligible

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
Accidents and injuries	Transport for Project construction	Major (negative)	■ The Operator Social Performance Plan will set out requirements for transport management to mitigate impacts relating to Community Health Safety and Security. The transport management system will include the following requirements: ▪ Repeated Mitigation – Social – the Operator Code of Conduct ▪ Minimum safety and equipment standards for Project vehicles including maintenance in accordance with Manufacturer recommendations and through regular scheduled maintenance. ▪ The Operator will conduct regular safety audits of all project vehicles, and rectifying actions should any non-conformance be identified. ▪ All drivers of Project vehicles will be required to hold a valid driver's licence; ▪ All drivers will meet the Operator driver standards and international standards as set out in International Association of Oil and Gas Procedures (IOGP) Land Transport Safety Recommended Practice 365. A training needs assessment of Contractor drivers will be undertaken by the Operator and the Contractor and a training plan will be agreed with the Operator and implemented as required; ▪ All vehicles will be fitted with inward and outward facing cameras to monitor driver performance and external hazards; ▪ Audible reversing alarms and other safety devices shall be fitted and maintained in good working order on all contractor vehicles; ▪ Project speed limits to be established and complied with by all Project vehicles; ▪ Signage will be installed, in coordination with County Administration, to draw driver's attention to specific hazards along approved routes; ▪ Night-time driving will be prohibited unless specifically authorised; ▪ Off-road driving will be prohibited; ▪ The Operator will provide guidelines for wet weather driving and training to all drivers;	Moderate (negative)

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
			▪ A Journey Management Plan will be prepared by the Contractor for all heavy vehicle convoy journeys, submitted to, and approved by, the Operator prior to each convoy. ▪ The Operator will survey all transport routes and develop a Hazard Identification and Mitigation booklet for the principal routes. All significant hazards are detailed in the book including a photograph and mitigation measure, e.g., reduction in speed. Coordinates for hazards will be linked with vehicle GPS systems to provide driver with advanced warning of approaching hazards; and ▪ The Operator will ensure all drivers and co-drivers are provided with the Hazard Identification and Mitigation booklet and trained in how to use it. ■ The Operator will develop and implement a Community Safety Outreach Programme to inform local communities of vehicle related hazards along Project in-field transport routes. In particular, schools along transport routes have been identified by the Operator and will be engaged as part of a Schools Safety Outreach Programme, led by the Operator. ■ The Operator will establish a Project Emergency Response Plan identifying procedures should an incident occur and how to manage and minimise any consequences of a road traffic accident. ■ The Operator will monitor key performance indicators relating to traffic management and potential effects, grievances and improvements through the Operator Grievance Management Procedure and the CHIS.	
Change in access to education	Infrastructure affecting movement of pastoralists, indirect impact of in-migration	Minor (positive)	■ Based on previous social investment related to education, the Operator will develop a strategy for future social investment in education for project affected people. ■ The Operator will develop a monitoring and evaluation process to assess the effectiveness of measures to maintain access to education and the triggers for action to take place if the measures have not been effective.	Moderate (positive)
Crime, commercial sex work and other	Indirect effect of increased salaried	Moderate (negative)	■ Prior to construction, the Operator will work with National Government, County Administration and key stakeholders to agree on the terms of reference and projects for the Operator investment to support information programmes that seek to identify and	Minor (negative)

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance

nuisances from growth	employment and procurement		provide support for key social maladies (e.g., gender-based violence, drug and alcohol abuse). Such programmes will be aligned to County Integrated Development Plans.
			▪ The Operator Social Performance Plan will set out requirements relating to mitigation of Social Maladies. These will include:
			  ▪ **Repeated Mitigation – Social 01 – the Operator Code of Conduct.**
			  ▪ Influx management procedures to manage speculative influx. Procedures will be developed in coordination with Turkana and West Pokot Governments and the respective County Commissioners.
			  ▪ Establishing KPIs relating to Social Maladies relating to the Project in coordination with the respective County Administrations.
			  ▪ Monitor KPIs through the CHIS.	

Inter-ethnic conflict	Project operating in region with history of inter-ethnic violence and raiding	Major (negative)	▪ **Repeated Mitigation – Social 07 – Human Rights Policy**
			▪ **Repeated Mitigation – Social 11– Inter Ethnic Conflict and Security:**
			The Operator Social Performance Plan will present requirements for mitigation measures relating to Inter Ethnic conflict and security. These will include:
			  ▪ All transportation activities will be undertaken under the advice of the Police. If the Police advise that security escorts are required to support the movement of vehicles, security will be provided by the Police and will be under the control of the Police at all times.
			  ▪ The Operator will liaise with the National Police Forces on at least a weekly basis to obtain briefings on regular monitoring by the Police of security incidents, including vandalism, crime, cattle raiding and inter-communal clashes.
			  ▪ The Operator will maintain an Incident Reporting System for monitoring of security incidents.
			  ▪ The Operator will complete risk assessments to identify potential impacts and risks to communities, and identify opportunities for the Project to minimise sources of potential grievance and insecurity as an inadvertent consequence of its activities
				Minor (negative)

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
			▪ The Operator will employ a suitably licenced and experienced security company, working to recognised international standards, to provide and manage trained guards for access control and security within its fenced locations. ▪ If the National Police advise that security escorts are required to support the movement of vehicles, security will be provided by the Police and will be under the control of the Police at all times. All guards engaged by Project Oil Kenya will be un-armed. The Operator will engage the National Police Force in line with Kenyan regulatory requirements to ensure the criteria on which security services are deployed are clearly understood. All security outside of fenced locations will be provided by the National Police force and they will not be under the control or direction of Project Oil Kenya. The Operator will establish and maintain security training for all employees, contractors and visitors during induction.	
Community cohesion within Turkana and West Pokot County	Introduction of outside workforce	Moderate (negative)	▪ **Repeated Mitigation – Social 12– Community Cohesion within Turkana and West Pokot County:** The Operator Social Performance Plan will set out requirements to work with National Government, respective County Administrations and key stakeholders relating to community cohesion, which can inform management of influx, social maladies, security and community health and safety. The Stakeholder Engagement Plan will be used to coordinate messaging on project employment, recruitment and hiring procedures and will describe how the Operator will maintain regular community engagement outreach to address rumour and other misunderstandings identified through regular engagement. The Operator Community Liaison teams will comprise experienced qualified staff, who are well trained in community relations and maintain links with traditional leadership	Minor (negative)

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
			throughout the project affected areas and maintain a comprehensive understanding of key cultural sensitivities	

7.9.9.12 Operational Phase Impact Assessment

Impacts associated to the operations phase are presented in Table 7.9-5. Many of the mitigations will be the same or a continuation of those in the construction phase, some though being less-resource intensive. The Table below highlights which commitments will continue beyond construction.

Table 7.9-6: Operations Impact Assessment

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
Project-induced influx and in-migration	Economic opportunities linked to a multi-billion investment Indirect effect of increased salaried employment and procurement	Moderate (negative)	■ The Operator will maintain influx management procedures established during construction, which are presented in the Operator Social Performance Plan and were agreed in coordination with Turkana and West Pokot County Administrations. ■ The Operator will work with National Government, County Administration and key stakeholders to support the monitoring of population changes in key settlements (Lokichar, Nakukulas, Lokori). The Operator will work with the relevant county and national administrations to monitor growth and location of homesteads in the immediate areas surrounding Project facilities and enact actions to manage influx. ■ The Operator will attend the Influx Working Group. ■ The Operator will implement the Local Content Development Plan and Workforce Training Strategy to reduce incentives for in-migration. ■ **Repeated Mitigation – Social 01– The Operator Code of Conduct** ■ **Repeated Mitigation – Social 02 - The Operator Local Content Development Plan and Workforce Training Strategy Communication.** ■ The Operator will undertake a campaign to communicate operational requirements under the Operator Local Content Development Plan.	Moderate (negative)
Infrastructure	Additional infrastructure and activities	Minor (positive)	■ The Operator will coordinate with County Administrations, in line with the CDP, aligned to the County Integrated Development Plan. ■ **Repeated Mitigation – Social 04 – The Operator CDP Availability and Update.** ■ The Operator will communicate social investment projects annually in sustainability reports publicly. ■ the Operator will continue to meet sustainability, governance, auditing and monitoring requirements described in the CDP. ■ **Repeated Mitigation – Social 05 – Sustainable Use of Community Offtakes.**	Moderate (positive)

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
Taxes and payments	Tax and other payments linked to Project	Moderate (positive)	■ **Repeated Mitigation – Social 06 – Taxes and Payments.**	Moderate (positive)
Contractor employment	Contractor managed construction and employment opportunities	Minor (positive)	■ The Operator National Content Development Plan and Local Content Development Plan will maintain procedures and requirements related to contractor employment and procurement, KPIs for national and local content inclusion and performance requirements, minimum requirements and expectations for contractor employment, monitoring and audit of contractor managed construction and employment opportunities. ■ **Repeated Mitigation – Social 01 – The Operator Code of Conduct.** ■ **Repeated Mitigation – Social 02 – The Operator Local Content Development Plan and Workforce Training Strategy Communication.** ■ **Repeated Mitigation – Social 07 – Human Rights Policy.**	Moderate (positive)
Business opportunities and local content	Procurement opportunities linked to the Project	Minor (positive)	■ The Operator Local Content Development Plan will be maintained with procedures and requirements related to business opportunities and procurement, KPIs for national and local content inclusion and performance requirements, minimum requirements and expectations for suppliers, monitoring and audit of the Operator and contractor managed procurement. ■ Prior to commencement of operations, the Operator will undertake a campaign to communicate operational requirements for local suppliers and businesses. The communication campaign will explain local procurement opportunities and procedures to be followed.	Moderate (positive)

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
Inflation	Indirect effect of increased salaried employment and procurement, plus in-migration and increased demand on goods and services	Minor (negative)	■ At the commencement of operations, the Operator will review inflation monitoring established during construction to inform ongoing management and mitigation for operations. Inflation monitoring will continue during the initial period of operations (3 years), thereafter alternative monitoring may be sought based on the review if considered necessary. ■ The Operator will continue to coordinate with NDMA to collect data similar, but supplementary, information to NDMA monthly surveys on socio-economic indicators throughout the operational period.	Minor (negative)
Loss of occupied homesteads (physical displacement)	Land acquisition to develop the facilities required for the Project	Moderate (negative)	■ The Operator will continue monitoring and evaluation of the implementation of the RLRP to assess the effectiveness of measures to restore livelihoods. ■ The Operator will complete or commission a completion audit (initially after 1 year, in line with IFC requirements) to confirm that livelihoods have been restored to pre-Project levels as a minimum.	Negligible
Impacts on livelihoods due to loss of communal land (economic displacement)	Land acquisition to develop the facilities required for the Project	Moderate (negative)	■ **Repeated Mitigation – Social 08 – Livelihood Restoration Support for Livestock Grazing**.	Negligible
Sexually transmitted infections	Introduction of outside workforce, financial incentives for vulnerable persons, and transport during operations	Major (negative)	■ **Repeated Mitigation – Social 09 –Sexually Transmitted Infections** ■ The Operator will continue providing social investment to specific Health Systems Strengthening activities in areas at higher risk for HIV transmission due to Project impacts.	Minor (negative)

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
Vector related diseases	Alteration of the physical environment	Moderate (negative)	■ Prior to operations all procedures and objectives in the Operator Social Performance Plan relating to vector related diseases will be reviewed, in light of construction phase monitoring. Updated procedures will include: ▪ Updated KPIs relating to Community Health and Safety agreed in coordination with County Government and the DCCs ▪ Malaria Management procedures. ▪ All worker accommodation will provide first aid / and first aiders and health clinics or paramedic services for workers. ▪ The Operator will monitor KPIs through the CHIS.	Minor (negative)
Communicable diseases	Introduction of outside workforce and transport during operations	Major (negative)	■ Prior to operations all procedures and objectives relating to Community Health Safety and Security in the Operator Social Performance Plan will be reviewed, in light of construction phase monitoring. Updated procedures will include the following: ▪ Camp cleanliness and hygiene requirements. ▪ The operation of all worker accommodation as “*closed camps*”. ▪ All camps will provide first aid / and first aiders and health clinics or paramedic services for workers. ▪ **Repeated Mitigation – Social 01– The Operator Code of Conduct.** ▪ Maintain Medical Fitness to Work procedures for all workers and contractors. ▪ Maintain effective waste management procedures, in line with procedures and performance monitoring in the Operator Environmental Performance Plan. ▪ Align food hygiene programmes with good industry practice standards and monitor performance. ▪ Maintain an Infectious Disease Health Policy and Programme (particularly related to HIV and TB) and establish KPIs under the CHIS, in collaboration with authorities in Turkana and West Pokot Counties. ▪ Maintain a Pandemic Preparedness Plan (including Covid). ▪ Monitor KPIs through a CHIS.	Minor (negative)

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
			■ The Operator will continue providing social investment to specific Health Systems Strengthening activities in areas at higher risk for HIV transmission due to Project impacts.	
Zoonotic diseases	Waste from Project activities	Moderate (negative)	■ **Repeated Mitigation – Social 10 - Zoonotic Diseases**.	Negligible
Accidents and injuries	Transport during operations	Moderate (negative)	■ The Operator Social Performance Plan will review and update procedures established during construction for maintaining the transport management system to mitigate impacts relating to Community Health Safety and Security. ■ At commencement of operations, the Operator will revisit the Community Safety Outreach Programme to inform local communities of vehicle related hazards along Project in-field transport routes. In particular, schools along transport routes have been identified by the Operator and will be engaged as part of a Schools Safety Outreach Programme, led by the Operator. ■ The Operator will maintain the Project Emergency Response Plan identifying procedures should an incident occur and how to manage and minimise any consequences of a road traffic accident. ■ The Operator will monitor key performance indicators relating to traffic management and potential effects, grievances and improvements through the Operator Grievance Management Procedure and the CHIS.	Moderate (negative)
Change in access to education	Infrastructure affecting movement of pastoralists, indirect impact of in-migration	Minor (positive)	■ The Operator will monitor households affected by the change in access to education to ensure that households are not disadvantaged by in migration relating to the project or change of access to education. ■ The Operator will review and maintain a strategy for future social investment in education for project affected people.	Moderate (positive)
Crime, commercial sex work and other	Indirect effect of increased salaried employment and procurement	Moderate (negative)	■ The Operator will continue to support the engagement process with National Government, County Administration and key stakeholders to consider and agree social investment proposals established during construction, to maintain a transparent process, through which the Operator can communicate concepts and annual budgets to be considered for social investment to support information	Negligible

Impact Topic	Source of Potential Impact	Impact Significance	Mitigation	Residual Impact Significance
nuisances from growth			programmes that seek to identify and provide support for key social maladies (e.g., gender-based violence, drug and alcohol abuse). ■ The Operator Social Performance Plan will set out requirements for the continued implementation of mitigation measures relating to Social Maladies.	
Inter-ethnic conflict	Project operating in region with history of inter-ethnic violence and raiding	Major (negative)	■ **Repeated Mitigation – Social 07– Human Rights Policy.** ■ **Repeated Mitigation – Social 11 – Inter Ethnic Conflict and Security.**	Minor (negative)
Community cohesion within Turkana and West Pokot County	Introduction of outside workforce	Moderate (negative)	■ **Repeated Mitigation – Social 12 – Community Cohesion within Turkana and West Pokot County.**	Minor (negative)

7.9.9.13 Decommissioning

Five years prior to the planned 'End of Project', a Decommissioning Plan will be developed for agreement with the appropriate authorities. It will include measures to help manage the legacy issues associated to the Project and mitigate the impacts of the transition of the Project operations to no Project. It will include general and specific mitigation measures relating to all social related policy and procedure and transition plans for ownership of social initiatives in the AoI.

7.9.10 Summary of Mitigation

Most of the socio-economic impacts will be experienced during the construction phase of the Project and some of these will continue during the operational phase. It is envisaged that mitigation measures for operational impacts will be similar to those identified for construction and it is unlikely that additional mitigation will be required during operations. Towards the end of the construction phase, commitments will be reviewed to determine if continuation is reasonable during the operational phase. This review will be based on construction phase monitoring.

As previously stated, the SEP (Annex II) and grievance mechanisms are key for all social mitigations. The SEP is a live document, that will be updated to reflect how the social mitigations relate to information disclosure and consultation. This procedural mitigation commitment serves a core purpose to identify as soon as possible unforeseen impacts and includes a detailed description of the grievance mechanism, a multi-tiered system for review and resolution of registered grievances.

Influx: The complex issue of Project-induced influx during both construction and operation is managed in four areas: monitoring, reducing incentives for uncontrolled migration, managing worker integration with local communities, and engagement. The Operator Social Performance Plan will present influx management procedures to be developed in coordination with Turkana and West Pokot County Administrations at construction, and then maintained throughout operations.

All employees will adhere to the existing the Operator Code Conduct (Repeated Mitigation: Social 01). This document sets the expectation for all who work for the Operator and their contractors. Firstly, the Operator will train all employees and contractor workers in the POK Code of Conduct, including worker rights and human rights, in line with implementing the UN Guiding Principles on Business and Human Rights and the Voluntary Principles on Security and Human Rights (Voluntary Principles).

The Operator Local Content Development Plan and Workforce Training Strategy (Repeated Mitigation: Social 02) will provide the framework for local recruitment to reduce incentives for in-migration, which will be communicated broadly in the region. Key principles of the recruitment procedures are to avoid confusion around the hiring practice and being clear on what job and local content opportunities are available, making sure this matches with external expectations, including:

- No informal ("at the gate") recruitment; and
- Clear definitions and criteria will be established for hiring of "local" and "local-local" workers, including a verification process to confirm their residency status.

These key principles, communicated frequently, help to mitigate the impact of rumours. Unclear procedure and definitions can cause job-seekers to move or re-establish themselves in areas where they think that might increase their chances of securing employment. The communication of each principle will extend beyond the closest locations in Turkana and West Pokot Counties.

With the implementation of influx management and monitoring during the construction phase, it is envisaged that there will be a reduction in influx. Therefore, the established measures will continue into the operational phase but will be less resource intensive.

During operations, the Operator will continue to work with National Government, County Administration and key stakeholders to support the monitoring of population changes in key settlements (Lokichar, Nakukulas, Lokori) and work with the relevant county and national administrations to monitor growth and location of homesteads in the immediate areas surrounding Project facilities and enact actions to manage influx during operation. The Operator will attend the Influx working group and make efforts to reduce the incentives for influx through its recruitment procedures as specified in the Operator's Local Content Development Plan and Workforce Training Strategy Communication (Repeated Mitigation: Social 02) While the Operator will undertake a campaign to communicate operational requirements through the Local Content Development Plan.

Another cross-cutting mitigation plan is the Operator CDP Availability and Update which will be publicly available and updated in timely fashion with agreed social investment projects. In the CDP, the Operator will present how investment projects distribute benefits transparently and fairly among affected communities, how the investment projects mitigate Project-induced in-migration.

Infrastructure: The Operator will work with National Government, County Administration and key stakeholders to agree on the terms of reference and projects for the Operator community investment, building on existing initiatives, as part of the CDP, aligned to County Integrated Development Plans. Although the focus will be on communities in Turkana County, there will be two CDPs (one for Turkana and one for West Pokot) which will clearly define all voluntary actions the Operator takes for social investment in community projects.

The Operator will establish an engagement process to consider and agree social investment proposals. The Operator will instigate CDP working groups, which will be headed by leadership at the County and Sub-county level, including representatives of government departments, private sector, NGOs and potentially religious institutions. The Operator will engage with this CDP working group to develop a transparent process, through which the Operator can communicate concepts and align annual budgets to be considered for social investment.

Contactor employment and business opportunities: Benefits related to employment and business opportunities will be managed through a series of procedures and plans. Key existing and planned documents include:

- The Operator National Content Plan;
- The Operator Local Content Development Plan and Workforce Training Strategy Communication;
- The Operator Contractor Management Procedure;
- Contractor Procedures for Local Procurement and Local Recruitment (including Contractor Demobilisation); and
- Human Rights Policy.

Inflation: The impacts related to inflation are difficult to isolate and manage. The Operator will seek to better understand inflation through selecting and monitoring prices for standard "*basket of goods*" and building on the current monitoring activities of the NDMA. Monitoring will be maintained throughout construction and inform ongoing management and mitigation for operations. The Operator Social Performance Plan will describe the strategy to use local and national suppliers and ensure the best market price is sought from suppliers to help manage local inflation. The Operator Social Performance Plan will also present methods for monitoring of local inflation and set out how information will be shared with County Government officials.

Land: It is envisaged that land impacts would be felt and mitigated during the construction phase and would not extent into operations. Land impacts, while still formalising key roles and responsibilities are guided by two key commitments. Firstly, compensation, as determined under the Kenyan Law, will be provided as part of the Government-led statutory land acquisition process. Secondly, any gaps between government-led land acquisition and IFC PS5 will be addressed as part of the RLRP. The implementation of the RLRP and CDPs will continue during the operational phase, in order to mitigate the impacts on livelihoods and livelihood restoration.

The Operator will engage with County Government, local stakeholders and communities to discuss and plan the relocation of community water tanks to suitable locations and the Operator will monitor households affected by the relocation of water points to ensure that affected water users are able to access the alternate water supply.

Community Health and Safety: Impacts related to community health and safety are managed through a series of procedures and plans. These are expected to be implemented during construction and maintained throughout operations. Project interventions in the series of plans and programmes will be revised to be relative to the operational impacts and informed by construction phase monitoring. The Operator Social Performance Plan will present procedures for the development, implementation and maintenance of mitigation measures relating to Community Health Safety and Security, including the establishment and maintenance of a CHIS. These procedures will include:

- Implementation of an Operator HIV Policy and Programme for all employees and requirements for Contractors to adhere to the HIV Policy and Programme.
- Development and implementation/ maintenance of the Operator's "*95-95-95*" strategy, which sets targets for awareness, treatment and demonstrating performance in viral suppression.
- Operation of all construction accommodation as "*closed camps*".
- The Operator will train all employees and contractor workers in the Operator Code of Conduct
- Providing training to all drivers (including contractors) on pre-designated routes and ensuring transport rest stops will have been surveyed and approved by the Operator,
- KPIs relating to Community Health and Safety and how the Operator will monitor KPIs through the CHIS.
- Medical Fitness to Work requirements for all workers and contractors.

Security: To manage the complex impacts and issues related to security, the Operator Social Performance Plan will present requirements for mitigation measures relating to Inter Ethnic conflict and security. These will include:

- The Operator will liaise with the Kenyan National Police Forces on at least a weekly basis to obtain briefings on regular monitoring by the Police of security incidents, including vandalism, crime, cattle raiding and inter-communal clashes.
- The Operator will maintain an Incident Reporting System for monitoring of security incidents.
- The Operator will complete risk assessments to identify potential impacts and risks to communities, and identify opportunities for the Project to minimise sources of potential grievance and insecurity as an inadvertent consequence of its activities

- The Operator will employ a suitably licenced and experienced security company, working to recognised international standards, to provide and manage trained guards for access control and security within its fenced locations.
- If the National Police advise that security escorts are required to support the movement of vehicles, security will be provided by the Police and will be under the control of the Police at all times.

Graves: Mitigation and management measures are presented in detail in Section 7.10.

7.9.11 Summary of Residual Impacts

With the proposed mitigation, the residual impacts for both Accidents and Injuries and Project-induced influx and in-migration predicted to be moderate negative, despite mitigation measures. All other residual impacts are expected to be minor negative or negligible, with many expected to be positive. Moderate or high positive impacts include transparent tax payments, employment and business opportunities. With participatory management of the proposed CDPs, benefit enhancement should also create improved socio-economic conditions in relation to infrastructure and services.

Key issues such as Project-induced influx and in-migration, inflation, permanent loss of land resulting in economic displacement, and security are complex issues that are influenced by a range of factors, not all of which fall under the control of the Operator and contractors. These impacts represent the highest pre-mitigation impact significance with moderate (negative) residual impacts expected. This issue will warrant close attention during the ongoing monitoring and engagement procedures and to monitor the implementation of planned mitigation.

7.10 Cultural Heritage

7.10.1 Introduction

The potential impacts on cultural heritage as a result of the Project have been determined using a phased qualitative assessment methodology, as outlined below:

- Cultural heritage receptors with the potential to be impacted by the Project are identified and ascribed an 'importance' value, ranging from 'low' to 'very high'. Further detail is provided in Section 7.10.3;
- The 'magnitude' of any impacts resulting from the Project, ranging from 'negligible' to 'high', on the identified receptors are established (assuming any specified inherent mitigation is in place). Further detail is provided in Section 7.10.4;
- A comparison of the receptor importance and the impact magnitude is used to calculate the impact significance (based on the matrix presented in Table 7.10-3, Section 7.10.6);
- Where required, a mitigation strategy is proposed, with the impact significance re-assessed (assuming both inherent mitigation and proposed mitigation is in place) to ascertain the residual impacts of the Project.

A description of Tangible, Intangible and Living Cultural Heritage is presented in Section 6.13.

7.10.2 Area of Influence

Cultural heritage impacts have the potential to occur within the Social AoI, which is presented in Chapter 3.0. Not all cultural heritage receptors within the Social AoI are expected to be impacted by the Project. It is considered that impacts on intangible cultural heritage could occur throughout the Social AoI, but that the potential of the Project to impact upon tangible cultural heritage receptors (including living cultural heritage and archaeology) is limited to within 500 m of Project infrastructure.

7.10.3 Receptor Importance

In order to identify the importance of the receptors, the scale of relative importance presented in Table 7.10-1

[36] has been used with reference to the information collated in the baseline to classify the selected receptors.

Table 7.10-1: Criteria for Determining Importance of Receptors for Cultural Heritage

Receptor Importance	Example Cultural Heritage Receptors
Very high	Receptors of international importance with significant cultural/archaeological value. Receptors that cannot be moved or are non-replicable. Receptors that are 'critical'[37]. Examples include sacred trees.
High	Receptors of national or regional importance with significant cultural value. Non-replicable receptors that are not critical, or cultural sites that are potentially replicable and that could be moved in highly exceptional circumstances (in consultation with site guardians and the affected communities). Examples include graves and burials, intangible cultural practices specific to northern Kenya and archaeological settlement sites.
Medium	Receptors of local importance with significant cultural value. Receptors that are common and potentially replicable and that can be moved in exceptional circumstances

[36] An expanded definition of the importance criteria for living cultural heritage, intangible cultural heritage and archaeological receptors is presented in Annex I.

[37] 'Critical' cultural heritage consists of one or both of the following types of cultural heritage: (i) the internationally recognised heritage of communities who use, or have used within living memory, the cultural heritage for long-standing cultural purposes; or (ii) legally protected cultural heritage areas, including those proposed by host governments for such designations' (IFC, 2012a).

Receptor Importance	Example Cultural Heritage Receptors
	(in consultation with site guardians and the affected communities). Examples include religious buildings, *akiriket* sites and intangible practices widely observed in Kenya.
Low	Receptors of limited local importance and cultural value. Receptors that are defunct and/or have little or no historic value. Receptors that are common and/or replicable and that can be moved or destroyed (in consultation with site guardians and the affected communities). Examples include isolated archaeological findspots and traditional land use sites.

7.10.4 Magnitude of Impact

The characterisation of the magnitude of the impact considers the description of Project processes and how the Project could result in a change at each of the receptors. The potential for an impact to occur at a receptor has been determined using the understanding of the baseline environment and consideration of whether there is a feasible linkage between a source of the potential impact and each receptor. The magnitude of each potential adverse impact has then been classified between 'negligible' and 'high', as described in Table 7.10-2[38]. There is also potential for positive impacts to occur. Where these are identified, there is no distinction made between magnitudes of impact; they are simply reported as positive impacts.

For cultural heritage, potential impacts are considered to be either direct or indirect. These are defined as:

- **Direct impacts**: Impacts that result from a direct interaction between a project activity and a receptor (e.g., destruction of a receptor through ground disturbance/compaction or severance of access to a receptor by project-related infrastructure); and
- **Indirect impacts**: Impacts that result from a project activity where the interaction with a receptor is through a secondary pathway, such as noise emissions or emissions to air, or impacts that affect the setting in which a receptor is experienced (e.g., increased noise levels or a visual change affecting the way in which a receptor can be used or dust deposition/ground vibration resulting in damage or a loss of amenity at a receptor). Impacts resulting from socio-economic changes are also considered to be indirect.

To robustly assess indirect impacts, cultural heritage receptors have been factored into the analyses for noise and vibration, air quality and landscape and visual, with the combined results of these assessments evaluated to complete a holistic qualitative analysis of the impacts upon cultural heritage. Where indirect impacts from these sources occur, the residual impacts (i.e., post-mitigation) have been used in order to avoid 'double counting' the impact. The results of the social impact assessment have also been considered to reflect indirect socio-economic impacts on cultural heritage receptors, as well as linkages with ecosystem services.

In determining the magnitude of any impacts, consideration has been given to both the duration and frequency of impacts, as well as to whether the impact is temporary or permanent. A permanent impact is defined as a change to the baseline that would not reverse itself naturally. A temporary impact is defined as a change to the baseline conditions that would reverse naturally once the source of the impact is exhausted or has stopped.

[38] An expanded definition of the magnitude criteria for living cultural heritage, intangible cultural heritage and archaeological receptors is presented in Annex I.

Table 7.10-2: Criteria for Assessing Magnitude of Impact

Magnitude of Impact	Description Criteria	
	Adverse	**Positive**
High	Anticipated impact 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.	Anticipated impact on tangible or intangible cultural heritage receptors results in beneficial consequences (e.g., improved access that facilitates the sustainable use of the receptor or dissemination of published research).
Medium	Anticipated impact on tangible or intangible cultural heritage receptors is moderate. It is considered that the receptor will be changed resulting in temporary or permanent modifications to cultural functions and processes.	
Low	Anticipated impact on tangible or intangible cultural heritage receptors is slight – considered to be of 'nuisance' value. Impact can be temporary or permanent but does not result in any modification of receptor use.	
Negligible	No significant predicted change from baseline for tangible or intangible cultural heritage receptors.	

7.10.5 Key Guidance and Standards

The cultural heritage impact assessment has been completed in accordance with Kenyan legislation and international guidance. The National Museums and Heritage Act (2006, revised 2012) is the key Kenyan legislation pertinent to the cultural heritage impact assessment. The Protection of Traditional Knowledge and Cultural Expressions Act (2016) is also relevant and has been given due consideration.

To meet good practice, the impact assessment has also been completed in compliance with IFC PS8: Cultural Heritage (2012a) (including accompanying guidance - Guidance Note 8: Cultural Heritage (2012b)).

7.10.6 Receptors of Interest and Importance

With reference to the results of the baseline study and the expected sources of impacts described in Section 7.10.7, archaeological, living cultural heritage and intangible cultural heritage assets have all been considered for inclusion as receptors in the impact analysis. The criteria for selecting receptors were:

- All living cultural heritage assets and archaeological assets (excluding findspots and isolated surface scatters – see explanatory note below) that are located within the proposed physical footprint of the Project (to account for potential direct impacts during construction);
- All living cultural heritage assets and archaeological assets (excluding findspots and isolated surface scatters – see explanatory note below) that are located within 500 m of the proposed footprint of the Project (to account for potential indirect impacts during both construction and operational phases); and
- Intangible cultural heritage assets within the Social AoI (to account for potential direct and indirect impacts during both construction and operational phases).

Regarding archaeological findspots and isolated surface scatters, survey work completed during the baseline study indicates that there is a consistent density and distribution of surface archaeological remains (i.e., findspots and surface scatters) throughout the region. It is considered, therefore, that the potential for archaeological remains to be present on the surface is uniformly high across the AoI. As such, identified findspots and isolated surface scatters have not been considered individually as part of the impact assessment. Instead, archaeological surface remains are considered more generally as a single receptor, with the assumption that archaeological remains are present within the Project footprint.

Receptors included within the impact analysis are presented in in Table 7.10-3, and the locations of tangible receptors are depicted in Figure 7.10-1 to Figure 7.10-4.

Table 7.10-3: Receptors and Importance

Receptor	Importance	Comment
Living cultural heritage – Sacred Trees[39]	Very high	Receptor that cannot be moved or replicated. Receptors identified include 16 sacred trees within 500 m of Project infrastructure (CH-009, -018, -019, -020, -021, -022, -033, -034, -035, -036, -037, -038, -040, -042, -043 and -046).
Living cultural heritage – Fire Pits (ritualistic)	Very High / High	Dependent upon ritual use, receptor that cannot be moved or replicated, or that could potentially be moved in highly exceptional circumstances (in consultation with site guardians and the affected communities). Receptors identified include four fire pits within 500 m of Project infrastructure (CH-014, -015, -016 and -039)
Living cultural heritage – Graves and Burial Sites	High	Receptor that is potentially replicable and could be moved in highly exceptional circumstances (in consultation with site guardians and the affected communities). Receptors identified include 10 graves or burials within 500 m of Project infrastructure (CH-017, -026, -027, -028, -044, -045, -090, -097, -105 and -106).
Living cultural heritage – *akiriket* sites	Medium	Receptors are of local importance with significant cultural value, but which could potentially be moved in exceptional circumstances (in consultation with site guardians and the affected communities). Receptors identified include CH-108.
Living cultural heritage – Traditional Land Use Sites (Irrigation Dams)	Low	Receptors of limited local value and cultural significance. Receptors identified include six traditional land use sites within 500 m of Project infrastructure (CH-010, -013, -041, -054, -055 and -056).
Intangible cultural heritage – Turkana culture (history, society and belief system)	High	Asset of national importance with significant cultural value. Endemic to Turkana County (and therefore 'rare') and widely representative of Turkana people.

[39] The term 'sacred' has been used in this assessment to refer to trees of cultural significance that are used by local communities for a range of purposes, including meetings (of elders and other community groups), initiations, celebrations and ceremonies. These locations have significant historical and traditional associations, but do not necessarily have religious associations (e.g., the trees are not viewed as deities).

Receptor	Importance	Comment
Intangible cultural heritage – West Pokot culture (history, society and belief system)	High	Asset of national importance with significant cultural value. Endemic to West Pokot County (and therefore ‘rare’) and widely representative of Pokot people.
Intangible cultural heritage – nomadic pastoralism	High	Asset of national importance with significant cultural value. Widely representative of population in northern Kenya.
Intangible cultural heritage – environmental subsistence	Medium	Asset with social, historic, scientific and environmental value that is representative of populations across Kenya.
Archaeological - potential settlement sites	High (potential)	If sub-surface archaeological remains are present, assets have the potential to be nationally significant, and represent features that are relatively understudied in the region. One archaeological asset within 500 m of Project infrastructure have been identified as having greater potential for sub-surface archaeological remains to be associated with it (the cluster of surface scatters to the north-east of the Ngamia area).
Archaeological - Surface Remains (Findspots and Isolated Surface Scatters)	Low	Assets with limited further research potential (with representative sampling already completed during survey). Relative abundance of material within AoI (in particular, lithics and pottery) that will remain unimpacted.

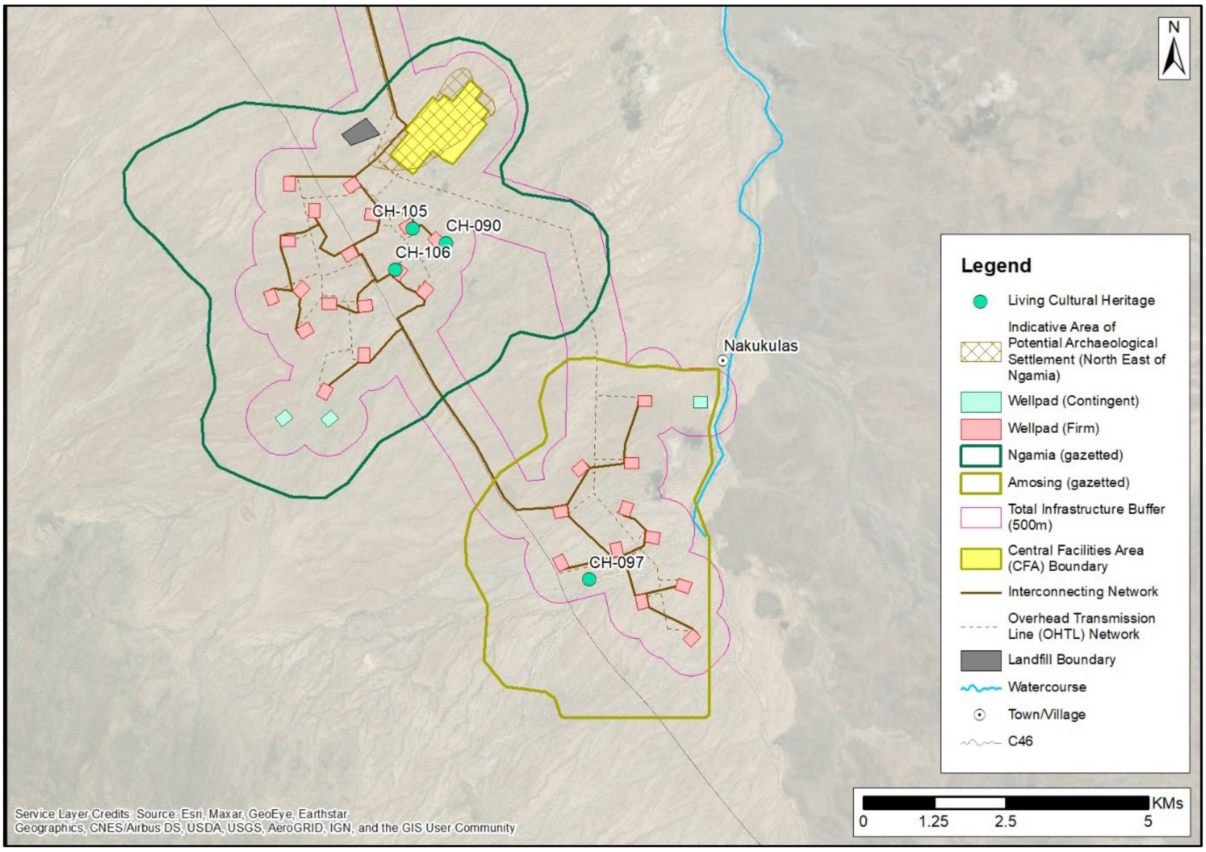

Figure 7.10-1: Cultural Heritage Receptors (Ngamia and Amosing)

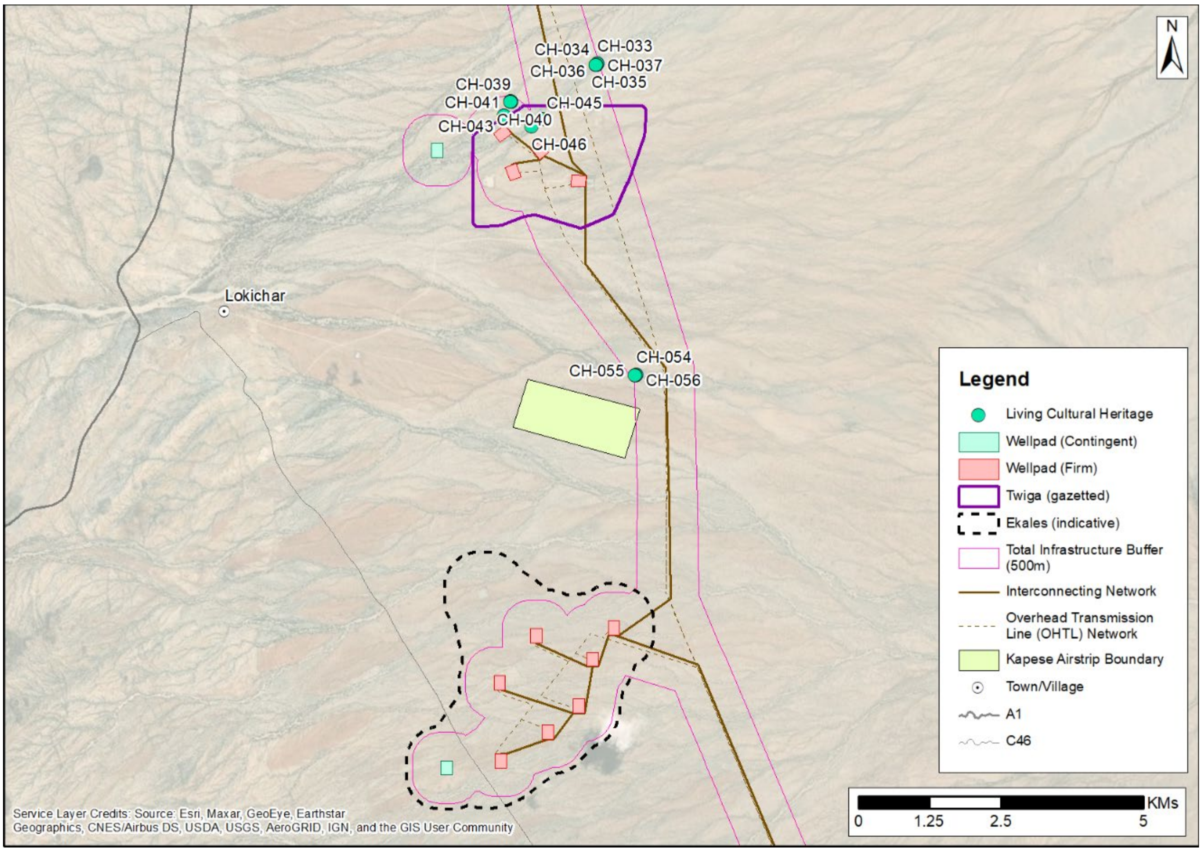

Figure 7.10-2: Cultural Heritage Receptors (Ekales and Twiga)

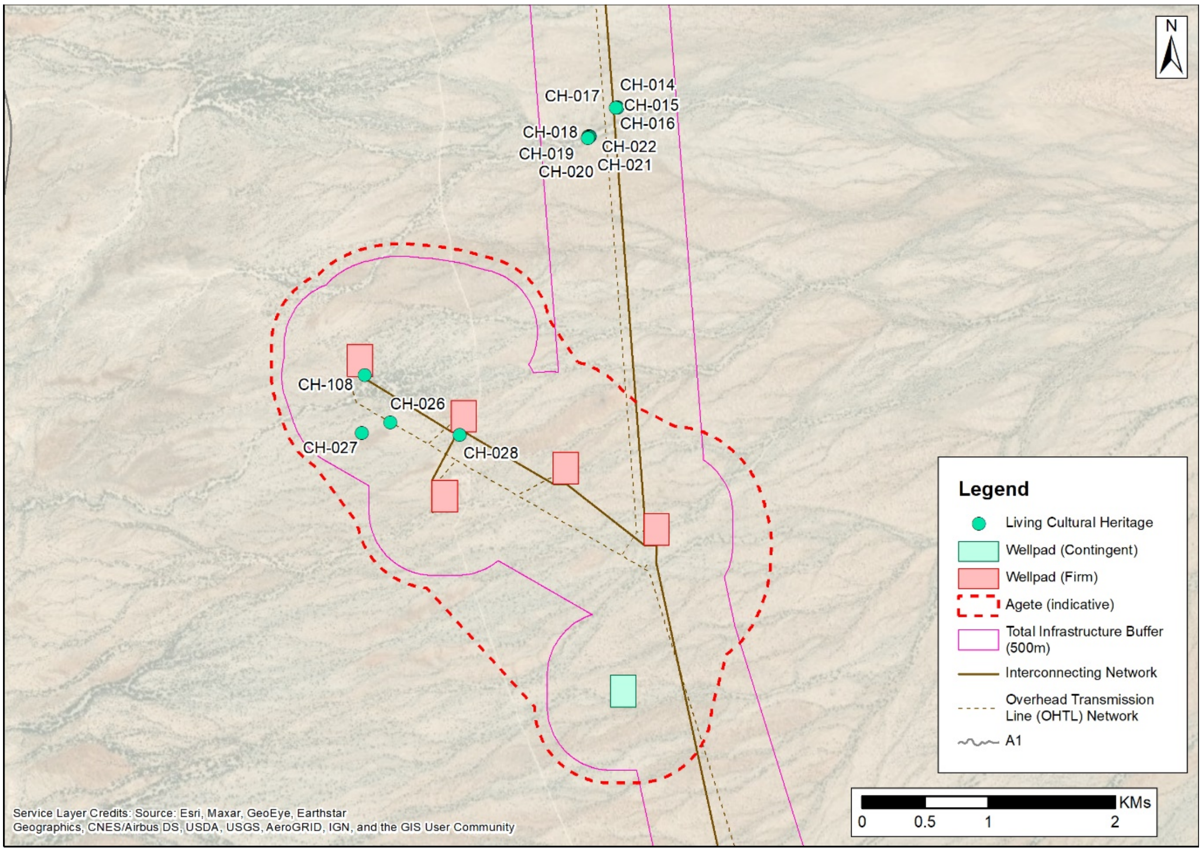

Figure 7.10-3: Cultural Heritage Receptors (Agete)

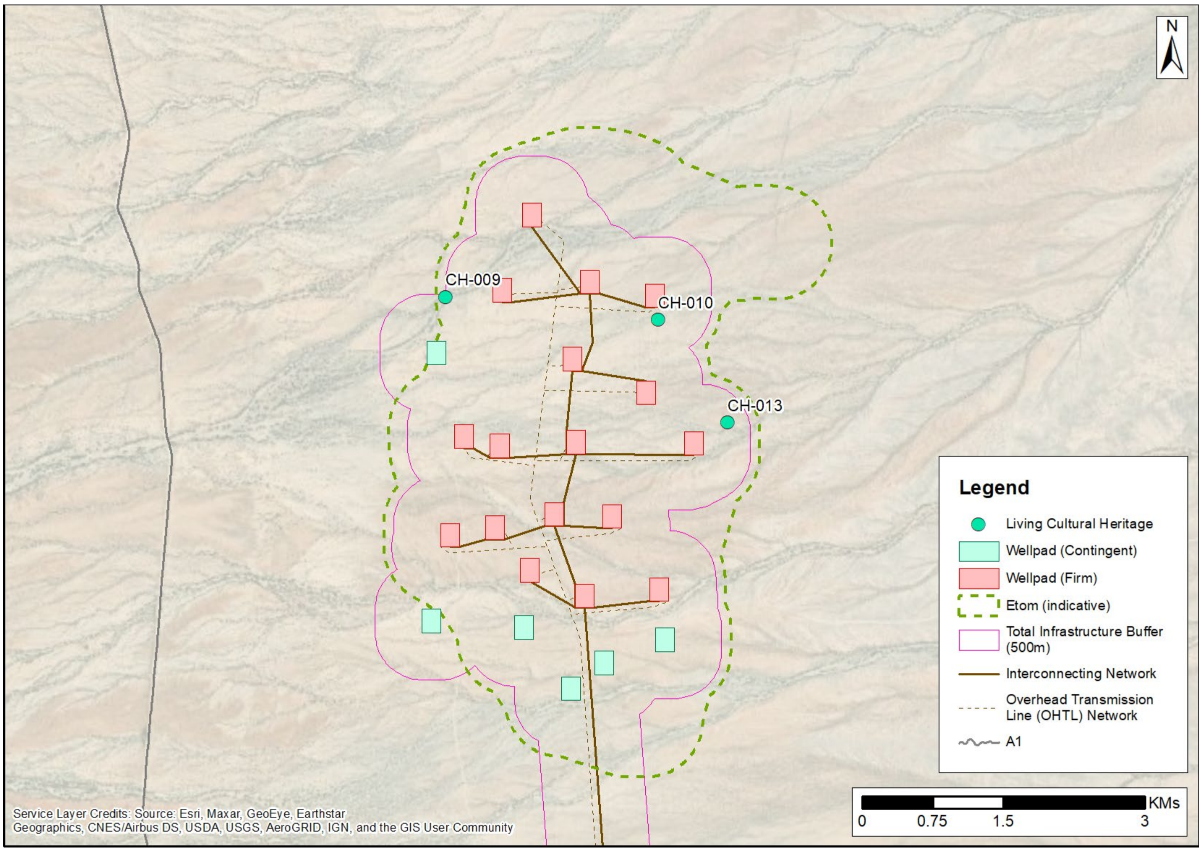

Figure 7.10-4: Cultural Heritage Receptors (Etom)

7.10.7 Sources of Impacts

Sources of impact resulting from the Project relevant to cultural heritage have been identified through a review of the Project Description (Chapter 5.0) and the identified receptors. It is expected that the Project will result in changes to both the physical and socio-economic landscape, which will result in direct and indirect impacts to cultural heritage receptors during both the construction and operational phases of the Project.

7.10.7.1 Construction Phase

There are aspects of the Project that have been identified as having the potential to impact cultural heritage receptors during the construction phase.

The potential sources of impact and routes by which they could impact cultural heritage during construction are:

- Ground disturbance and other changes to the land surface as a result of site preparation and construction works, including ground clearance, scrub removal, surface levelling and compaction, and fence installation, as well as intrusive excavation activities and the laying of foundations. This could result in cultural heritage receptors being displaced, damaged or destroyed, both above and below the ground surface. Changes to the land surface could also result in the severance of access to cultural heritage assets or the modification of intangible practices;
- Change in environmental conditions as a result of noise and vibration, emissions to air and visual changes, which could result in impacts on the setting of cultural heritage assets or the modification of intangible practices. Vibration and dust emissions also have the potential to physically damage cultural heritage assets; and
- Change in socio-economic conditions, particularly through changes in land ownership, demographics and employment, which could impact intangible cultural heritage.

7.10.7.2 Operational Phase

There are aspects of the Project that have been identified as having the potential to impact cultural heritage receptors during the operational phase. The potential sources of impact and routes by which they could impact cultural heritage during the operational phase include:

- Change in environmental conditions as a result of noise and vibration, emissions to air, and visual changes, which could result in impacts on the setting of cultural heritage assets or the modification of intangible practices. Vibration and dust emissions also have the potential to damage cultural heritage assets; and
- Change in socio-economic conditions, particularly through changes in demographics and employment, which could impact intangible cultural heritage.

To avoid under-representing the magnitude of impact during construction or 'double-counting' the impact during the operational phase, changes to the land surface that could result in severance of access to cultural heritage assets or the modification of intangible practices, which would initially occur during construction and then persist throughout the operational phase, are only considered during construction. The duration of any impacts continuing throughout the operational phase is accounted for in the impact magnitude during construction.

7.10.7.3 Climate Change

Climate change is not considered relevant to this section of the ESIA.

7.10.8 Incorporated Environmental Measures

The Project has been designed and planned to incorporate a range of incorporated environmental measures that provide inherent mitigation to avoid potential impacts or reduce their magnitude. The design measures relevant to cultural heritage are described below. Incorporated environmental measures to manage air quality, noise and vibration, visual, and socio-economic impacts, which may reduce or avoid indirect impacts to cultural heritage assets, are described in those relevant chapters.

7.10.8.1 Design Measures

Incorporated environmental design measures pertaining to cultural heritage include:

- The Project will make use of land that has previously been permitted and used by the Project for exploration and appraisal wellpads, thereby reducing the amount of additional undisturbed land where direct impacts to land use and cultural heritage assets can occur. Previous well pads were subject to permitting by NEMA and by an internal Site Specific Assessment process undertaken by the Operator.
- Speed limits along roads will not exceed national speed limits and will be set with consideration to their use by other road users, including those associated with nearby cultural heritage receptors.

7.10.8.2 Good Industry Practice

This impact assessment has been completed and mitigation proposed in accordance with IFC PS8: Cultural Heritage (2012a) (including accompanying guidance - Guidance Note 8: Cultural Heritage (2012b)).

7.10.9 Impact Classification

Taking into account the baseline cultural heritage conditions (Section 6.13), the relevant incorporated environmental measures (Section 7.10.8), and the potential sources of impact (Section 7.10.7) determined from the Project Description, the potential source-pathway-receptor impact linkages for the construction and the operational phases are presented in this section.

A discussion regarding feasible impact linkages during each of the Project phases is presented in each of the sub-sections below. Each discussion is accompanied by a table where the potential sources of impact and relevant additional mitigation applicable to each receptor are summarised. The magnitude and significance of each impact linkage is assigned following the method presented in Section 7.10.1.

7.10.9.1 Construction

The results of the construction phase impact assessment with respect to cultural heritage are described below. Those impacts where additional mitigation is proposed are presented in Table 7.10-4.

One critical commitment applicable to living cultural heritage and intangible cultural heritage receptors is the Operator's continued stakeholder engagement as defined in the Operator Stakeholder Engagement Plan (SEP). Engagement activities serve to identify, as soon as possible, any unforeseen impacts and any appropriate site-specific mitigation that could be applied. The Operator SEP includes the Operator Grievance Management Procedure. Implementation of the Operator SEP and effective responses to grievances is essential in managing all impacts to living and intangible cultural heritage.

7.10.9.1.1 Ground Disturbance/Change in Land Surface

It is expected that ground disturbance will result in direct impacts at living cultural heritage, intangible cultural heritage and archaeological receptors within the AoI.

Archaeological remains, particularly lithic and pottery artefacts, are assumed to be present on the ground surface throughout the Project footprint and it is predicted that these will be disturbed and removed as a result of construction activities. Without mitigation, a high magnitude impact is expected on a low value receptor, resulting in a **Minor** impact significance.

The volume of individual artefacts that are likely to be impacted makes mitigation through collection unfeasible. Without an established archival resource or research objective, collection of remains would not be an effective form of mitigation. Instead, the Operator Social Performance Plan will include an appropriate Chance Finds

Procedure with an established protocol, to be agreed with the NMK and administered by an on-site Supervisor, that will define the steps to be taken if surface remains are encountered. Suggested steps include noting the types of material encountered and where (e.g., a specific well-pad) and, if possible, moving the artefacts outside the area of disturbance (leaving them on the surface). All cultural heritage finds will be communicated to NMK and an archiving protocol will be agreed with NMK for artefacts that are considered to be of research of conservation value. Construction staff will also be informed, as part of their general induction, about the archaeological remains that are likely to be encountered in the landscape and what they should do in line with the procedures in the Operator Social Performance Plan. It should be made explicitly clear that these remains have no monetary value to avoid looting. With the described mitigation in place, the impact magnitude would reduce to medium, but the residual impact significance on this receptor remains **Minor**.

A representative sample of archaeological remains was collected during baseline survey, which will also be considered as part of the archiving protocol. These artefacts, including a number of obsidian lithics with potential for future research, will be made available to NMK.

One potential archaeological settlement site, the cluster of surface scatters to the north-east of the Ngamia area, is located within the proposed CFA footprint (shown in Figure 7.10-5). A high magnitude impact on this potentially high value receptor is expected during the construction of the CFA, resulting in a potentially major impact significance, if subsurface archaeological remains are present. It is proposed that further archaeological investigation of the area be completed to better understand the subsurface archaeology in this location. The Operator will work with NMK to develop and implement an archaeological clearance plan to investigate the potential settlement and/ or industrial Site within the CFA footprint, prior to construction. The archaeological clearance plan will comply with NMK requirements for archaeological clearance and will include a sampling strategy for the collection of archaeological remains identified during the investigation. If subsurface remains are present, the proposed archaeological investigation would reduce the impact magnitude to low, thereby lowering the residual impact significance to **Minor**. If no archaeological remains are present, there is no receptor and no impact is expected.

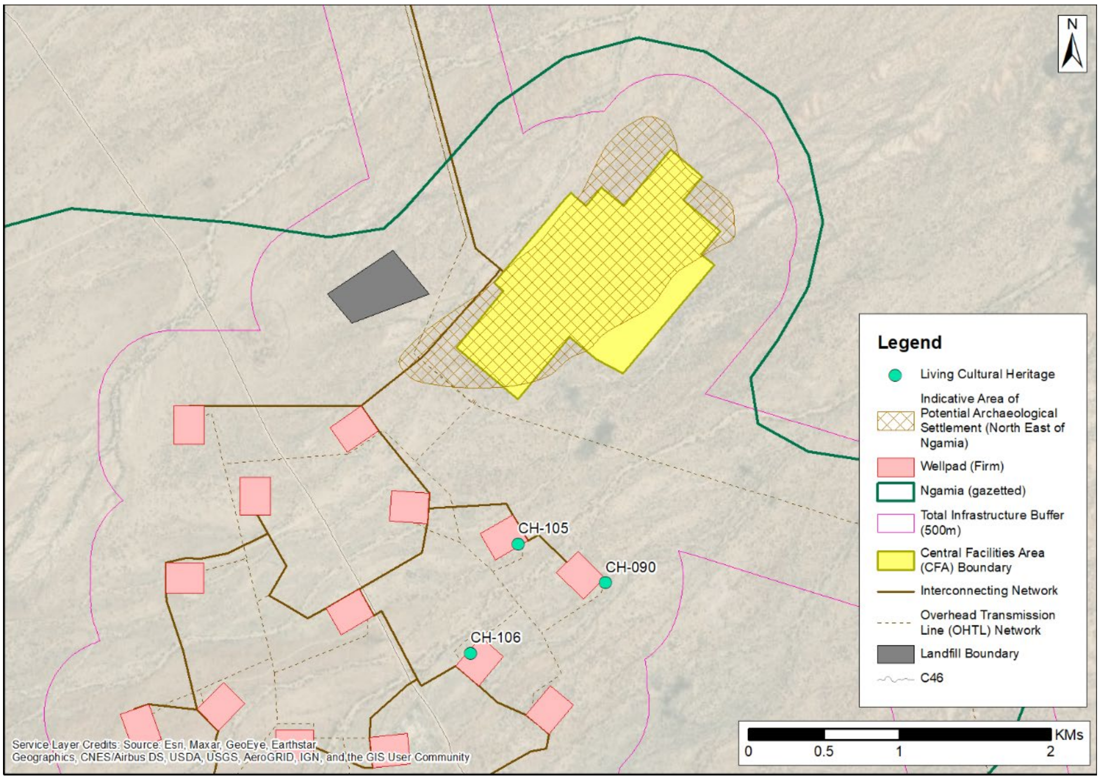

Figure 7.10-5: Location of potential archaeological settlement site and graves at Ngamia

Direct ground disturbance is expected to impact five graves/burials[40] (as shown in Figure 7.10-5 and Figure 7.10-6). CH-105 is located within a proposed wellpad at Ngamia. CH-017 and CH-028 are located within the interconnecting network RoW. CH-090 and CH-026 are within the OHTL RoW. Unmitigated direct disturbance of this high value receptor is a high magnitude impact, resulting in a major impact significance. Consultation with affected communities and site guardians will be required to effectively mitigate this impact. Micro-alignment of the interconnecting network and OHTL within the RoW around CH-017, CH-026, CH-028 and CH-090 will be used to avoid direct impacts to these graves, if feasible. The well-pad at CH-105 cannot be re-aligned, and so exhumation and reburial will be required. The Operator Social Performance Plan will describe the procedures for micro-alignment and for relocation of graves. With this mitigation in place, a medium magnitude impact is expected, resulting in a **Moderate** impact significance.

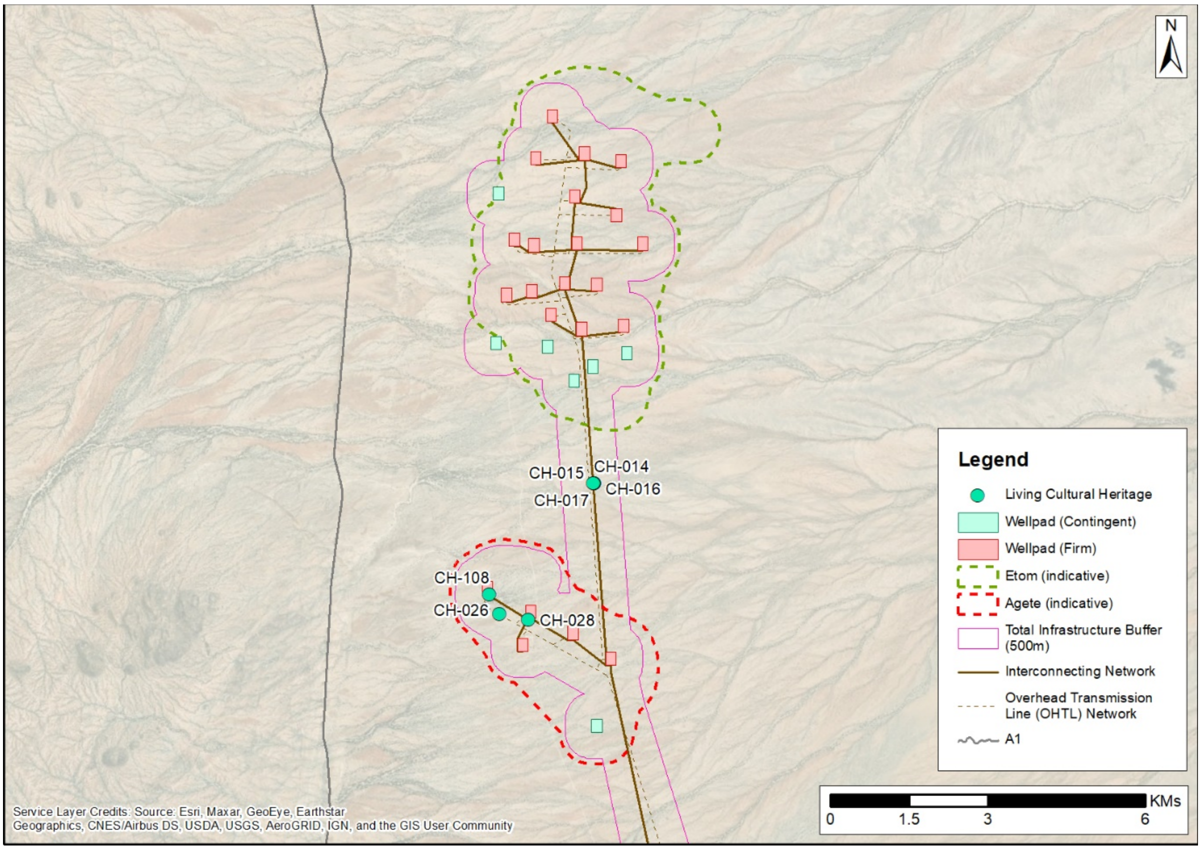

Figure 7.10-6: Location of graves, firepits and *akiriket* site at Agete and Etom

The Operator Social Performance Plan will present detailed steps for identifying unrecorded graves within the development footprint, prior to construction and will set out requirements for cultural heritage late finds protocols. Training will be provided to all construction contractors to assist in grave identification and the implementation of the protocol. The Operator Social Performance Plan will set out how the Operator will consult with affected communities and site guardians to agree procedures for demarcation (e.g., demarcation and communication of 'no go' sensitive locations and mapping and communication of cultural heritage 'constraints').

Three fire pits (CH-014, -015 and -016) associated with the grave at CH-017 are also within the interconnecting network RoW (as shown in Figure 7.10-6). These fire pits are used by the local seer to communicate with their buried ancestor and so have strong ritualistic ties with the burial. Direct ground disturbance of these fire pits would result in a high magnitude impact on a high value receptor, resulting in a major impact significance. As

[40] One other grave/burial (CH-106) is located within an existing wellpad and so no impact is expected.

with the associated grave, consultation with affected communities and site guardians will be required to effectively mitigate this impact. Micro-alignment of the interconnecting network around CH-014, -015 and -016 will be used to avoid direct impacts to these fire pits, if feasible. With this mitigation in place, a low magnitude impact is expected, resulting in a **Moderate** impact significance.

An *akiriket* site (CH-108) is located within the footprint of a proposed wellpad at Agete (as shown in Figure 7.10-6). There are no graves or other cultural heritage features recorded in close proximity to this site, which was observed during walkover survey in 2021. The asset is considered to have a medium importance, as it is possible that the location is not fundamental to the asset's use and could be moved in exceptional circumstances. A high magnitude impact on a medium importance receptor results in a **Moderate** impact significance.

The Operator Social Performance Plan will set out requirements for consultation and engagement with the affected community and site guardians at CH-108, and if the location is fundamental to the asset's use, the Operator will agree procedures to support the sustainability of traditional practices, including those conducted at this asset. It is anticipated that this mitigation would reduce the magnitude of the impact to medium, resulting in a **Minor** impact significance.

The change in ground surface as a result of construction also has the potential to impact intangible cultural heritage within the AoI. The loss of land available to traditional communities is addressed in detail in the social assessment, but at a broader scale it has the potential to impact on high value intangible cultural heritage, including traditional practices and beliefs (e.g., Turkana culture and nomadic pastoralism). It is not expected that these traditional practices or beliefs will be stopped or be prevented within the AoI as a result of a change in land surface within the Project footprint, but modification of behaviours is likely. It is predicted that there will be a medium magnitude impact on Turkana culture, with a medium magnitude impact on nomadic pastoralism in general. These will result in **Moderate** impact significances for Turkana culture and nomadic pastoralism. No impacts are expected to West Pokot culture as a result of changes in ground surface.

The key mitigation associated with this impact is detailed in the social assessment, with consideration of livelihood restoration support for livestock grazing in the Operator Resettlement and Livelihood Restoration Plan (RLRP) and CDPs.

The Operator Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders of the construction activity dates and the potential for increased disturbance during construction.

The Operator Stakeholder Engagement Plan will include a strategy (timetable) for the continuation of community consultation and liaison with the Operator, to provide a platform to listen to and address community concerns and develop and mechanisms to support the sustainability of traditional practices in response to issues as they may arise during the construction phase.

Cultural Awareness Training will be implemented for all site staff / contractors as part of the Project site induction process for all field-based staff during construction. The training will be outlined with the Operator Social Performance Plan and include:

- Specific local taboos / respectful behaviours with regard to sacred trees;
- A calendar of culturally significant events; and
- Constraints mapping to highlight sensitive areas or no-go areas.

The Operator will monitor grievances and improvement opportunities through the Operator Grievance Management Procedure.

These mitigation measures are expected to reduce the impact magnitude from medium to low for Turkana culture and nomadic pastoralism. A residual **Minor** impact significance is predicted for both receptors.

The impact of changes on land surface with regards to specific resources for environmental subsistence is addressed within the ecosystem services assessment (Section 7.8). The general practice of environmental subsistence as intangible cultural heritage is considered in a broader sense here. The loss of available land and resources to use for environmental subsistence within the Project footprint is not likely to stop or prevent the practice across the AoI and it is considered the practice of opportunistic foraging of available resources will continue unmodified. Therefore, a low magnitude impact is predicted, resulting in a **Minor** impact significance.

The Operator Stakeholder Engagement Plan will include a strategy (timetable) for the continuation of community consultation and liaison with Operator, to provide a platform to listen to and address community concerns and to develop mechanisms to support the sustainability of traditional subsistence practices, specifically the transfer of traditional knowledge and skills[41]. This will include the mapping and provision of continued access to natural resources which support subsistence activities. A residual **Minor** impact significance is expected with mitigation in place, as a low magnitude impact is still likely.

7.10.9.1.2 Change in Environmental Conditions

Emissions to air are expected to result in impacts at nine living cultural heritage receptors as a result of construction dust, comprising:

- Six sacred trees - CH-043 near Twiga, and a cluster of five trees (CH-018 – CH-022) between Agete and Etom, shown in Figure 7.10-7; and
- Three fire pits - CH-014, -015 and -016, shown in Figure 7.10-6.

[41] These mitigation proposals seek to preserve traditional knowledge and skills. They are not intended to inhibit access to alternative livelihoods or greater food security.

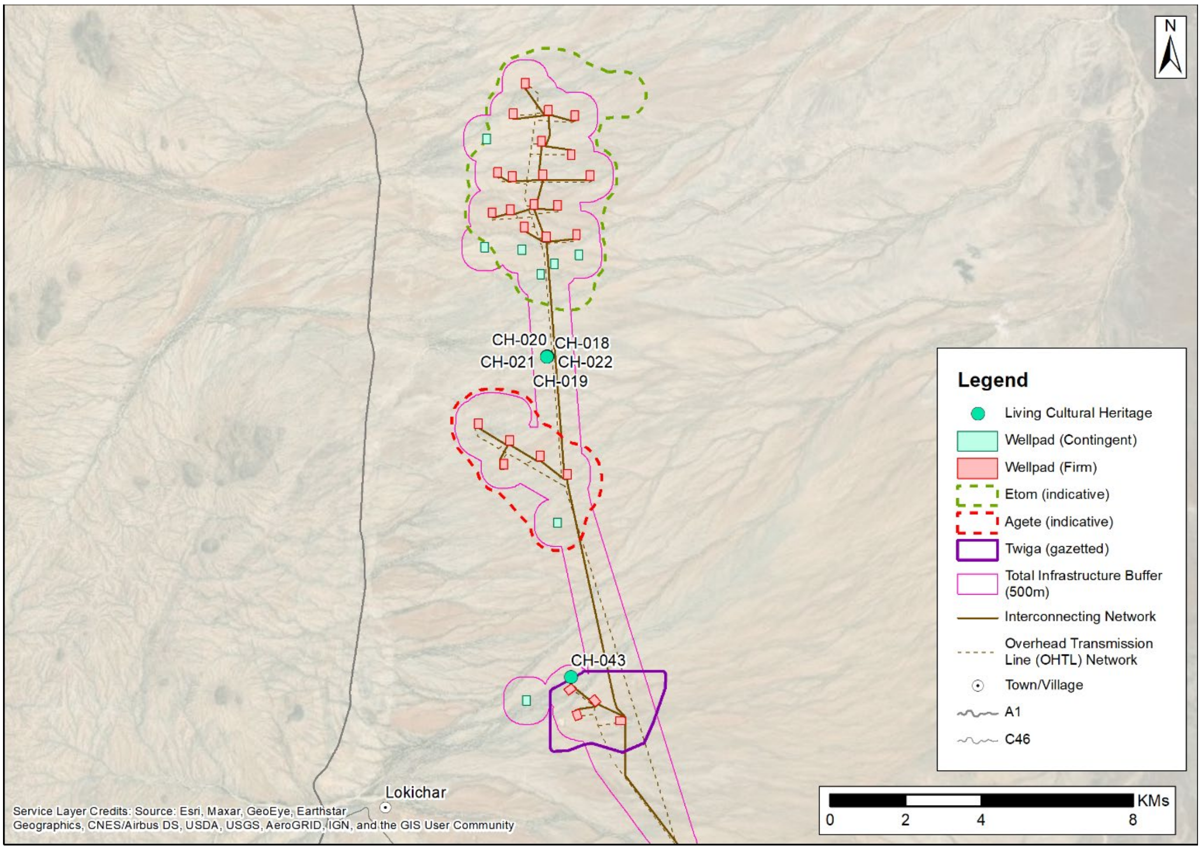

Figure 7.10-7: Location of sacred trees within 250 m of construction activity

The level of dust deposition has the potential to impact sacred trees and could result in a modification of the receptors' use as meeting/ritual locations. This is considered to be a medium magnitude impact on very high value receptors, resulting in a major impact significance. To mitigate this impact, it is proposed that local stakeholders will be informed of construction activity dates and the potential for increased dust emissions through the procedure defined in the Operator Stakeholder Engagement Plan, which will take account of any identified culturally sensitive days. The Operator Environmental Performance Plan will include a procedure for daily visual monitoring by the Environmental Supervisor. If high levels of dust are observed causing a nuisance to sacred trees or fire pits, any appropriate changes to working practices (e.g., dust barriers or netting) will be undertaken to limit the dispersion of dust. The Operator Social Performance Plan will contain procedures for consultation with the local communities who use identified sacred trees and fire pits as a meeting point/ritual location with regard to this proposed visual monitoring strategy and if any remedial actions e.g., dust netting are required. The Operator will monitor grievances and improvement opportunities through the Operator Grievance Management Procedure. It is considered that this will reduce the impact magnitude to negligible, resulting in a **Negligible** impact significance.

All other emissions to air are expected to result in negligible magnitude impacts, with **Negligible** impact significance. No mitigation is proposed for these negligible impacts and they are not considered further.

Of the cultural heritage receptors identified, it is considered that, based upon the noise modelling results (Section 7.2), noise emissions only have the potential to impact the use of sacred trees near Twiga. The setting or use of other receptors will remain unchanged by a change in noise level. Construction noise and well drilling is predicted to result in noise levels at Twiga that are less than the recorded baseline level at Ngamia, Ekales, Agete and Etom and within 3 dB of the recorded baseline at Amosing (i.e., a negligible impact for noise). As the use of sacred trees in the wider area is unaffected by the baseline noise level, a negligible magnitude impact on cultural heritage receptors at Twiga is predicted, resulting in **Negligible** impact significance.

Local stakeholders will be informed of construction activity dates and the potential for increased noise levels through the procedure defined in the Operator Stakeholder Engagement Plan, which will take account of any identified culturally sensitive days.

Visual changes during construction, related primarily to construction activities and equipment, are expected to cause a low magnitude impact on 16 very high value sacred trees (CH-009, -018, -019, -020, -021, -022, -033, -034, -035, -036, -037, -038, -040, -042, -043 and -046, shown in Figure 7.10-2, Figure 7.10-3 and Figure 7.10-4) and 3 very high value fire pits (CH-014, -015 and -016, shown in Figure 7.10-6), resulting in a moderate impact significance at all 19 receptors. At locations where construction will occur, the Operator or the EPC contractor will engage stakeholders in affected areas to inform them where, when and for how long temporary works are taking place. The Operator Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders of the construction activity dates and the potential for increased visual disturbance from dust and artificial lighting. Signage will be put in place to inform people where, when and for how long temporary dust generating works are taking place. The Operator and their contractors will monitor grievances and improvements through the Operator Grievance Management Procedure. Whilst it is expected that these mitigation measures will reduce the impact, it is not possible to entirely avoid the impact and so a residual low magnitude impact is predicted, with a residual **Moderate** impact significance.

7.10.9.1.3 Change in Socio-Economic Conditions

Intangible cultural heritage, particularly Turkana culture and nomadic pastoralism, are likely to be impacted by socio-economic changes, such as changes in demographics and employment. Impacts resulting from these changes are considered in detail in the social assessment, but the impact on intangible cultural heritage at a broad level is presented here. Socio-economic changes have the potential to reduce the number of people continuing these traditional practices (e.g., as they seek alternative job opportunities), and exposure to other cultures is likely to influence traditional belief systems. Whilst there is likely to be a consequent reduction in the number of people holding these beliefs and employing traditional practices, it is considered that these elements of intangible cultural heritage will continue unmodified within the AoI during construction. As such, a low magnitude impact is predicted, resulting in a minor significance impact. No impact is expected to West Pokot culture as a result of changes in socio-economic conditions.

The Operator will develop influx management procedures to manage speculative influx (emergence of informal settlements) occurring. Procedures will be developed in coordination with Turkana County Government and Administration. Agreed procedures will be presented in the Operator Social Performance Plan and will include consideration for potential changes in culturally sensitive practices. The Operator Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders of the construction activity dates and the potential for increased disturbance during construction. Cultural Awareness Training will be implemented for all site staff / contractors as part of the Project site induction process for all field-based staff during construction. The training will be outlined with the Operator Social Performance Plan and include:

- Specific local taboos / respectful behaviours with regard to sacred trees;
- A calendar of culturally significant events; and
- Constraints mapping to highlight sensitive areas or no-go areas.

The Operator will monitor grievances and improvement opportunities through the Operator Grievance Management Procedure.

Whilst it is expected that these mitigation measures will reduce the impact, it is not possible to entirely avoid the impact and so a residual low magnitude impact is predicted, with a residual **Minor** impact significance.

The impact of changes in socio-economic conditions is predicted to have a negligible magnitude impact upon the practice of environmental subsistence, resulting in a **Negligible** impact significance.

Table 7.10-4: Construction Phase Impact Assessment

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Archaeological - Surface Remains (Low)	Ground disturbance/ Change in land surface due to construction activities within the entire Project footprint i.e., wellpads, interconnecting network, infield OHTL, roads, and CFA)	High Direct – permanent	Minor	The Operator Social Performance Plan will set out a Chance Finds Procedure to manage accidental disturbance of archaeological finds. The Chance Finds Procedure will cover all potential disturbance of tangible cultural heritage during ground disturbance activities. Compliance with the Chance Finds Procedure will be mandatory for all Operator staff and contractors. All cultural heritage finds will be communicated to NMK and an archiving protocol will be agreed with NMK for collected artefacts which either the Project cultural heritage advisor, or an NMK advisor, has indicated are of research and conservation value. In particular, the Operator will make available to NMK the obsidian materials, collected during baseline and pre-construction surveys, and associated baseline data and reports.	Medium	Minor
Archaeological - Potential Settlement Sites (High – potential) shown in Figure 7.10-5.	Ground disturbance/ Change in land surface due to construction activities within the entire Project footprint i.e., wellpads, infield flowlines, OHTL and roads, and CFA)	High Direct – permanent	Major	The Operator will work with NMK to develop and implement an archaeological clearance plan to investigate the potential settlement and/ or industrial Site within the CFA footprint, prior to construction. The archaeological clearance plan will include a sampling strategy for the collection of archaeological remains identified during the investigation. The plan will comply with NMK requirements for archaeological investigation.	Low	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Living cultural heritage – Sacred Trees (Very High)	Change in environmental condition as a result of construction dust at six sacred trees (CH-018, -019, -020, -021, -022, and -043), as shown in Figure 7.10-7.	Medium Indirect – short-term – temporary	Major	Local stakeholders will be informed of construction activity dates and the potential for increased dust emissions through the procedure defined in the Operator Stakeholder Engagement Plan, which will take account of any identified culturally sensitive days. The Operator Environmental Performance Plan will include a procedure for daily visual monitoring by the Environmental Supervisor. If high levels of dust are observed causing a nuisance to sacred trees, any appropriate changes to working practices (e.g., dust barriers or netting) will be undertaken to limit the dispersion of dust. The Operator Social Performance Plan will contain procedures for consultation with the local communities who use identified sacred trees as a meeting point with regard to this proposed visual monitoring strategy and if any remedial actions e.g., dust netting are required. The Operator will monitor grievances and improvement opportunities through the Operator Grievance Management Procedure.	Negligible	Negligible
	Change in environmental condition as a result of construction noise at sacred trees near Twiga	Negligible	Negligible	Local stakeholders will be informed of construction activity dates and the potential for increased noise levels through the procedure defined in the Operator Stakeholder Engagement Plan, which will take account of any identified culturally sensitive days.	Negligible	Negligible

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
	Change in environmental conditions as a result of visual changes to setting due to construction activities	Low Indirect – short-term – temporary	Moderate	At locations where construction will occur, the Operator or the EPC contractor will engage stakeholders in affected areas to inform them where, when and for how long temporary works are taking place. The Operator Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders of the construction activity dates and the potential for increased visual disturbance from dust and artificial lighting. Signage will be put in place to inform people where, when and for how long temporary dust generating works are taking place. The Operator and their contractors will monitor grievances and improvements through the Operator Grievance Management Procedure.	Low	Moderate
Living cultural heritage – Graves and Burials (High) as detailed in Figure 7.10-5 and Figure	Ground disturbance/ Change in land surface during construction activities at Ngamia wellpad and the interconnecting network	High Direct – permanent	Major	The Operator Social Performance Plan will present detailed steps for identifying unrecorded graves within the development footprint, prior to construction and set out requirements for cultural heritage late finds protocols, and training to be provided to all construction contractors to assist in grave identification and the implementation of the protocol.	Medium	Moderate

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Burial CH-017, CH-026, CH-028 and CH-090 (interconnecting network and OHTL RoWs) Burial CH-105 (within a proposed well-pad at Ngamia)				■ The Operator Social Performance Plan will describe the procedures for micro alignment of the interconnecting network and OHTL within the RoW to avoid direct impact to graves (including CH-017, CH-026, CH-028 and CH-090 in Figure 7.10-5 and Figure 7.10-6), where feasible. ■ The Operator Social Performance Plan will set out how the Operator will consult with affected communities and site guardians to agree procedures for demarcation (e.g., demarcation and communication of 'no go' sensitive locations and mapping and communication of cultural heritage 'constraints'). ■ For graves where this is unavoidable (including CH-105 in Figure 7.10-5), the Operator Social Performance Plan will set out the procedures for relocation in line with national statutory land acquisition processes set out in Kenyan law, which recognises graves and the costs of rituals required to relocate graves.		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				■ Where graves have to be relocated, the Operator will ensure it is done in consultation with site guardians, PAP, County Government and in line with Kenyan cultural heritage requirements.		

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Living cultural heritage – fire pits (CH-014, -015 and -016) (Very High), shown in Figure 7.10-6	Ground disturbance/Change in land surface during construction activities at the interconnecting network	High	Major	The Operator Social Performance Plan will describe the procedures for micro alignment of the interconnecting network and OHTL within the RoW to avoid direct impact to the fire pits, where feasible. The Operator Social Performance Plan will set out how the Operator will consult with affected communities and site guardians to agree procedures for demarcation (e.g., demarcation and communication of ‘no go’ sensitive locations and mapping and communication of cultural heritage ‘constraints’). Where direct impacts cannot be avoided through micro alignment and relocation is required the Operator will ensure it is done in consultation with site guardians, PAP, County Government and in line with Kenyan cultural heritage requirements.	Low	Moderate

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
	Change in environmental condition as a result of construction dust	Medium Indirect – short-term – temporary	Major	Local stakeholders will be informed of construction activity dates and the potential for increased dust emissions through the procedure defined in the Operator Stakeholder Engagement Plan, which will take account of any identified culturally sensitive days. The Operator Environmental Performance Plan will include a procedure for daily visual monitoring by the Environmental Supervisor. If high levels of dust are observed causing a nuisance to fire pits, any appropriate changes to working practices (e.g., dust barriers or netting) will be undertaken to limit the dispersion of dust. The Operator Social Performance Plan will contain procedures for consultation with the local communities who use identified sacred trees as a meeting point with regard to this proposed visual monitoring strategy and if any remedial actions e.g., dust netting are required. The Operator will monitor grievances and improvement opportunities through the Operator Grievance Management Procedure.	Negligible	Negligible

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
	Change in environmental conditions as a result of visual changes to setting due to construction activities	Low Indirect – short-term – temporary	Moderate	At locations where construction will occur, the Operator or the EPC contractor will engage stakeholders in affected areas to inform them where, when and for how long temporary works are taking place. The Operator Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders of the construction activity dates and the potential for increased visual disturbance from dust and artificial lighting. Signage will be put in place to inform people where, when and for how long temporary dust generating works are taking place. The Operator and their contractors will monitor grievances and improvements through the Operator Grievance Management Procedure.	Low	Moderate
Living cultural heritage – *akiriket* site (CH-108) (Medium) shown in Figure 7.10-6	Ground disturbance/ Change in land surface during construction activities at Agete wellpad	High	Moderate	The Operator Social Performance Plan will set out requirements for consultation and engagement with the affected community and site guardians at CH-108, and if the location is fundamental to the asset's use, the Operator will agree procedures to support the sustainability of traditional practices, including those conducted at this asset.	Medium	Minor

Intangible cultural heritage – Turkana culture and nomadic pastoralism within social AoI (High)	Ground disturbance/ Change in land surface due to construction activities within the entire Project footprint i.e., wellpads, interconnecting network, infield OHTL, roads, and CFA	Medium Direct – permanent	Moderate	The Operator Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders of the construction activity dates and the potential for increased disturbance during construction. The Operator Stakeholder Engagement Plan will include a strategy (timetable) for the continuation of community consultation and liaison with the Operator, to provide a platform to listen to and address community concerns and develop and mechanisms to support the sustainability of traditional practices in response to issues as they may arise during the construction phase. Cultural Awareness Training will be implemented for all site staff / contractors as part of the Project site induction process for all field-based staff during construction. The training will be outlined with the Operator Social Performance Plan and include: ■ Specific local taboos / respectful behaviours with regard to sacred trees; ■ A calendar of culturally significant events; and ■ Constraints mapping to highlight sensitive areas or no-go areas. The Operator will monitor grievances and improvement opportunities through the Operator Grievance Management Procedure.	Low	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
	Change in socio-economic conditions in Turkana	Low Indirect – long-term – temporary	Minor	The Operator will develop influx management procedures to manage speculative influx (emergence of informal settlements) occurring. Procedures will be developed in coordination with Turkana County Government and Administration. Agreed procedures will be presented in the Operator Social Performance Plan and will include consideration for potential changes in culturally sensitive practices. The Operator Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders of the construction activity dates and the potential for increased disturbance during construction. Cultural Awareness Training will be implemented for all site staff / contractors as part of the Project site induction process for all field-based staff during construction. The training will be outlined with the Operator Social Performance Plan and include: ■ Specific local taboos / respectful behaviours with regard to sacred trees; ■ A calendar of culturally significant events; and	Low	Minor

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
				■ Constraints mapping to highlight sensitive areas or no-go areas. The Operator will monitor grievances and improvement opportunities through the Operator Grievance Management Procedure.		
Intangible cultural heritage – Environmental subsistence within social AOI (Medium)	Ground disturbance/Change in land surface due to construction activities within the entire Project footprint i.e., wellpads, interconnecting network, infield OHTL, roads, and CFA	Low Indirect – long-term – temporary	Minor	The Operator Stakeholder Engagement Plan will include a strategy (timetable) for the continuation of community consultation and liaison with the Operator, to provide a platform to listen to and address community concerns and to develop mechanisms to support the sustainability of traditional subsistence practices, specifically the transfer of traditional knowledge and skills. This will include the mapping and provision of continued access to natural resources which support subsistence activities.	Low	Minor

7.10.9.2 Operational Phase

The results of the operational phase impact assessment with respect to cultural heritage are described below. Those impacts where mitigation is proposed are presented in Table 7.10-5.

7.10.9.2.1 Change in Environmental Conditions

No impacts to cultural heritage receptors are predicted as a result of air or noise emissions during operation.

Visual impacts on cultural heritage receptors during the operational phase will be limited to the OHTL, which are expected to cause low magnitude visual impacts at a sacred trees (CH-009, -018, -019, -020, -021, -022, -033, -034, -035, -036, -037, -038, -040, -042, -043 and -046, shown in Figure 7.10-2, Figure 7.10-3 and Figure 7.10-4) and fire pits (CH-014, -015 and -016, shown in Figure 7.10-6). This will result in **Moderate** impact significances at these receptors. The Operator will monitor grievances and improvements through the Operator Grievance Management Procedure. Any complaints will be investigated and followed up.

7.10.9.2.2 Change in Socio-Economic Conditions

Impacts as a result of changes in socio-economic conditions during operation are expected to be a continuation of those described construction. A continuation of the mitigation proposed during construction is required to mitigate for operational phase impacts.

Table 7.10-5: Operational Phase Impact Assessment

Receptor (Importance)	Source of Potential Impact	Impact classification (excluding mitigation)	Impact Significance	Mitigation	Residual Impact Classification (including mitigation)	Residual Impact Significance
Living cultural heritage – Sacred Trees (Very High)	Change in environmental conditions as a result of visual changes to setting from the OHTL.	Low Indirect – long-term – permanent	Moderate	The Operator will monitor grievances and improvements through the Operator Grievance Management Procedure. Any complaints will be investigated and followed up	Low	Moderate
Living cultural heritage – Fire pits (Very High) (CH-014, -015 and -016, shown in Figure 7.10-6)	Change in environmental conditions as a result of visual changes to setting from the OHTL.	Low Indirect – long-term – permanent	Moderate	The Operator will monitor grievances and improvements through the Operator Grievance Management Procedure. Any complaints will be investigated and followed up	Low	Moderate
Intangible cultural heritage – Turkana culture and nomadic pastoralism (High)	Change in socio-economic conditions in Turkana	Low Indirect – long-term – temporary	Minor	The Operator Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders of the expected disturbances and constraints from project operation. The Operator Stakeholder Engagement Plan will include a timetable for the continuation of regular dialogue between the Operator and stakeholders during Project operation, to provide a platform to listen to and address community concerns and develop participatory mechanisms to support any ongoing concerns about effects the project operation may have on local culture and cultural practices.	Low	Minor

				Cultural Awareness Training will be implemented for all site staff / contractors as part of the Project site induction process for all field-based staff during operation. The training will be outlined with the Operator Social Performance Plan and include: ■ Specific local taboos / respectful behaviours with regard to sacred trees; ■ A calendar of culturally significant events; and ■ Constraints mapping to highlight sensitive areas or no-go areas. The Operator will monitor grievances and improvements through the Operator Grievance Management Procedure.		

7.10.9.3 Decommissioning

Decommissioning refers to the dismantling, decontamination and removal of process equipment and facility structures and any appropriate remediation. As the operational phase of the Project nears its end, a decommissioning plan will be developed for agreement with the appropriate authorities.

The likely decommissioning activities would be focused on:

- Production and injection wells with corresponding wellpads;
- The interconnecting network;
- Surface facilities in the CFA; and
- Other outfield infrastructure.

A qualitative assessment of the likely impacts of decommissioning activities on cultural heritage is presented here. Likely impacts from decommissioning activities are expected to be limited to living and intangible cultural heritage receptors.

No further direct ground disturbance is predicted, but the physical decommissioning of Project infrastructure is expected to result in noise and air emissions equivalent to, or less than, those produced during construction. As such, similar indirect impacts upon sacred trees, as predicted during construction, might reasonably be expected to occur. Equally, similar mitigation measures could reasonably be expected to reduce this.

The removal of Project infrastructure and reinstatement of the land is expected to reverse some of the visual effects at living cultural heritage receptors, although the potential retention and transfer of the infield OHTL to another operator could result in long-term visual impacts on the setting of living cultural heritage receptors.

The reinstatement of land will also allow intangible practices, such as nomadic pastoralism, to resume in areas within the Project footprint in the long-term. The legacy of the Project post-decommissioning in terms of socio-economic changes and their impact on intangible cultural heritage cannot be predicted at this stage.

7.10.10 Summary of Mitigation

The following mitigation is proposed to address impacts on cultural heritage:

- The Operator Social Performance Plan will set out requirements for a Chance Finds Procedure to manage accidental disturbance of archaeological finds.
- The Chance Finds Procedure will cover all potential disturbance of tangible cultural heritage during ground disturbance activities.
- Compliance with the Chance Finds Procedure will be mandatory for all Operator staff and contractors.
- All cultural heritage finds will be communicated to NMK and an archiving protocol will be agreed with NMK for collected artefacts which either the Project cultural heritage advisor, or an NMK advisor, has indicated are of research and conservation value.
- In particular, the Operator will make available to NMK the obsidian materials, collected during baseline and pre-construction surveys, and associated baseline data and reports.
- The Operator will work with NMK to develop and implement an archaeological clearance plan to investigate the potential settlement and/ or industrial Site within the CFA footprint, prior to construction.
- The archaeological clearance plan will include a sampling strategy for the collection of archaeological remains identified during the investigation.

- The plan will comply with NMK requirements for archaeological investigation.
- The Operator will monitor grievances and improvement opportunities through the Operator Grievance Management Procedure.
- Local stakeholders will be informed of construction activity dates and the potential for increased dust emissions through the procedure defined in the Operator Stakeholder Engagement Plan, which will take account of any identified culturally sensitive days
- The Operator Environmental Performance Plan will include a procedure for daily visual monitoring by the Environmental. If high levels of dust are observed causing a nuisance to sacred trees or fire pits, any appropriate changes to working practices (e.g., dust barriers or netting) will be undertaken to limit the dispersion of dust.
- The Operator Social Performance Plan will contain procedures for consultation with the local communities who use identified sacred trees as a meeting point with regard to this proposed visual monitoring strategy and if any remedial actions e.g., dust netting are required.
- Local stakeholders will be informed of construction activity dates and the potential for increased noise levels through the procedure defined in the Operator Stakeholder Engagement Plan, which will take account of any identified culturally sensitive days.
- At locations where construction will occur, the Operator or the EPC contractor will engage stakeholders in affected areas to inform them where, when and for how long temporary works are taking place.
- The Operator Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders of the construction activity dates and the potential for increased visual disturbance from dust and artificial lighting. Signage will be put in place to inform people where, when and for how long temporary dust generating works are taking place.
- The Operator Social Performance Plan will present detailed steps for identifying unrecorded graves within the development footprint, prior to construction and set out requirements for cultural heritage late finds protocols, and training to be provided to all construction contractors to assist in grave identification and the implementation of the protocol.
- The Operator Social Performance Plan will describe the procedures for micro alignment of the interconnecting network and OHTL within the RoW to avoid direct impact to graves (including CH-017, CH-026, CH-028 and CH-090 in Figure 7.10-5 and Figure 7.10-6), where feasible.
- The Operator Social Performance Plan will set out how the Operator will consult with affected communities and site guardians to agree procedures for demarcation (e.g., demarcation and communication of ‘no go’ sensitive locations and mapping and communication of cultural heritage ‘constraints’).
- For graves where this is unavoidable (including CH-105 in Figure 7.10-5), the Operator Social Performance Plan will set out the procedures for relocation in line with national statutory land acquisition processes set out in Kenyan law, which recognises graves and the costs of rituals required to relocate graves.
- Where graves have to be relocated, the Operator will ensure it is carried out in consultation with site guardians, PAP, County Government and in line with Kenyan cultural heritage requirements.
- The Operator Social Performance Plan will describe the procedures for micro alignment of the interconnecting network and OHTL within the RoW to avoid direct impact to the fire pits (CH-014, -015 and -016), where feasible. The Operator Social Performance Plan will set out how the Operator will consult with affected communities and site guardians to agree procedures for demarcation (e.g., demarcation and communication of ‘no go’ sensitive locations and mapping and communication of cultural heritage

'constraints'). Where direct impacts cannot be avoided through micro alignment and relocation is required the Operator will ensure it is done in consultation with site guardians, PAP, County Government and in line with Kenyan cultural heritage requirements.

- The Operator Social Performance Plan will set out requirements for consultation and engagement with the affected community and site guardians at CH-108, and if the location is fundamental to the asset's use, the Operator will agree procedures to support the sustainability of traditional practices, including those conducted at this asset.
- The Operator Stakeholder Engagement Plan will detail an information campaign to inform local stakeholders of the construction activity dates and the potential for increased disturbance during construction.
- The Operator Stakeholder Engagement Plan will include a strategy (timetable) for the continuation of community consultation and liaison with the Operator, to provide a platform to listen to and address community concerns and develop and mechanisms to support the sustainability of traditional practices in response to issues as they may arise during the construction phase.
- Cultural Awareness Training will be implemented for all site staff / contractors as part of the Project site induction process for all field-based staff during construction/ operation. The training will be outlined within the Operator Social Performance Plan and include:
  - Specific local taboos / respectful behaviours with regard to sacred trees;
  - A calendar of culturally significant events; and
  - Constraints mapping to highlight sensitive areas or no-go areas.
- The Operator will develop influx management procedures to manage speculative influx (emergence of informal settlements) occurring. Procedures will be developed in coordination with Turkana County Government and Administration. Agreed procedures will be presented in the Operator Social Performance Plan and will include consideration for potential changes in culturally sensitive practices.
- The Operator Stakeholder Engagement Plan will include a strategy (timetable) for the continuation of community consultation and liaison with the Operator, to provide a platform to listen to and address community concerns and to develop mechanisms to support the sustainability of traditional subsistence practices, specifically the transfer of traditional knowledge and skills. This will include the mapping and provision of continued access to natural resources which support subsistence activities.

7.10.11 Summary of Residual Impacts

Four moderate residual impacts are predicted during construction, with all other residual impacts being minor or negligible. Two residual moderate impacts are predicted as a result of visual changes on the setting of a sacred trees and fire pits, where there is no feasible mitigation to reduce the impact magnitude (low). The other residual moderate impacts during construction are on graves and burial sites, and fire pits associated with them, that may have to be relocated.

Two residual moderate impacts are also predicted during the operational phase. These are a result of visual impacts on the setting of sacred trees and fire pits from the long-term presence of the OHTL. As during construction, there is no feasible mitigation to reduce the impact magnitude (low).

7.11 Emergency, Accidental and Non-routine Events

7.11.1 Introduction

This section details the *emergency, accidental and non-routine events* risk assessment and includes an evaluation of natural and industrial hazards and the probability of their occurrence in order to assess the risks to the Project and from the Project to public safety.

7.11.2 Hazards to be Considered

The following sections describe the natural and industrial hazards considered in this assessment and provides an indication of how they will be assessed, including whether they have been scoped in or out of the assessment. Where hazards have been scoped out of the assessment, GIP will be implemented and will be included in the relevant management and emergency plans and procedures.

7.11.2.1 Natural Hazard Scenarios

- Natural seismic activity (earthquakes) which may lead to loss of containment or flowline integrity (potential for contamination via surface water or groundwater pathways) and to vibration-sensitive built structures or equipment which may lead to operational failure – scoped in to be addressed with procedures in an Emergency Preparedness Response Plan.
- Heavy rainfall, high wind speeds, flooding or other extreme weather leading to damage to containment structures or storage of hazardous, combustible or explosive materials – scoped out due to the potential low resulting impact and low frequency and intensity; in addition, the basis of design for the facilities has taken account of weather and climatic factors. Although scoped out, the response to such an unplanned event will be covered in an Emergency Preparedness Response Plan.
- Lightning strikes causing fires and damage to project infrastructure, for example, the enclosed emergency ground flare, GTGs, WHRUs storage tanks and pumps – scoped out due to the potential low resulting impact and expected low frequency and intensity. Although scoped out, the response to such an unplanned event will be covered in an Emergency Preparedness Response Plan.
- Dust storms which may lead to damage to site infrastructure and potential operational failure – scoped out due to the potential low resulting impact and expected low frequency and intensity; in addition, the basis of design for the facilities has taken account of weather and climatic factors. This will form part of management of natural hazards in this environment.

7.11.2.2 Industrial Hazard Scenarios

- Perforation or rupture of an oil storage tank leading to leakage which may lead to a spill of production fluid onto land - scoped in to be addressed in the oil spill response section of the Operator’s Emergency Preparedness and Response Plan.
- Perforation or rupture of a flowline leading to leakage which may lead to a spill of production fluid onto land or at a lugga crossing - scoped in to be addressed in the oil spill response section of the Operator’s Emergency Preparedness and Response Plan.
- A structural or mechanical failure of vehicle or plant which may lead to a collision resulting in damage to the flowline or containment structures – scoped out due to the potential low resulting impact and expected low frequency due to the flowlines being buried. The consequences of such an unplanned event will be covered in the Operator’s Emergency Preparedness and Response Plan under measures required for other emergency, accidental or unplanned events.

- Road traffic accidents on access roads which may lead to a spillage of hazardous materials, injury or death of human or ecological receptors - scoped in to be addressed in the Operator's Transport Management System and the Operator's Emergency Preparedness and Response Plan.
- Road traffic accidents on public roads which may lead to a spillage of hazardous materials, injury or death of human or ecological receptors or damage to public infrastructure - scoped in, to be addressed in the Operator's Transport Management System and the Operator's Emergency Preparedness and Response Plan.
- Uncontrolled releases of waste materials into the environment - scoped out due to the potential low resulting impact and likelihood of occurrence due to the adoption of measures detailed in the Operator's Environmental Performance Plan.
- Induced seismicity due to well testing/ oil production which may lead to loss of containment or flowline integrity (potential for contamination via surface water or groundwater pathways) and to vibration-sensitive built structures or equipment which may lead to operational failure – scoped in to be addressed with procedures in the Operator's Emergency Preparedness and Response Plan.
- Accidental discharges from systems that are normally isolated e.g. evaporation ponds leading to uncontrolled leaks and spills - scoped out due to potential low resulting impact and expected low frequency and likelihood of occurrence due to system design.
- Well casing/cement integrity failure and during drilling interventions and production – scoped in to be addressed in the oil spill response section of the Operator's Emergency Preparedness and Response Plan.
- Blow outs from wells explosions or integrity failure resulting in emergency releases of gas from wells or the CPF - scoped in to be addressed with procedures in an Emergency Preparedness and Response Plan.
- Failure of loss of integrity of the wellpad pit liners leading to accidental discharge of cuttings (oil based) and drilling muds/waste – scoped out due to potential low resulting impact and expected low frequency due to system design.
- Fire within the CFA leading to spread into surrounding areas and potential risk of explosion - scoped out due to expected very low frequency of occurrence. The consequences of such an unplanned event will be covered in the Operator's and the EPC contractor's Emergency Preparedness and Response Plans under other fire prevention measures.
- Dropped object or mechanical impact during drilling potentially resulting in a loss of containment of well fluid - scoped out due to expected low frequency due to operating procedures detailed in the Operator's Worker Health and Safety Plan.
- Spillage of chemicals or fuel which could lead to changes in water quality - scoped out due to the potential low resulting impact and expected low frequency and likelihood of occurrence. The consequences of such an unplanned event will be covered in the Operator's Emergency Preparedness and Response Plan under measures required for other emergency, accidental or unplanned events.
- Damage to sanitation tanks and pipework leading to wastewater discharge to local watercourses or groundwater - scoped out due to potential low resulting impact and expected low frequency due to system design.
- Injury and potential mortality of biodiversity receptors resulting from entrapment in open trenches - scoped out as this will be addressed in the Operator's Environmental Performance Plan (as detailed in Section 7.7.9, in the Biodiversity, Ecology and Protected Areas impact assessment).

- Discharge of firefighting water could result in impacts to local water quality – scoped out due to anticipated low frequency of the event. The consequences of such an unplanned event will be covered in the Operator's Emergency Preparedness and Response Plan under measures required for other emergency, accidental or unplanned events.

7.11.2.3 Quantitative Risk Assessment

A Quantitative Risk Assessment (QRA) is a formal and systematic risk analysis approach to quantifying the risks associated with the operation of an engineering process (i.e. operation of the CPF). A QRA is an essential tool to support the understanding of exposure of risk to employees, the environment, local communities, company assets and its reputation. A QRA also helps to make cost effective decisions and manages the risks for the entire asset lifecycle.

Objectives for a QRA study include:

- To identify the hazards associated with a facility;
- To determine the potential frequencies and consequences of the identified hazards;
- To determine the system availability of the protection systems; and
- To quantify the risks associated with a facility (e.g. Risk Contours, Individual Risk Per Annum (IRPA), Potential Loss of Life (PLL) and F-N
- [42] Plots to estimate numbers of potential fatalities).

Although a preliminary QRA was undertaken as part of FEED, a detailed QRA study will be developed for the CPF as part of the detailed engineering design and appropriate mitigation and management options will be implemented depending on the results so that the facility meets GIP in this regard.

7.11.3 Legislative Context

According to paragraphs 67 and 68 of the Petroleum Act 2019:

- A contractor and any other participant in upstream petroleum operations shall, at all times maintain efficient measures for emergency preparedness with a view to dealing with incidents which may lead to loss of life or personal injury, pollution or damage to property.
- The contractor shall ensure that the measures taken to prevent or reduce harmful effects, include measures to ensure that the environment is restored as much as possible to its original condition prior to commencement of operations.
- The contractor shall initiate and maintain emergency preparedness measures to prevent and mitigate against any hazards occurring within facilities and shall at all times have contingency plans to deal with such emergencies.
- The contractor shall place facilities at the disposal of the relevant authorities for emergency and security drills and shall, where necessary, participate in such drills.
- The contractor shall take all reasonable measures to:
  - Identify the hazards and evaluate the risks associated with any work performed in the course of upstream petroleum operations carried out under the license which constitute a hazard to the health

[42] During the analysis to estimate societal risk, various hypothetical events will have been assessed. Each of these events will have a predicted frequency of occurrence, F, and a predicted number of persons harmed, N.

of persons employed for the purposes of that work and the steps to be taken to comply with the provisions of this Act and Regulations made herein; and

- As far as practicable, prevent the exposure of the persons referred to in paragraph (a) to the hazards.

- As far as is practicable, the contractor shall involve the Authority, NEMA, the Council of Governors, and the relevant local communities in the preparation of emergency preparedness measures.

In addition to the Petroleum Act and national ESIA requirements which specify that the environmental and social management measures emerging from the assessment process should incorporate measures for "*emergency preparedness and response*".

IFC PS1, Assessment and Management of Environmental and Social Risks and Impacts (2012) outlines the requirement for an ESMP which incorporates emergency preparedness and response. In order to formulate the ESMP, this risk assessment is required to identify which, if any, risks there are regarding emergency preparedness and response.

7.11.4 Assessment Methodology

For each of the hazards listed in Section 7.11.2, a consequence rating and its probability of occurring have been assigned according to the definitions given in Figure 7.11-1. Hazard consequence and probability are then combined to give the risk level of each hazard (Table 7.11-1).

7.11.4.1 Natural Hazards

Natural hazards have been qualitatively assessed and the risk rating and proposed method of management and response is presented in Section 7.11.2.1. These consider hazards which have the potential to impact soils, water, air, human health, ecosystems and biodiversity.

7.11.4.2 Industrial Hazards

Industrial hazards have been qualitatively assessed and the risk rating and proposed method of management and response is presented in Section 7.11.5.

Emergency, Accidental and Non-routine Events- RISKS AND ASSOCIATED CONSEQUENCES			CONSEQUENCE				
			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		The unwanted event occurs in order of one or more times per year & is likely to reoccur within 1 year	M	M	H	H	H
LIKELY		The unwanted event occurs less than once per year & is likely to reoccur within 5 years	M	M	M	H	H
POSSIBL E		The unwanted event can occur during the life of the porject & is unlikely to reoccur with any more frequency that every 10 years	L	M	M	M	H
UNLIKEL Y		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	L	L	M	M	H
RARE		The unwanted event has never been known to occur in the business: or it is highly unlikely that it will occur within 25 years	L	L	L	M	M

	Risk Level	GUIDELINES FOR RISK MATRIX
	H - High	A high risk exists, appropriate mitigation strategy to be devised immediately.
	M - Medium	A moderate risk, appropriate mitigation strategy to be devised as part of the normal management process.
	L - Low	A low risk,A5:H18 monitor risk, no further mitigation required.

Figure 7.11-1: Risk Matrix for the Assessment of Emergency, Accidental and Non-Routine Event

7.11.5 Risk Assessment

Table 7.11-1: Risk Assessment of Emergency, Accidental and Non-Routine Events

Haz No.	Hazard	Consequence	Receptor	Consequence rating	Probability	Risk	Mitigation measures	Relevant Management Plan
Natural Hazards								
1	Natural seismicity (earthquakes) on built structures, flowlines, vibration-sensitive built structures or equipment.	Damage to flowlines or containment structures for storage of materials.	Soil, surface water and/or groundwater contamination.	Moderate	Rare	Low	Spill response kits will be available at well-pads and the CFA and used as soon as possible following an event.	■ Operator's Emergency Preparedness and Response Plan
Industrial hazards								
2	Failure or rupture of a storage tank.	Leakage and spill of production fluid onto land.	Soil, shallow groundwater	Moderate	Rare	Low	Spill response kits will be available at well-pads and the CFA and used as soon as possible following an event.	■ Operator's Emergency Preparedness and Response Plan.
3	Perforation or rupture of a flowline or spillage due to poor working practices.	Leakage and spill of production fluid onto land or at a lugga crossing.	Soil, surface water, shallow groundwater	Moderate	Rare	Low	Flowlines will be buried. Due to the waxy properties of the oil, if there are any breaks to the flowlines it is likely that the oil will solidify quickly (crude is solid below 57°C). Spill response kits will be available at well-pads and the CFA and used as soon as possible following an event.	■ Operator's Emergency Preparedness and Response Plan. ■ Operator's Environmental Performance Plan.

Haz No.	Hazard	Consequence	Receptor	Consequence rating	Probability	Risk	Mitigation measures	Relevant Management Plan
4	Road traffic accidents on access roads.	Spillage of hazardous materials, injury or death.	Soil, surface water, shallow groundwater, Human or ecological receptors.	Moderate	Likely	Medium	Project speed limits will be adhered to. Education programme for drivers and passengers. Compliance with the Kenyan Road Traffic Act.	■ Transport Management System. ■ Operator's Emergency Preparedness and Response Plan.
5	Road traffic accidents on public roads.	Spillage of hazardous materials, damage to public infrastructure, injury or death.	Soil, surface water, shallow groundwater, Human or ecological receptors, public infrastructure.	High	Likely	High	National and Project speed limits will be adhered to. Education programme for drivers and passengers. Community awareness programme for traffic awareness. Compliance with the Kenyan Road Traffic Act.	■ Transport Management System. ■ Operator's Emergency Preparedness and Response Plan.
6	Induced seismicity due to well testing/ oil production.	Loss of containment leading to leakage and a spill of production fluid.	Soil, surface water, shallow groundwater.	Moderate	Rare	Low	Flowlines will be buried. Due to the waxy properties of the oil, if there are any breaks to the flowlines it is likely that the oil will solidify quickly (crude is solid below 57°C). Spill response kits will be available at wellpad and the CFA and used as soon as possible following an event.	■ Operator's Emergency Preparedness and Response Plan. ■ Operator's Environmental Performance Plan.

Haz No.	Hazard	Consequence	Receptor	Consequence rating	Probability	Risk	Mitigation measures	Relevant Management Plan
7	Blow outs from wells, explosions or integrity failure resulting in emergency releases of gas from wells or the CPF.	Gaseous releases to atmosphere.	Air quality	Moderate	Rare	Low	Each well will be fitted with a BOP; the CPF is equipped with an appropriate flare system.	▪ Operator's Emergency Preparedness and Response Plan. ▪ Operator's Environmental Performance Plan.
8	Well casing/cement integrity failure during drilling and production.	Loss of containment and leakage of production fluids.	Soil, surface water, shallow groundwater.	Moderate	Rare	Low	Due to the waxy properties of the oil, if there are any breaks to the flowlines it is likely that the oil will solidify quickly (crude is solid below 57°C). Spill response kits will be available at wellpad and the CFA and used as soon as possible following an event.	▪ Operator's Emergency Preparedness and Response Plan ▪ Operator's Environmental Performance Plan

7.11.6 Conclusion

This *emergency, accidental and non-routine events* assessment includes an evaluation of natural 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. A qualitative assessment of natural and industrial events has been undertaken.

The risk associated with the unplanned events ranges from Low to High, depending on the consequence and probability of occurrence. The following management plans are required to respond to the unplanned events detailed in this assessment:

- Operator's Emergency Preparedness and Response Plan which will include the following sections: procedures to identify and how to respond to potential emergency situations (including oil spills), potential failure of risk controls and potential for incidents that would have health and safety implications for workers and/or the community; and environmental implications. Provision for emergency arrangements with contractors and collaboration with other appropriate and relevant third parties; provision of equipment and resources and designation of responsibilities. Process for review and revision as necessary to reflect changing conditions.
- Operator's Environmental Performance Plan which will include the following sections: Air Emissions, Biodiversity, Climate Change, Hazardous Materials, Noise & Vibration, Soil Management, Waste Management, Water Resources. For each section, there will be a summary of key issues relating to emergency events, applicable standards, management controls, monitoring requirements and KPIs. There will also be sections on monitoring compliance with the plan, evaluation and auditing, training, resourcing, roles and responsibilities. The Plan will be prepared to meet the requirements of ISO 14001:2015.
- Operator's Worker Health and Safety Plan which will detail the requirements of the Occupational Health and Safety Management System.
- Operator's Contractor Management Procedure which will detail the contractors' responsibilities for implementing the Operator's ESMS during construction, including the plans described above.

In addition, a full QRA will be undertaken as part of the detailed design of the facilities and appropriate mitigation and management options will be implemented depending on the results so that the facility meets GIP for both worker and community health and safety, the environment and company assets.

8.0 CUMULATIVE IMPACTS

8.1 Introduction

Cumulative impacts, as defined by the IFC (IFC 2013), are those that may result from the incremental impact, on areas or resources used or directly impacted by the Project, from other existing or reasonably defined planned developments, at the time the risks and impact identification process is undertaken. While a standalone activity may itself result in an impact that is not significant, when combined with other impacts (significant or not significant) in the same geographical area and occurring simultaneously, it may result in a significant cumulative impact. Understanding of the impacts of planned developments varies, with some planned projects well understood, both spatially and temporally, whilst for others there is only limited information available. The IFC Good Practice Handbook on Cumulative Impact Assessment (CIA) (IFC, 2015b) suggests that government and regional planners have ultimate responsibility for CIAs, so a broader scale assessment was not considered appropriate for this Project ESIA.

8.2 Assessment Method

This CIA identifies areas where the cumulative impacts of the Project and anticipated future developments may occur. The assessment methodology involves:

- Defining the spatial and temporal scope of the assessment within which other planned developments need to be considered;
- Identification of defined or foreseeable Associated Facilities and third-party projects;
- Identifying groups of receptors[1] that have environmental and social attributes that may be important to assessing risks;
- Identify how new activities and developments may generate impacts that could act cumulatively, together with potential combined effects;
- Assess the impact of any potential combined effects of the Project with the Associated Facilities and third-party projects on the identified receptors; and
- Where relevant, outline mitigation and management strategies to address any potential cumulative impacts.

Cumulative impacts from historic projects (including EOPS and Exploration and Appraisal activities) have not been included in this assessment, as they have been considered in the ESIA through the inclusion and consideration of the baseline environment.

8.3 Spatial and Temporal Scope

The cumulative assessment focuses on developments located within the Project AoI (as illustrated in Figure 8.3-1) which have the potential for combined impacts with the Project. It considers known proposed associated facilities and third-party project developments that will likely be constructed and subsequently operated within the lifespan of the Project.

While most potential cumulative effects may manifest locally, some effects (e.g. socio-economic) may extend beyond the AoI. Third-party project activities located outside of Kenya have been scoped out of this CIA, due to their distance from the Project. Any components or activities of these third-party projects which are likely to occur in the AoI, for example routes used by construction vehicles and materials, have been included.

[1] Termed “Valued Environmental and Social Components (VECs)” (IFC, 2013). The term ‘receptor(s)’ is used for the purposes of this assessment, rather than VECs, in order to maintain consistency throughout the ESIA.

The temporal scope of this CIA includes the construction period which is 66 months (the maximum anticipated construction period) although the majority of the Project infrastructure (Central Facilities Areas/Central Processing Facility) will be constructed within the first 36 months, and the 25-year operational life of the Project.

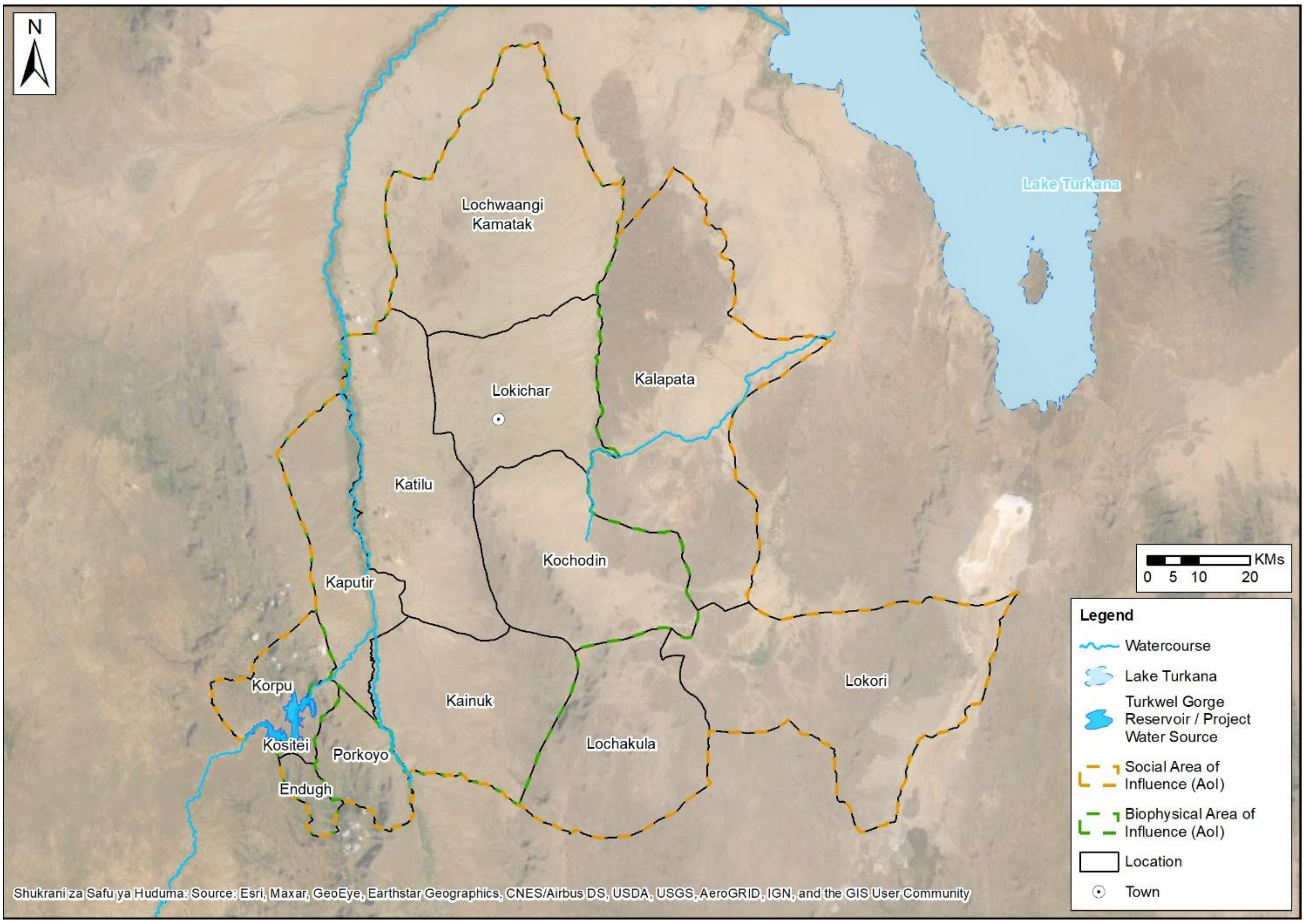

Figure 8.3-1: Project AoI

8.4 Scoping of the CIA and Identification of Other Developments

Associated Project facilities and third-party projects have been identified and defined using publicly available information, including but not limited to the following sources:

- Publicly available third-party project specific ESIA documents;
- Turkana County Annual Development Plan 2019 - 2020;
- Turkana County Annual Development Plan 2020 - 2021;
- West Pokot County Annual Development Plan 2017- 2018;
- Kenya Vision 2030;
- LAPSSET Corridor Development Project Strategic Environmental Assessment 2017; and
- KeNHA website.

These documents and sources have been reviewed to identify current or planned third-party projects within the AoI which may combine with the Project to generate cumulative impacts. The following projects have been identified in the AoI and a justification for their inclusion into or scoping out of the CIA is provided below.

8.4.1 Associated Project Facilities

Associated facilities are facilities that are not funded as part of the Project and that would not have been constructed or expanded if the Project did not exist and without which the project would not be viable (IFC, 2012b).

Project impacts relating to the use of these facilities have been included within the impact analysis in the ESIA and the Operator has committed to exert influence on the operators of these associated facilities to adopt potential mitigation measures, identified through this ESIA. Nevertheless, all of these associated Project facilities are outlined below and are also considered in this CIA, as there are elements of the construction and operation of these facilities which are outwith the Operator's influence.

The EOPS operation has concluded and will not operate simultaneously with the Project but the baseline conditions considered in the ESIA include EOPS operation.

8.4.1.1 Lokichar to Lamu Crude Oil Pipeline (LLCOP)

The LLCOP Project is proposed to transport stabilised crude oil from the South Lokichar Basin Upstream processing facilities along an 824 km long pipeline to a storage and load-out facility at a new port in Lamu. The pipeline will form an integral part of the LAPSSET Corridor. The LAPSSET Corridor is considered as a Third-Party Project in Section 8.4.2.1.

The following components of the LLCOP are anticipated to have potential cumulative effects due to their location within the AoI or the nature of the activities:

- The construction and operation of the LEF which is located within the CFA;
- The construction and operation of the pumping stations associated with the pipeline, of which none are located within the biophysical AoI and two are located within the social AoI;
- Safety aspects relating to the operation of the sections of the roads in the AoI;
- The construction of the section of the oil pipeline located within the AoI. This is approximately 30 km for the biophysical AoI and 90 km for the social AoI. As the pipeline is buried, any impacts relating to the direct operational phase of the pipeline (excluding supporting infrastructure) have been scoped out of the assessment;
- The construction and operation of any electricity/power transmission and connectivity infrastructure located within the AoI;
- Construction water supply for the section of the LLCOP and associated infrastructure located within the AoI;
- The construction and operation of accommodation camps for construction of the LLCOP in the AoI. The exact location of the accommodation camp is yet to be defined but it will be located within Turkana;
- Waste disposal facilities for the construction and operational aspects of the LLCOP located within the AoI; and
- Population influx and social and health related aspects during construction of LLCOP in the AoI.

8.4.1.2 Make-up water pipeline

The Operator will construct and operate a buried make-up water pipeline to transport water to meet project demands from the Turkwel Gorge Reservoir to the CPF for the Project. The water take from the Turkwel Gorge Reservoir is covered under this ESIA. The make-up water pipeline will be permitted under a separate ESIA.

The make-up water pipeline will be operational by month 22 of construction of the Project.

There will be an abstraction facility on the Turkwel Gorge Reservoir. Water will be pumped to a break tank located at the high point of the escarpment adjacent to the Turkwel Gorge Dam. From the break tank, water will Dflow under gravity, using the natural elevation difference between the Turkwel Gorge Dam and the CPF, through approximately 90 km of pipeline to the CPF.

There will be a pipeline construction camp near the Turkwel Gorge Dam. Power supply to the make-up water abstraction facilities will be from the Turkwel Gorge Dam substation located approximately 5 km from the facility area.

There will be a temporary RoW during the construction phase, which will be allowed to revegetate after completion of construction activities. A permanent easement will be in place once the make-up water pipeline is built. No permanent structures will be permitted within the permanent easement.

Watercourse crossings (except the Malmalte crossing) will be installed using open cut techniques wherever possible. A desk-based scour assessment will be completed for each watercourse crossing and a pre-construction survey of each lugga/watercourse crossing will be completed to verify the assumptions and outcome of the desk-based scour assessment. Scour potential and scour depth will be assessed and work on ephemeral rivers, smaller streams/luggas and wetland crossings will be planned take place during the dry seasons, when no flow is anticipated. The choice of crossing at the Malmalte River will be based on the results of the geotechnical survey and developed in line with the known biodiversity constraints.

Hydrotesting of the make-up water pipeline, will be undertaken to confirm the strength and integrity of the systems. Hydrotesting water will be sourced from the Turkwel Gorge Reservoir. At the completion of hydrotesting activities, test water will be discharged into purpose-built evaporation ponds as a first preference or discharged to the environment in line with Kenyan permitting requirements.

The following components of the make-up water pipeline are anticipated to have potential cumulative effects due to their location within the AoI or the nature of the activities:

- The construction of the make-up water pipeline, including any blasting of rocky outcrops;
- The construction and operation of the abstraction facilities on the Turkwel Gorge Reservoir;
- The construction and operation of the break tank and pressure reduction station, at the base of the slope;
- The construction and operation of construction accommodation camps; the exact location of the accommodation camp is yet to be defined;
- Construction of the Malmalte crossing to minimise impacts on biodiversity in the critical habitat triggering riparian corridor;
- Safety aspects relating to the management of the construction RoW and the permanent easement;
- Contractor employment and management for temporary construction workers on the make-up water pipeline;
- Discharge of potentially contaminated hydrotest water to the environment, in areas where evaporation ponds are not feasible, (abstraction of the water to meet demand is covered under this ESIA); and
- Associated water offtakes (Section 8.4.1.3).

8.4.1.3 Water off-takes

The Operator will make provisions for community water off-take points from the make-up water pipeline allowing County water service providers to access the non-potable water. These providers will be responsible for the treatment of water to ensure it meets drinking water standards, and the distribution to surrounding community water points.

8.4.1.4 Off-Site Overhead Transmission Lines

To provide Power for the Project, construction and installation of the following off-site OHTLs will be required and undertaken by the relevant Kenyan electricity company, which is currently the KETRACO.

- A high voltage Turkwel – Lokichar – Lodwar – Lokichoggio transmission line and a new substation adjacent to the CPF.
- A high voltage transmission line from Kainuk Substation to the Make-up Water abstraction facilities and new transformer station; and
- Lifting of any existing transmission lines to remove supply pinch points.

8.4.1.5 Rest stops

Rest stops will be required at a number of locations along the construction materials transport route from Mombasa to the Project. These locations are yet to be defined, but they will be existing rest stop locations which will be audited by the Operator.

8.4.2 Third-Party Projects

8.4.2.1 LAPSSET Corridor Development Project

The LAPSSET Corridor is a linear multi-spoke land corridor identified by the GoK for strategic development as part of the Vision 2030 process and is a major initiative for Kenya and the East African region.

Land required for the LAPSSET Corridor will be acquired by the GoK (NLC, supported by Ministry of Lands and Physical Planning) by compulsory acquisition under the terms of the Land Act (2012) and transferred to the LCDA.

The entire LAPSSET Corridor spans over 2,000 km in length and is comprised of two core elements:

- A 500 m wide Infrastructure Corridor, which will accommodate the LLCOP, new roads, a railway, and utilities (water and OHTLs); and
- A 50 km wide Economic Corridor spanning either side of the Infrastructure Corridor, where industrial developments will be situated.

The LAPSSET Corridor will comprise the following key components:

- Roads;
- Standard Gauge Railway (SGR);
- Oil pipeline and associated stations;
- LEF which is located within the Project CPF
- Electricity/Power Transmission;
- Fibre Optic Connectivity;
- Water Supply;

- 32 berth sea-port at Lamu;
- International Airports;
- Resort Cities; and
- High Grand Falls Dam.

Due to the Project being intrinsically linked to sections of the infrastructure for the LLCOP and the likely close alignment of the construction periods for certain components, this development is likely to generate cumulative impacts.

8.4.2.2 Tilenga Project

The Tilenga project includes the development of six oil fields which are located within western Uganda, close to Lake Albert. The project will incorporate wellpads, wells and buried pipelines and infrastructure with water sourced from Lake Albert. Due to the distance from the Project, cumulative impacts from the operations phase of the Tilenga project are not anticipated and are therefore scoped out of this CIA. To construct the Tilenga project, construction materials will be moved by road from the Port at Mombasa towards Eldoret, then into Uganda. Part of the transport route is the same as for the Project, therefore cumulative impacts from road traffic are considered in this CIA, all other construction impacts are scoped out of the assessment.

8.4.2.3 Kingfisher Oil Development

The Kingfisher Oil Project includes the development of oil fields which are located within western Uganda, close to Lake Albert. The project will incorporate wellpads, wells and buried pipelines and infrastructure with water sourced from Lake Albert. Due to the distance from the Project, cumulative impacts from the operations phase of the Kingfisher Project are not anticipated and are therefore scoped out of this CIA. To construct and operate the Kingfisher Project, materials will be moved by road using the P2 and R7 roads in Kenya. Part of the transport route is the same as for the Project, therefore cumulative impacts from road traffic are considered in this CIA, all other construction impacts are scoped out of the assessment.

8.4.2.4 Proposed Turkana Mega-Dams

The Turkana Draft Annual Development Plan (ADP) 2020 - 2021 outlines that four mega-dams are proposed in Turkana with proposed locations at Kotome, Letea, Kalemngorok and Napeitom. The dams will be developed by Turkana Government in partnership with other development partners. The dams will be developed as a form of water harvesting for use by pastoralists. The ESIAs for these proposed developments are reportedly due to be undertaken in the coming year. All the proposed dams are in Turkana County with Kalemngorok located the closest to the Project. Due to the current development stage of these projects there is no information on the likely residual impacts. As the ESIAs for these projects are yet to be undertaken, the Project should be included in the CIA of these four ESIAs, and they are not assessed in this CIA.

8.5 Identification of Receptors

The receptors identified within each technical chapter in Chapter 7 of this ESIA mostly remain relevant to the cumulative assessment, including physical, biological or social, for example PAP, areas of cultural importance, watercourses, flora and fauna, depending on the technical discipline. These are summarised in Table 8.5-1.

Table 8.5-1: Cumulative Impact Assessment - Receptors

Technical Discipline	Receptor(s)
Air Quality	PAP (transient or permanent), and flora.
Noise and Vibration	PAP (transient or permanent), the Turkwel Gorge Dam and fauna.

Technical Discipline	Receptor(s)
Water Quantity and Quality	Kalabata, Malmalte and Turkwel Rivers, seasonal rivers and ephemeral streams/drainage luggas, Turkwel Gorge Reservoir, shallow and deep groundwater aquifers, water users and PAP (transient or permanent).
Soils, Terrain, Geology and Seismicity	Soils (Cambisols, Fluvisols, Lixisols, and Regosols).
Landscape and Visual	Landscape receptors (e.g. Protected Areas and landscape character areas), and visual impact receptors (PAP).
Biodiversity, Ecology and Protected Areas	Habitats and species.
Ecosystem Services	Cultivated and wild food, medicinal plants, grazing, biomass fuel, wood and fibre, freshwater and regulation of water flows, cultural sites, and educational and spiritual values.
Social	PAP
Cultural Heritage	Tangible living cultural heritage (e.g. sacred trees, graves), intangible cultural heritage, and archaeology.

Through the social engagement work undertaken to date, there have been environmental concerns raised by stakeholders. These include:

- Water – general concerns regarding treatment, and water access as well as the possible impacts of Project-related abstraction on flows in the Turkwel River and resultant effects on livelihoods;
- Pollution/waste – concerns regarding the provisions for waste management and the establishment of Waste Management Facilities;
- Air – concerns relating to pollution as a result of Project-related flaring activity and dust from Project vehicles; and
- Biodiversity – general concerns regarding the overall biological sensitivity of the area and specific concern on the consumption of wastewater by birds.

8.6 Project Residual Impacts

The residual impacts of the Project are summarised below for each technical discipline and are referenced in the CIA sections below.

8.6.1 Air Quality

For the construction phase, minor residual impacts relating to construction dust are anticipated on PAP and transient receptors.

For the operational phase, minor residual impacts are anticipated on PAP and transient receptors around the CFA from changing local air quality concentrations associated with the emissions to air from exhaust emissions of equipment located at the CFA and wellpads.

8.6.2 Noise & Vibration

For the construction phase, minor residual noise impacts are anticipated on PAP and transient human receptors from the construction of Project components including the CFA, wellpads and flowlines and the landfill. Minor residual impacts are also anticipated on PAP and transient receptors from well drilling activities. One residual impact significance was classified as moderate during construction for PAP within the areas of predicted high magnitude (0 to 75 m from the perimeter) of CFA, wellpads, infield flowlines and the landfill.

For the operational phase, minor residual impacts are anticipated on transient human receptors outside of the CFA fence-line, the wellpad fence-lines, and the landfill fence-line. No residual impacts from vibration are anticipated for either the construction or operational phase.

8.6.3 Water Quantity

For the construction phase, minor residual impacts are anticipated on the Kalabata River from the Project abstraction of groundwater from boreholes for the initial construction period. Minor to negligible residual impacts are anticipated on seasonal rivers/ streams and drainage luggas from water discharges, construction activities near or within water courses and the abstraction of groundwater from boreholes for the initial construction period. Minor impacts are anticipated on the Turkwel Gorge Reservoir and groundwater, specifically shallow aquifers and water users of hand dug wells in dry riverbeds, from abstraction of groundwater from boreholes for the initial construction period and construction activities. Minor residual impacts are anticipated on human residences downstream of the proposed Project infrastructure during construction relating to the flood risk due to the presence of the Project infrastructure.

For the operational phase, minor residual impacts are anticipated on the Turkwel Gorge Reservoir due to continued water abstraction.

8.6.4 Water Quality

For the construction phase, minor residual impacts are anticipated on the Kalabata River and seasonal rivers/streams and drainage luggas from construction activities near or within the watercourses/bodies. Minor residual impacts are also anticipated on the Kalabata River, seasonal rivers/streams and drainage luggas and groundwater (shallow aquifers) from discharges/releases from waste storage and disposal activities.

For the operational phase, minor residual impacts are anticipated on the Kalabata River, seasonal rivers/streams and drainage luggas and groundwater (shallow aquifers) from discharges/releases from waste storage and disposal activities.

8.6.5 Soils

For the construction and operational phases only negligible residual impacts are identified.

8.6.6 Landscape and Visual

For the construction phase, moderate visual residual impacts are anticipated on permanent human receptors from construction of Project infrastructure, with a minor residual impact from site activity (e.g. plant movement) and the clearance and removal of vegetation and soils.

For the operational phase, a moderate residual visual impact on permanent human receptors is predicted as a result of the presence of the OHTL, whilst minor residual visual impacts are anticipated from the location of above ground infrastructure such as wellpads and the CFA.

8.6.7 Biodiversity, Ecology and Protected Areas

For the construction phase, minor residual biodiversity impacts are anticipated for rocky ridges habitat (and associated species) and northern *Acacia-Commiphora* bushlands and thicket.

Minor residual impacts to mammal SoCC, including leopard and striped hyaena, and bird SoCC, from factors including land take, sensory disturbance (noise and light), increased access, invasive species, direct mortality and influx are likewise predicted. Moderate residual impacts are also anticipated on vultures from direct mortality due to infield OHTL, sensory disturbance and loss of critical habitat due to the potential dewatering of the Kalabata River. The Turkana toad and the *Omophron* ground beetle will have a moderate residual impact significance due to the potential for direct mortality, attraction to lights and loss of critical habitat due to the potential dewatering of the Kalabata River.

For the operational phase, minor residual biodiversity impacts are anticipated on rocky ridge habitats. Equally, minor residual impacts are predicted for leopard, striped hyaena, bird SoCC, the Turkana toad and the *Omophron* ground beetle from factors including sensory disturbance (noise and light), increased access, direct mortality and attraction to water and light sources. Moderate residual impacts are anticipated on vultures from direct mortality due to OHTL.

8.6.8 Ecosystem Services

For the construction phase, minor residual ecosystem services impacts are anticipated on the availability of grazing/ browsing for livestock, medicinal plants and freshwater from changes to land use and a reduction in availability. Moderate residual impacts are anticipated on cultural sites and spiritual values from the disturbance of sacred sites and changes to landscape aesthetics.

For the operational phase, minor residual ecosystem services impacts are anticipated on the availability of wild foods, medicinal plants, biomass fuels and wood and fibre from influx of people and livestock. Moderate residual impacts are anticipated on the availability of grazing/browsing for livestock, spiritual values, and educational/inspirational values due to the influx of people and livestock and the presence of the Project in the landscape.

8.6.9 Social

For both the construction and operational phases of the Project there are a number of positive residual social impacts which are anticipated. These include, but are not limited to, additional infrastructure, payments of taxes, employment and procurement opportunities and improved access to education.

For accidents and injuries and Project-induced influx and in-migration residual impacts during construction and operations are predicted to be moderate negative, despite mitigation measures. All other residual impacts are expected to be minor negative or negligible.

8.6.10 Cultural Heritage

For the construction phase, minor cultural heritage residual impacts are anticipated on potential archaeological settlement sites, some living cultural heritage sites (e.g. *akirket* sites), and intangible cultural heritage, including Turkana culture, nomadic pastoralism, and environmental subsistence, due to ground disturbance, changes in environmental setting and socio-economic conditions. Moderate residual impacts are anticipated on sacred trees and ritual fire pits, as well as graves and burials, from ground disturbance and changes to environmental setting (from dust generated during construction and visual impacts).

For the operational phase, minor residual impacts are anticipated on Turkana culture and nomadic pastoralism from changes in socio-economic conditions. Moderate residual cultural heritage impacts are anticipated on sacred trees and ritual fire pits from visual changes due to the presence of infield OHTL.

8.7 Assessment of Other Developments

Known and proposed Project associated facilities and third- party projects, located within Kenya and specifically within the AoI have been identified in Section 8.4.2. The likely cumulative impacts of these associated facilities or third-party projects with the Project are detailed in the following section.

8.7.1 Associated Facilities

8.7.1.1 LLCOP

The ESIA completed for LLCOP (Golder, 2019c) identified the following potential residual (negative) impacts associated with the development:

- Potential decline in air quality through LLCOP station emissions (generator exhaust);
- Noise and vibration impacts associated with heavy construction equipment / traffic noise, which may have implications on local communities;
- Water management impacts during construction and operational phases in relation to the maintenance of drainage patterns, water availability and the discharge of wastewater;
- Ground disturbance resulting in increased soil erosion risk and loss of agricultural land capability;
- The temporary impingement of ecological connectivity and habitat severance during the construction phase and potential road collision impacts on protected species;
- Potential impacts on marine flora and fauna from accidental spillages or releases from Project related tanker vessels. For sea turtles, marine mammals and fish, there is also risk of vessel collision. These potential impacts will be managed through an Emergency Preparedness and Response Plan, invasive species management, a no hunting or fishing policy, monitoring of mangrove restoration and procedural controls in adherence with GIP;
- Minor residual impacts during construction and operation associated with the partial loss/damage to key landscape characteristics in the immediate setting of the Project Stations in areas of predominantly low-lying scattered scrub;
- Potential project–related ground disturbance (e.g. vegetation clearing, soil stripping, stockpiling) impacting on cultural heritage sites which have yet to be identified pre-construction;
- Impacts on traffic volumes and composition, particularly during construction;
- Community health and safety impacts associated with influx of workers including increased risk of HIV/AIDS and STIs;
- Potential impacts on employment and temporary competition for labour; and
- Potential impacts on ecosystem services associated with vegetation clearance, population influx, loss of land and resources, disruption to pastoral access to grazing/browsing resources and freshwater (fishing) and marine (fishing and mangroves) environments.

8.7.1.1.1 Potential Cumulative Impacts

Residual Impacts from the Project leading to potential cumulative impacts with the LLCOP project are anticipated during the construction and operational phases:

- Potential decline in air quality through combined construction dust emissions - the construction of the CFA (including the LEF) has been included in the Project construction dust assessment and therefore the mitigation defined in Section 7.1.9.1 consider cumulative impacts. There is also the potential for the construction of the most northern section of the LLCOP to generate cumulative dust impacts with the Project. The project proponents will engage to plan construction programmes so any concurrent work in the same location (within 250 m of each project) are minimised as far as practicable. Where concurrent work is required, the project proponents will work together to identify additional measures and controls to limit the significance and duration of activities.

- Potential decline in air quality from traffic emissions - a traffic screening for the impact of exhaust emissions on air quality has been undertaken for the Project and LLCOP. For both projects, the anticipated vehicle numbers are below the screening criteria and therefore detailed assessments have not been undertaken. Screening and assessment of air quality impacts from traffic consider the change in traffic associated with a development, with each proposed development assessed individually. Therefore, the cumulative impacts from traffic, with regards to air quality, are no greater than predicted for the Project (not-significant).
- Potential decline in air quality through operational exhaust emissions associated with the generator located at the LEF and the operation of the CFA – the magnitude criteria for the Project have been defined to consider the process contribution of the project and ensuring there is headroom for other developments in the airshed as recommended by IFC.
- Noise impacts from construction of LEF - The assessment of the Project construction noise considers the construction of the LEF which is located within the CFA and therefore the mitigation avoidance areas defined in Section 8.6.2 consider cumulative impacts. The project proponents will engage to plan construction programmes so any concurrent work in the same location are minimised as far as practicable. Where concurrent work is required then the project proponents will work together to identify additional measures and controls to limit the significance and duration of activities. If these mitigation measures are implemented alongside GIP, the residual cumulative impacts are no greater than predicted for the Project.
- Noise impacts from the construction of the pipeline – cumulative noise impacts may occur if construction of the Project and the northern section of the LLCOP occur at the same time. Where concurrent work is required then project proponents will work together to identify additional measures and controls to limit the activities significance and duration. If these mitigation measures are implemented alongside GIP, the residual cumulative impacts are no greater than predicted for the Project.
- Noise impacts from the operation of the LEF - the operation of the LEF is included in the Project assessment of operational noise, therefore cumulative impacts of operational noise have already been considered and mitigated as detailed in Section 8.6.2. The residual cumulative impact significance is anticipated to be minor. LLCOP Pumping Station 1 is located approximately 35 km from the LEF, therefore cumulative noise impacts with the Project are not anticipated and therefore scoped out of this assessment as not significant.
- Biodiversity impacts during construction - cumulative biodiversity impacts may occur when construction of the two projects occurs simultaneously in the same area. Cumulative impacts on terrestrial biodiversity during operation of LLCOP and the Project, once the LLCOP is installed and the pipeline corridor restored, will reduce. However, terrestrial biodiversity impacts are likely to include minor disturbance and changes to fauna and flora species receptors as a result of increases in noise and light around LLCOP stations during operation. It should be noted that the closest LLCOP station, outside of the LEF, is situated approximately 35 km from the Project. Mitigation for impacts to habitats and species as committed to in Section 7.7 will minimise cumulative impacts and the residual cumulative impacts are anticipated to be no greater than predicted for the Project.
- Community health, safety and security impacts associated with construction and operational phases – cumulative impacts are anticipated associated with the influx of people and workers relating to both projects. The cumulative impacts of the projects may include increased risk of HIV/AIDS and STIs. Alongside the mitigation measures identified for each project including closed camps, engagement campaigns and HIV and health plans and policies, the Project proponents will work together to align proposed measures and identify if any additional measures and controls are required to limit significance.

If these mitigation measures are implemented alongside GIP, the residual cumulative impact significance is anticipated to be no greater than predicted for the Project.

- Project construction wastes – Construction wastes will be managed by the EPC contractor in accordance with the relevant Kenyan and international requirements and the Project Waste Management Plan. Non-degradable construction wastes from the LLCOP in the AoI will be disposed of in the Project's engineered landfill and have been allocated for in the landfill design. The engineered landfill has been designed and specified to include LLCOP wastes, therefore cumulative impacts are considered.

8.7.1.2 Make-up Water Pipeline

The make-up water pipeline will require land take of community land on a temporary basis. It will likely be located in areas where important vegetation and soils has been identified, graves and sacred sites may be encountered and luggas will need to be crossed and close to where PAP reside. In addition, the pipeline will likely cross the Malmalte riparian corridor and the Malmalte river. The Malmalte riparian corridor is approximately 1.2 km wide and provides connectivity for the movement of a number of SoCC, some of which trigger critical habitat, including elephants, hyena, leopards and fish.

8.7.1.2.1 Potential Cumulative Impacts

The following key negative cumulative impacts are anticipated relating to the make-up water pipeline and will require mitigation or management once the design is defined:

- Dust and particulates generated during the construction of the pipeline, impacting PAP and vegetation SoCC, e.g. *Euphorbia turkanensis* for approximately the nearest 1 km of the pipeline to the infield construction activities (assuming that construction happens in parallel);
- Noise generated during construction of the pipeline from vehicle movement, construction activities including clearing and material movement for approximately the nearest 1 km of the pipeline to the infield construction activities (assuming that construction happens in parallel);
- Temporary changes to water quality (potential for sediment transport) in luggas due to construction activities near to and in lugga for approximately the nearest 1 km of the pipeline to the infield construction activities (assuming that construction happens in parallel);
- In areas where evaporation ponds are not feasible, discharge of potentially contaminated hydrotest water to the environment along the nearest 1 km of the pipeline to the infield construction activities (assuming that construction happens in parallel);
- During construction activities within or near luggas along the nearest 1 km of the pipeline to the infield construction activities (assuming that construction happens in parallel). There will be changes to the conveyance of water quantity downstream of construction areas, which would normally allow water to recharge shallow aquifers, which may be accessed by local communities;
- Changes to access along the pipeline in proximity to the infield infrastructure (e.g. through creation of the RoW and the permanent easement) increasing opportunities for people to poach, hunt and fish in critical habitat areas, inducing in-migration to the Upstream area;
- Potentially increased inter-ethnic conflict and tension related to the transporting of water from one County to another County, where the presence of infield infrastructure may already have resulted in heightened risk of conflict; and
- Population Influx and social and health related impacts relating to water offtakes (Section 8.4.1.3), particularly where these are located in proximity to infield infrastructure.

8.7.1.3 *Water Off-Takes*

While there will be positive benefits with the provision of non-potable water via water offtakes along the make-up water pipeline route, negative impacts relating to influx are anticipated relating to overgrazing around water points and influx of people into the vicinity of the water supply, if the Operator and County Government are unable to effectively manage the off-takes.

8.7.1.3.1 Potential Cumulative Impacts

Potential cumulative impacts may include population influx as people wish to be close to a permanent and secure water supply, inter-ethnic conflict due to the locations of the water offtakes, health aspects relating to consumption of non-potable water and impacts on ecosystem services relating to availability of grazing/browsing for livestock if the number of animals increase (relating to influx). This may exacerbate other in- migration resulting from the construction and operation of the Project. The Operator is committed to encourage sustainable use of water points to discourage overgrazing and record issues as part of the grievance mechanism to manage any cumulative impacts.

8.7.1.4 *Off-Site Overhead Transmission Lines*

An ESIA[2] was submitted in August 2017 for the Turkwel – Lokichar – Lodwar 220 kV transmission line project. Residual negative impacts associated with the development include construction noise and dust, management of demolition wastes, oil spills relating to construction plant and vegetation disturbance. Operational impacts may also include mortality of birds through electrocution or direct impacts with OHTL. Section 7.7 (Biodiversity) considers the cumulative impacts of the off-site OHTLs in more detail.

8.7.1.4.1 Potential Cumulative Impacts

Depending on the construction schedule there is a possibility that the OHTLs could be constructed at the same time as Project infrastructure which may result in cumulative impacts relating to dust, noise and biodiversity. Where dust and noise impacts may occur, these will be temporary as they will be confined to the construction phase and cumulative impacts will only occur in the areas of residual impact defined in Sections 8.6.1 and 8.6.2. Where any cumulative impacts occur GIP and Project-specific mitigation measures will be applied. Where cumulative impacts occur regarding biodiversity, the Operator is committed to engage with the OHTL operator to discuss optimal OHTL routing and the incorporation of bird-friendly measures into the OHTL design. The Operator is also committed to the implementation of a mitigation and monitoring plan to assess the effectiveness of any mitigation measures relating to birds. Following adoption of these mitigation measures the cumulative impact significance is anticipated to be no greater than for the Project.

8.7.1.5 *Construction Route Rest Stops*

Rest stops will be required at several locations along the construction materials transport route from Mombasa to the Project. These locations are not yet defined, but they will be existing rest stop locations which will be frequently audited by the Operator. The increased use of existing rest stops could increase the risk of HIV/AIDS and STIs due to the potential increase in availability of sex workers.

8.7.1.5.1 Potential Cumulative Impacts

Cumulative social impacts will be managed and mitigated through the same strict implementation of company policies and strategies described in Section 7.9. These policies will be applicable for the Operator's employees, contractors and sub- contractors and will include but not be limited to the Influx Management Plan, the Operator Code of Ethical Conduct, a Community Health, Safety and Security Management Plan, an HIV Policy and

[2] Environmental and Social Impact Study Report for the proposed Turkwel- Lokichar- Lodwar high voltage transmission line project in Turkana County, Tingori Consultancy Limited, 2017

Programme and a Transport Management Plan. Following these mitigation measures the cumulative impact significance is anticipated to be no greater than for the Project.

8.7.2 Third-Party Projects

8.7.2.1 LAPSSET Corridor Development Project

8.7.2.1.1 Strategic Environmental Assessment (SEA)

The SEA completed for LAPSSET (REPCON Associates, 2017[3]) considered the cumulative impacts of the wider LAPSSET Corridor and identified the following potential impacts as those with the greatest potential to be realised as part of the strategic LAPSSET plan implementation:

- Realignment of land-use along the corridor and beyond;
- Impacts to pastoral and rangeland agriculture and land management;
- Impacts to biodiversity; and
- Impacts to water resources.

Although the project will contribute to all of these impacts in a minor or negligible way, the most significant potential impacts will be realised if any aspects of the LAPSSET corridor (excluding the LLCOP which has already been discussed in Section 8.7.1.1) are constructed concurrently with the Project. Such construction impacts may include:

- Potential decline in air quality through the combined operational vehicle exhaust emissions and emissions to air from vehicles using the LAPSSET corridor roads and railway.
- Noise and vibration impacts associated with heavy construction equipment and traffic noise may have implications on local communities.
- Terrestrial biodiversity impacts during construction include temporary impingement of ecological connectivity and habitat severance.
- Terrestrial biodiversity impacts include relatively minor disturbance and changes to fauna and flora species receptors as a result of increases in vehicular movements, noise and light around the LAPSSET corridor.
- Community health and safety impacts associated with influx of workers including increased risk of HIV/AIDS and STIs.

8.7.2.1.2 Cumulative Impacts

Residual Impacts from the Project (as detailed in Section 8.6) leading to potential cumulative impacts with the LAPSSET project are anticipated during the construction and operational phases. These may include:

- Potential decline in air quality through combined construction dust emissions and air quality related traffic emissions. Where concurrent work is required, the project proponents will work together to identify additional measures and controls to limit the significance and duration of activities;
- Noise impacts from construction: the project proponents will engage to plan construction programmes so any concurrent work in the same location are minimised as far as practicable. Where concurrent work is required then the project proponents will work together to identify additional measures and controls to limit the significance and duration of activities.

[3] Strategic Environmental Assessment-SEA in the LAPSSET Corridor Infrastructure Development Project (LCIDP) – Draft Report, REPCON Associates January 2017 **(LCDA, 2017)**

- Biodiversity impacts during construction - cumulative biodiversity impacts may occur when construction of two or more projects occurs simultaneously in the same area. Where concurrent work is required then the project proponents will work together to identify additional measures and controls to limit the significance and duration of activities.
- Community health and safety and security impacts associated with construction and operational phases - cumulative impacts are anticipated associated with the influx of people and workers relating to both projects. It is proposed that the LLCOP project proponent is engaged to work together to align proposed mitigation measures defined for community health and safety relating to the potential increased risk of HIV/AIDS and STIs and identify if any additional measures and controls are required to limit significance.

8.7.2.2 Tilenga Project

To construct the Tilenga project, construction materials will be moved by road from the port at Mombasa towards Eldoret, then into Uganda. The Tilenga project anticipates a low residual impact for traffic which includes air quality, noise and the increased risk of traffic collisions. Major routes through Kenya were identified as being affected although project related traffic would not be expected to significantly increase the road traffic numbers. A part of the project's mitigation, a road safety and transport management plan will be implemented.

8.7.2.2.1 Cumulative Impacts

Cumulative impacts with the Project may occur along the shared transport route, including the road from Mombasa to Eldoret. Both projects will develop and implement road safety and transport management plans to manage any potential impacts. If these mitigation measures are implemented alongside GIP, the residual cumulative impact significance is anticipated to be no greater than predicted for the Project.

8.7.2.3 Kingfisher Oil Project

To construct the Kingfisher Oil project, construction materials will be moved by road from the port at Mombasa using the P2 and R7 roads in Kenya. Part of the transport route is the same as for the Project. The Kingfisher oil project anticipates a low residual impact for traffic and pedestrian safety on all related routes, not just those in Kenya which are scoped into this assessment. A part of the project's mitigation a road safety and transport management plan will be implemented.

8.7.2.3.1 Cumulative Impacts

Cumulative impacts with the Kingfisher Oil Project may occur along the shared transport route, including the road from Mombasa to Eldoret, as this is a shared route. Both projects will develop and implement mitigation measures and road safety and transport management plans to manage any potential impacts. If these mitigation measures are implemented alongside GIP, the residual cumulative impact significance is anticipated to be no greater than predicted for the Project.

8.8 Summary

Cumulative impacts have been identified for areas where interactions may arise from cumulative impacts of the proposed Project and anticipated future developments. The identified potential cumulative impacts include:

- Local air quality impacts;
- Local noise impacts;
- Local biodiversity impacts;
- Local ecosystem services impacts;
- Local water resource impacts; and

- Local and regional social and community health and safety impacts.

Associated facilities and third-party projects have been identified which have the potential to generate cumulative impacts with the Project. Associated Facilities include LLCOP, make-up water pipeline, water off-take points, OHTL, rest stops associated with the transport and delivery of construction materials to the Site. Third party projects include the LAPSSET Corridor, the Tilenga Project, the Kingfisher Oil Development and the proposed Turkana Mega dams.

Potential cumulative impacts from the Project and associated facilities have been considered for construction dust, noise, biodiversity, ecosystem services, social and health for the construction and/or operational phases. Alongside the mitigation proposed for the Project and GIP, specific commitments to manage cumulative impacts will include the following:

- Engagement with the LLCOP project proponents to plan construction programmes so any concurrent work in the same location are minimised as far as practicable. Where concurrent work is required, the project proponents will engage to plan construction programmes so any concurrent work in the same location (within 250 m of each project) are minimised as far as practicable. Where concurrent work is required, the project proponents will work together to identify additional measures and controls to limit the significance and duration of activities.
- Engagement with the LLCOP project proponent to work together to align proposed mitigation measures defined for community health and safety relating to the potential increased risk of HIV/AIDS and STIs and identify if any additional measures and controls are required to limit significance.
- The Operator will plan the make-up water pipeline construction programme to meet water demands by month 22 of the Project construction. If concurrent construction work is required on the pipeline and the Project, the project proponents will work together to identify additional measures and controls to limit the significance and duration of activities; and
- Engaging with the OHTL contractor to encourage consideration on routing and bird-friendly OHTL design measures.

With the Project mitigation and these additional mitigation measures in place, the residual cumulative impacts are anticipated to be no greater than for the Project alone. Potential cumulative impacts from the Project and the assessed third-party LAPSSET corridor project include construction phase dust, noise, biodiversity and social and health. Alongside the mitigation proposed for the Project and GIP, where concurrent work is required then the project proponents will work together to identify additional measures and controls to limit the significance and duration of activities.

Potential cumulative impacts from the Project and the assessed third-party Tilenga and Kingfisher oil projects include traffic collision risk. All projects will develop and implement road safety and transport management plans to manage any potential impacts. If these mitigation measures are implemented alongside GIP, the residual cumulative impact significance is anticipated to be no greater than for the Project.

It should be noted that there is the potential for other, as yet undefined developments to be present within the Project AoI which could present cumulative impacts. These developments will be required to undertake their own ESIA and CIA to identify cumulative risks, some of which may be associated with the Project.

The mitigation measures described above identify where the Project will seek to coordinate management of the identified environmental and social risks with other developments. Ultimately, the Project will endeavour to engage with other developers concerned as well as with the relevant authorities, in order to work concurrently towards the minimisation of the cumulative impacts identified.

9.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

9.1 Introduction

This Chapter is referred to as the "Environmental and Social Management Plan" or "ESMP" and sets out the key impacts and mitigations from this ESIA in a set of tables. These ESMP tables have been prepared to meet the requirements of the Kenyan Environmental (Impact Assessment and Audit) Regulations (2003)[1].

Every environmental and social commitment set out in the ESMP tables will be implemented via the Operator's Environmental and Social Management System. The principles of the Operator ESMS are set out in Section 9.2.

9.2 Operator Environmental and Social Management System

The Operator will develop its Environmental and Social Management System in line with Kenyan regulatory requirements and the Operator's own environmental and social requirements, including meeting the management system requirements outlined in IFC Performance Standard 1 and ISO 14001.

9.2.1 Environmental and Social Management System Framework

An Environmental and Social Management System Framework will set out the processes and organisation to be adopted and implemented by the Operator so that it can achieve its environmental and social performance requirements. This will include the requirement for developing:

- Specific policies for Environmental Performance, Social Performance, Human Rights and Occupational Health and Safety;
- A Supplemental Assessment that meets the requirements of the IFC Sustainability Framework and Performance Standards; and
- A set of auditable management plans that capture the specific management controls, roles and responsibilities and monitoring requirements for implementation of its environmental and social requirements.

The primary objective is to have a single, consistent and simple approach to the planning and management of environmental and social risks, whilst retaining flexibility to manage specific issues in the most appropriate manner.

9.2.2 Plans and Procedures

The Operator's commitments to its environmental and social performance from this ESIA (and any Supplemental Assessment) will be captured in the documents outlined in Table 9.2-1.

Table 9.2-1: Documents Capturing the Operator's Commitments from this ESIA

Document	Summary of Contents
Environmental Performance Plan	■ This will capture commitments relating to: Air Emissions, Biodiversity, Climate Change, Hazardous Materials, Noise & Vibration, Soil Management, Waste Management, Water Resources. ■ For each section, there will be a summary of key issues, applicable standards, management controls, monitoring requirements and KPIs.

[1] the Kenyan Environmental (Impact Assessment and Audit) Regulations (2003) require development projects to set out "*an environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment; including the time frame and responsibility to implement the measures*".

Document	Summary of Contents
	■ There will also be sections on monitoring compliance with the plan, evaluation and auditing, training, resourcing, roles and responsibilities. ■ The Plan will be prepared to meet the requirements of ISO 14001:2015.
Social Performance Plan	■ This will capture commitments relating to: Community Development, Community Health, Safety and Security, Cultural Heritage, Influx, Infrastructure Routing, Labour and Working Conditions, Employment and Training, Resettlement, Livelihood Restoration, Transport Management (relating to community safety) ■ Mitigation measures relating to Local Content and Resettlement/Livelihoods will be mentioned in the Social Performance Plan but will each have its own standalone plan. ■ For each section, there will be a summary of key issues, applicable standards, management controls, monitoring requirements and KPIs. ■ There will also be sections on monitoring compliance with the plan, evaluation and auditing, training, resourcing, roles and responsibilities. ■ The Plan will be prepared to meet the requirements of ISO 14001: 2015.
Resettlement and Livelihood Restoration Plan	■ The Resettlement and Livelihood Restoration Framework (Annex I) has already been prepared and sets out a roadmap of preparatory activities to be undertaken prior to construction and will feed into stakeholder engagement relating to Project land access. ■ A Resettlement & Livelihood Restoration Plan will be developed following submission of the ESIA and prior to construction. This will provide a record of work and studies done to date and set out the detailed plans, schedule, roles and responsibilities etc. for implementation prior to construction. The Plan will be disclosed in line with national and IFC requirements. ■ Implementation will commence immediately prior to construction, but some early works related to resettlement activities may be required to be undertaken prior to FID to support the construction schedule (to be confirmed).
Stakeholder Engagement Plan (Section 9.3 and Annex II)	■ This Plan has already been prepared, and outlines processes for: informing people of Project activities, schedule, potential impacts, local employment opportunities, community grievance resolution process. ■ The SEP outlines the Operator's approach to stakeholder identification, engagement with various stakeholders and includes an action plan for engagement for ongoing and planned activities. ■ The SEP will be updated prior to construction and will set out how the Operator will engage with stakeholders, including the ongoing management of a grievance procedure, information disclosure and consultation. It also sets out a series of engagement methods and events that are intended to maximise participation and to be appropriate for a given stakeholder group's needs and preferences. The SEP will ensure that the engagement process is credible and transparent and

<table>
<tr><th>Document</th><th>Summary of Contents</th></tr>
<tr><td></td><td>maintains simplicity in information comprehension, is as accessible as practically possible and maintains accuracy of information.
■ The SEP includes a section providing a detailed description of procedures for the resolution of complaints and grievances.</td></tr>
<tr><td>Emergency Preparedness and Response Plan</td><td>■ This Plan will include:
▪ Procedures on how to identify and respond to potential emergency situations, potential failure of risk controls and potential for incidents that would have health and safety implications for workers and/or the community and environmental implications;
▪ Provision for emergency arrangements with contractors and collaboration with other appropriate and relevant third parties;
▪ Provision of equipment and resources and designation of responsibilities; and
▪ A process for review and revision as necessary to reflect changing conditions.</td></tr>
<tr><td colspan="2">Supporting plans and procedures will be prepared as follows:
■ Code of Conduct;
■ Worker Complaints and Grievance Procedure (separate to the community grievance and resolution process set out in the SEP);
■ Stakeholder Engagement Plan (Section 9.3 and Annex II)
■ Worker Health and Safety Plan which will set out the Occupational Health and Safety Management System requirements, prepared to meet the requirements of ISO 45001:2018.
■ National Content Plan (as part of the Field Development Plan;)
■ Local Content Development Plan (as part of the Field Development Plan);
■ Contractor Management Procedure (Section 9.2.3);
■ Procurement Procedure (to ensure that procurement of equipment, materials, chemicals and services (including labour) meet the Operator’s environmental and social requirements; and
■ Environmental Incident Reporting Procedure (All non-conformances, incidents and near misses must be investigated to a level commensurate with the potential risk or outcome, to include lessons learnt and improvement recommendations).</td></tr>
</table>

9.2.3 Contractor Management

As part of the engineering, procurement and construction (EPC) tendering process, potential contractors will need to demonstrate understanding, resourcing and scheduling to meet the requirements set out in the Operator’s Environmental and Social Management System. The Operator will assess environmental and social risks for each contract.

Prior to construction, the EPC Contractor will develop its systems and plans for implementing the Operator's environmental and social requirements. The Operator will assure that the EPC Contractor's systems and plans meet the requirements of the Operator's Environmental and Social Management System.

During construction, the EPC Contractor is responsible for implementing the Operator's environmental and social requirements which will be set out in the EPC Contractor's systems and plans. The EPC Contractor's responsibilities include communicating these requirements to subcontractors and monitoring their performance to assure implementation. Throughout construction, all contractors are required to provide workers and subcontractors with the means to ensure compliance with the requirements of the Operator's Environmental and Social Management System.

Whilst the EPC Contractor will implement the majority of the Operator's environmental and social requirements during construction (a contracted requirement), as "owner", the Operator will assure that the EPC Contractor has implemented its requirements, and appropriate resourcing will be provided to do this.

9.2.4 Budgets for ESIA Mitigation and ESMP Implementation

Budgetary provisions for the implementation of ESIA mitigations and the Environmental and Social Management Plan tables set out below will be developed as part of the EPC process and will be agreed with the Operator and will be available for review by NEMA.

In support of this ESIA, the following indicative budgets have been prepared and will be revised and updated as part of the EPC process.

Table 9.2-2 Summary of ESMP Indictive Annual Budgets by Project Phase

Project Phase	ESMP Budget Item	Indicative Annual Budget ($)
Construction	Environmental Monitoring (including implementation of ISO 14001)	1,500,000
	Social Performance	2,000,000
	Emergency Response	500,000
	Waste Management	250,000
	Training	350,000
	Construction Total	4,600,000
Operations (Mitigations only, operating costs excluded)	Environmental Monitoring (including implementation of ISO 14001)	750,000
	Social Performance	1,500,000
	Emergency Response	200,000
	Waste Management	200,000
	Training	150,000
	Operations Total	2,800,000
Decommissioning	See Section 9.4 for details of the Project decommissioning framework	

9.3 Environmental & Social Management Plan Tables

The “ESMP tables” below bring together the mitigations set out in the impact assessment sections of this ESIA into a set of auditable management controls. These commitments will be captured within the Operator ESMS, as described above in Section 9.2.

The following topics are addressed:

- Air quality;
- Noise and vibration;
- Water quantity;
- Water quality;
- Soils, terrain, geology and seismicity;
- Landscape and visual;
- Biodiversity, ecology and protected areas
- Ecosystem services;
- Social;
- Cultural heritage;
- Emergency, accidental and non-routine events (including oil spill management); and
- Cumulative impacts.

The ESMP tables follow the same format as the individual tables in the main body of the ESIA report:

- An identification number and topic are outlined in the first two columns;
- The third column summarises the impact as it is identified in the ESIA;
- The fourth column sets out the mitigations to minimise the impact, as defined in the ESIA; and
- The final two columns set out responsibilities and a means of verification which would demonstrate that the mitigations have been implemented.

The tables cover construction (including pre-construction) and operational phases. Following the tables is a section summarising the general approach to decommissioning. This will require further future development by the Operator and as a result, an over-arching plan and framework is set out describing how the Operator will address this issue.

Where mitigation measures are repeated for different receptors, they are stated as a numbered “Repeated mitigation” in the initial instance and referred back to thereafter.

Table 9.3-1: Air Quality

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
AQ-01	Air Quality	Dust from the construction of Project related infrastructure on PAP and transient receptors located within the RoW and 250 m in any direction of construction.	Construction	Local stakeholders to be informed of the construction activity dates. Daily visual dust monitoring will be undertaken. If high levels of dust are observed causing a nuisance to local receptors any appropriate changes to working practices (e.g. dust barriers or netting) will be undertaken to limit the dispersion of dust. Signage will be put in place to inform people where, when and for how long temporary dust generating works are taking place. Dust trackout and dispersal will be managed via: - Project speed limits to be established and complied with by all Project vehicles; - Night-time driving will be prohibited unless specifically authorised; and - Off-road driving will be prohibited.	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of appropriate communication of construction schedule/ duration with PAP prior to commencement of construction, along with any subsequent material changes to schedule. Grievance register logging any complaints received relating to dust, including a record of the investigation and/or remedial actions taken as a result of the complaints. Record of routine dust monitoring including any remedial actions. Evidence of establishment of Project speed limits and prohibition of night-time and off-road driving. Evidence of erection of signage prior to commencement of operation.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				As part of the development of borrow pits: ■ A pre-construction survey will identify and map receptors within 500 m of proposed borrow pit locations. These receptors will be considered as part of site selection and risk assessment processes. ■ NEMA, DCCs and relevant local stakeholders will be engaged to inform and consult on assets which could be affected by deposited dust during the development and operation of borrow pits. Grievances will be monitored and remediated through the Grievance Management Procedure. Any complaints will be investigated and followed up.		Evidence of pre-construction surveys for borrow pits to identify potential receptors to dust impacts. Evidence of consideration of any identified receptors in risk assessments. Records of engagement with local stakeholders regarding the construction activity dates
AQ-02	Air Quality	Emissions of $PM_{2.5}$ for 24-hour averaging period on PAP and transient receptors within a medium impact area identified in the ESIA.	Operation	Further air dispersion modelling will be carried out during the detailed design process. The fenceline will then incorporate any areas where the Process Contribution (emissions from the Project) is predicted to exceed 25% of the air quality	The Operator	Evidence of air dispersion modelling during detailed design process and any revisions to CFA fenceline.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				standards to ensure that public access will be restricted.		
AQ-03	Air Quality	Changes in odour levels associated with wellpad operations on PAP and transient receptors located downwind of wellpads	Operation	Daily odour 'sniff' monitoring around the perimeter of the wellpads will be undertaken. Additional monitoring will also be undertaken in response to any complaints. The monitoring will include the following: ▪ Date, time, and locations of monitoring; ▪ Weather conditions; ▪ Intensity and description of the odour including duration e.g. constant or intermittent; ▪ Odour source, if identified including location and activity; ▪ Any remedial odour control measures which are implemented; and ▪ A record will be kept of all routine monitoring. Records of monitoring in response to complaints will be undertaken	The Operator	Evidence of routine odour monitoring including any remedial actions. Grievance register logging any complaints received relating to odour, including a record of the investigation and/or remedial actions taken.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				including any investigative and remedial actions.		

Table 9.3-2: Noise and Vibration

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification

NV-01	Noise	Noise from construction of Project components on PAP within the areas of predicted high and medium magnitude identified in the ESIA.	Construction	At locations where construction noise will temporarily exceed statutory limits, NEMA will be notified.
				
				Implement an information campaign to inform local stakeholders where, when and for how long temporary noise generating works are taking place and describe any measures adopted to minimise exposure such as limited work hours and phasing of work to limit the impact of noise.
				
				As a minimum the following needs to be communicated:
				▪ Within 0 to 75 m from the perimeter of the following, noise levels may lead to hearing impairment if exposure occurs for a 24-hour period according to the WHO Guidelines for Community Noise, 1999.
				  ▪ The wellpads;
				  ▪ The infield flowlines RoW;
				  ▪ The CFA; and
				  ▪ The landfill.
					The EPC Contractor is responsible for implementation of mitigation.
					
					The Operator is responsible for assuring implementation of mitigation.
						Evidence of appropriate communication with PAP of construction schedule/ duration, impacts and demarcated areas prior to commencement of construction, along with any subsequent material changes.
						
						Evidence of 24-hour noise monitoring undertaken for the first construction activities in an area including findings and any remedial actions.
						
						Evidence of demarcated areas on EPC Contractor mapping.
						
						Evidence of erection of signage prior to commencement of construction.
						
						Evidence of routine visual monitoring in demarcated areas, including findings and any remedial actions.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				In the area directly outside this perimeter, noise will change due to the Project up to that similar to an elevated conversation at 1 m but should not lead to any hearing impairment through sustained exposure. These areas (which are located within the gazetted areas) will be demarcated as areas to be avoided. Local stakeholders will be informed of the demarcated areas and signage will be installed to inform people not to remain in the area for periods greater than 24 hours during construction. There will be weekly visual monitoring of any homestead structures which are developed within the demarcated areas. If homestead structures are observed, the Operator will work with local chiefs and DCCs to assist with the movement of the structures and people to outside of the demarcated areas. Monitoring over a 24-hour period will be undertaken 75 m from the perimeter of the first construction works in an area e.g. wellpads, CFA,		Grievance register logging any complaints received relating to noise, including a record of the investigation and/or remedial actions taken.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				flowlines, landfill, etc, using an appropriately calibrated and maintained Class 1 Sound Level Meter. Monitoring will be carried out by trained personnel to confirm noise levels are within the Project Standard (Kenyan Construction Nosie Guidelines) and to confirm and inform the demarcation distances for future construction tranches. There will be an investigation into potential additional monitoring and a review of further controls of receptor movement within the area 0 to 75 m from the perimeter subject to monitoring results. Grievances and improvements will be monitored. Any complaints will be investigated and followed up to ensure a form of remediation (e.g., improved engagement, sound barriers or equipment maintenance) is in place to prevent recurrence.		
NV-02	Noise	Noise from wellpad drilling on permanent and transient human receptors within the areas of predicted high and medium magnitude identified in the ESIA.	Construction	A detailed information campaign will inform local stakeholders of the drilling schedule and where, when and for how long temporary noise generating works are taking place. Any measures adopted to minimise exposure such as limited work hours and phasing of work to limit the impact of noise will be discussed.	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for	Evidence of appropriate communication with PAP of construction schedule/ duration and impacts prior to commencement of well drilling, along with any subsequent material changes.

				The following will also be communicated: ■ In the area surrounding the wellpad fence-line (during drilling) noise will change due to the Project to levels similar to a normal conversation at 1 m distance (or quieter) but should not lead to any hearing impairment through sustained exposure. Monitoring over a 24-hour period will be undertaken at the wellpad fenceline during the first drilling works, using an appropriately calibrated and maintained Class 1 Sound Level Meter. Monitoring will be carried out by trained personnel to confirm noise levels are within the Project Standard (Kenyan Construction Nosie Guidelines). A procedure will be prepared to define the actions to be taken and the timeframes in which those actions will be taken should exceedances of ambient noise guidelines be observed, e.g. review and maintenance of noise source equipment, review of noise	assuring implementation of mitigation.	Evidence of 24-hour noise monitoring undertaken at the wellpad fenceline including any remedial actions. Evidence of additional noise modelling if concurrent drilling at adjacent wellpads is required.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				abatement measures and implementation of demarcation areas. If during detailed design it is determined that concurrent drilling at adjacent wellpads is required, or other acoustically significant factors change, additional noise modelling will be completed and the proposed mitigation review and amended, as required.		
NV-03	Noise	CFA operations on transient human receptors.	Operation	A detailed information campaign will inform local stakeholders of the following information: - In the area surrounding the CFA, wellpads and landfill, noise will change due to the Project up to levels similar to a normal conversation at 1 m distance (or quieter) but should not lead to any hearing impairment through sustained exposure;	The Operator	Evidence of appropriate communication with PAP, informing them of predicted changes to the noise baseline, prior to commencement of operations. Evidence of 24-hour noise monitoring including any remedial actions.
NV-04	Noise	Noise from wellpads in Amosing or Twiga with jump-over lines (AM-01, NG-20, NG-23, EM-03, ET-09, TW-07, AG-03, EK-07) on transient human receptors within the impacted zone identified in the ESIA.				
NV-05	Noise	Noise from wellpads in Amosing or Twiga without jump-over lines on transient human receptors within the impacted zone identified in the ESIA.				

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
NV-06	Noise	Noise from landfill operations on transient human receptors.		On a quarterly basis, and in response to noise complaints, 24-hour duration noise monitoring will be undertaken at the medium magnitude contour line defined in the ESIA, using an appropriately calibrated and maintained Class 1 Sound Level Meter. Monitoring will be carried out by trained personnel to confirm noise levels are within the Project Standard (WBG EHS Guidelines). A procedure will be prepared to define the actions to be taken and the timeframes in which those actions will be taken e.g. review and maintenance of noise source equipment and review of noise abatement measures, should exceedances of the Project Standard (WBG EHS Guidelines) be observed.		

Table 9.3-3: Water Quantity

ID	Topic/Aspect	Source of Impact	Project Phase	Mitigation	Responsibility	Means of Verification
WQT-01	Water Quantity	Abstraction of groundwater for initial construction water requirements, leading to a reduction in baseflow due to lowered groundwater levels, impacting the Kalabata River within the area of influence of abstraction wells used for construction water, where critical habitat may be triggered.	Construction	Construction-phase water demand will be minimised as part of the detailed design process. **Repeated Mitigation – Water Quantity 01 - Further Hydrogeological Investigation:** A hydraulic testing plan will be prepared and a further hydrogeological investigation undertaken to evaluate existing data for community and project abstraction wells within the potentially affected area prior to commencement of construction-phase water abstraction, to understand if, and to what degree, hydraulic connectivity exists between the hydrogeological units used for Project water supply and the shallow aquifers used for community water supply. The hydrogeological investigation will include the following: ▪ Pump testing in abstraction wells which have not been previously tested (Ngamia East, Nakukulas 9, Nakukulas 10). Testing will comprise both constant rate tests and step-	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of hydraulic testing plan. Evidence of hydrogeological investigation including pump tests and water quality monitoring data. Evidence of the installation of new groundwater monitoring wells. Evidence of reporting (public disclosure) of routine water level monitoring. Evidence showing definition of groundwater action levels and subsequent groundwater monitoring. Evidence of implementation of appropriate management controls if monitoring indicates action levels have been surpassed.

ID	Topic/Aspect	Source of Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				tests. Step tests should include a minimum of four steps, with each step lasting a least 100 minutes. ▪ Pump testing will be undertaken towards the end of a dry season and in accordance with the International Standard for Hydrometric Determinations – Pumping Tests for Water Wells (BSI, 2006). ▪ Full-scale constant rate pump tests (at 100% of abstraction volume) will be undertaken at Ngamia East, Nakukulas 9, Nakukulas 10, Kengomo 1 and Kengomo 2. Each well will be tested individually for a 24-hour period, and all wells will be tested in combination for a minimum of a 72-hour period. ▪ During pump testing, water quality (pH, temperature, EC, major ions, bacteria) will be monitored on a 12-hour basis to indicate any change which		Evidence demonstrating development of a conceptual hydrogeological model for the section of the Kalabata catchment where the potential for groundwater draw-down impacts have been identified in the ESIA; and review of hydrogeological connectivity. Evidence of biodiversity survey in the Kalabata catchment for Turkana toad and previously undescribed beetle. Evidence that the results of the survey have been used to review critical habitat mapping and associated monitoring requirements.

ID	Topic/Aspect	Source of Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				may be related to hydraulic stresses induced by pumping. Abstracted water will be discharged down-gradient of the abstraction point. **Repeated Mitigation – Water Quantity 02 - Groundwater Level Monitoring:** Prior to construction, a network of shallow groundwater monitoring wells will be installed to continuously monitor water levels. In addition to existing monitoring locations, water levels will be monitored in at least two monitoring boreholes within the identified potential radius of influence of each construction-phase abstraction well. Where no suitable existing well exists, new monitoring boreholes will be installed. Monitoring boreholes will be spaced at different distances from the abstraction well to allow characterisation of the cone of depression. Water levels will be monitored throughout construction and for a period of at least 12 months after the later of i) water levels rising above the action level and ii) the cessation of groundwater abstraction for		

ID	Topic/Aspect	Source of Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				construction water supply by the Project. Water level data will be disclosed publicly. **Repeated Mitigation – Water Quantity 03 - Conceptual Model and Trigger Levels:** A conceptual hydrogeological model for the section of the Kalabata catchment where the potential for groundwater draw-down impacts have been identified in the ESIA will be developed. Prior to construction, data will be evaluated to identify any evidence of hydraulic connectivity (draw-down and/or changes in water chemistry) between shallow aquifers used for community water supply and deep aquifers used for the supply of construction activities. Monitoring data and data from the hydrogeological investigations will be used to revise the conceptual hydrogeological model. Water levels will be defined (including consideration for natural seasonal fluctuations), below which detailed monitoring will be undertaken on a weekly basis to		

ID	Topic/Aspect	Source of Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				determine if water levels have reduced sufficiently to threaten continuity of supply (action level). Action levels will be determined to ensure that alternative water supplies would be provided prior to the supply of shallow water resources being affected. The objective is to ensure continuity of supply for local water users within the potentially affected area of the Kalabata catchment. **Repeated Mitigation – Water Quantity 04 - Biological Monitoring:** ■ In parallel with groundwater monitoring, an additional biodiversity survey within the potentially affected area of the Kalabata catchment, will be undertaken (at least one June survey before construction) to identify the presence (or otherwise) of the Turkana toad and previously undescribed beetle. Based on that data, critical habitat mapping will be revised, future biological monitoring will be evaluated, and sensitivities related to		

ID	Topic/Aspect	Source of Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				groundwater levels will be evaluated and included in consideration of action levels and associated water supply mitigations including alternative solutions .e.g. water bowser to avoid long term stress of potential critical habitat, e.g., targeted irrigation during the impacted period. Construction-phase water demand will be minimised as part of the FEED process. Continuity of water supply will be assured to any water users affected by the abstraction of groundwater during the construction phase, and for the duration of the effect. An abstraction strategy will be implemented to minimise the effect on sensitive natural receptors (i.e. critical habitat) and water users by prioritising the wells used to provide construction water supply.		

ID	Topic/Aspect	Source of Impact	Project Phase	Mitigation	Responsibility	Means of Verification
WQT-02	Water Quantity	Abstraction of groundwater for initial construction water requirements, lowering groundwater levels below a level accessible by hand dug well and impacting water users of the shallow hand dug wells in the dry riverbeds.	Construction	**Repeated Mitigation – Water Quantity 01 - Further Hydrogeological Investigation.** **Repeated Mitigation – Water Quantity 02 - Groundwater Level Monitoring.** **Repeated Mitigation – Water Quantity 03 - Conceptual Model and Trigger Levels.** **Repeated Mitigation – Water Quantity 05 – Monitoring Shallow Groundwater Used by Humans:** Further hydrocensuses to establish hand dug well water users in areas predicted as impacted. Manual measurements at hand-dug wells within the radii of influence of each construction-phase abstraction well. A monthly photolog of the hand-dug wells used for monitoring will also be prepared. If water levels do fall below the action level (Repeated Mitigation – Water Quantity 03 - Conceptual model and trigger levels), the Operator will then implement its contingency water supply plans to provide alternative water supplies	EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of hydraulic testing plan. Evidence of hydrogeological investigation including pump tests and water quality monitoring data. Evidence of the installation of new groundwater monitoring wells. Evidence of reporting (public disclosure) of routine water level monitoring. Evidence showing definition of groundwater action levels and subsequent groundwater monitoring. Evidence of implementation of appropriate management controls if monitoring indicates action levels have been surpassed. Evidence demonstrating development of a conceptual

ID	Topic/Aspect	Source of Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				for human water users for the duration of the impact. Detailed procedures will be defined for communicating to existing local water users within the predicted impacted area to identify alternative sources of water e.g., bowser from Turkwel Gorge Reservoir, or from alternative water supply points and to help PAP understand that hand dug wells in luggas in the zones identified may not be able to be used during the period of the impact and alternative supplies may be needed.		hydrogeological model for the section of the Kalabata catchment where the potential for groundwater draw-down impacts have been identified in the ESIA; and review of hydrogeological connectivity. Evidence of completion of a hydrocensus. Evidence of hand-dug well water level monitoring data and monthly photo log. Evidence of communication to existing water users of the location and availability of alternative water supplies.
WQT-03	Water Quantity	Abstraction of groundwater for initial construction water requirements, leading to a reduction in baseflow due to lowered groundwater levels, impacting discharges at seasonal rivers/streams and drainage luggas, and groundwater levels in deep aquifers within the area of	Construction	Construction-phase water demand will be minimised as part of the detailed design process. **Repeated Mitigation – Water Quantity 01 - Further Hydrogeological Investigation.**	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring	Evidence of hydraulic testing plan. Evidence of hydrogeological investigation including pump tests and water quality monitoring data.
WQT-04	Water Quantity					

ID	Topic/Aspect	Source of Impact	Project Phase	Mitigation	Responsibility	Means of Verification
		influence of the abstraction wells used for construction.		**Repeated Mitigation – Water Quantity 02 - Groundwater Level Monitoring.** **Repeated Mitigation – Water Quantity 03- Conceptual model and trigger levels.** **Repeated Mitigation – Water Quantity 04 - Biological Monitoring.** Continuity of water supply to water users affected by the abstraction of groundwater during the construction phase will be ensured, for the duration of the effect. An abstraction strategy will be implemented to minimise the effect on sensitive natural receptors (i.e. critical habitat) and water users by prioritising the wells used to provide construction water supply. Detailed procedures will be defined for communicating to existing local water users within the predicted impacted area to identify alternative sources of water e.g., bowser from Turkwel Gorge Reservoir, or from alternative water supply points and to help PAP understand that hand dug wells in luggas in the zones identified may not be able to be used	implementation of mitigation.	Evidence of the installation of new groundwater monitoring wells. Evidence of reporting (public disclosure) of routine water level monitoring. Evidence showing definition of groundwater action levels and subsequent groundwater monitoring. Evidence of implementation of appropriate management controls if monitoring indicates action levels have been surpassed. Evidence demonstrating development of a conceptual hydrogeological model for the section of the Kalabata catchment where the potential for groundwater draw-down impacts have been identified in the ESIA; and review of

ID	Topic/Aspect	Source of Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				during the period of the impact and alternative supplies may be needed.		hydrogeological connectivity. Evidence of biodiversity survey in the Kalabata catchment for Turkana toad and previously undescribed beetle. Evidence that the results of the survey have been used to review critical habitat mapping and associated monitoring requirements. Evidence of communication to existing water users of the location and availability of alternative water supplies.
WQT-05	Water Quantity	Unplanned, discharges from hydrotest water and other construction activities, impacting seasonal rivers/streams and drainage luggas throughout the project affected area.	Construction	Procedures will be prepared for abstraction, use, storage, and disposal of water used during hydrotest of pipelines and describing how water reuse will be maximised. Where possible, evaporation from fenced, lined ponds will be used to dispose of hydrotest water. Any evaporite remaining will be	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of hydrotest water disposal (including evaporite). Evidence of correspondence with NEMA relating to any disposal methods into the environment, and evidence of permitting and compliance with permit requirements.

ID	Topic/Aspect	Source of Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				packaged up with the liner and disposed of. Should disposal of hydrotest water to the environment be required and evaporation is not a feasible option, the disposal location and method of disposal will be in line with Kenya legislation and details of permitting agreed with the Kenya regulator, and criteria for water quality monitoring of discharge will meet permitting requirements.		
WQT-06	Water Quantity	Construction activities for infrastructure development near or within seasonal rivers/ streams and drainage luggas.	Construction	Procedures will be prepared to prevent changes to flow regimes in watercourses due to construction activities. Pre-construction surveys will be completed to identify potential locations where construction activities could have an impact on lugga drainage patterns. In identified areas, drainage channels and ditches will be designed to limit changes to natural flow ranges and reduce the potential for flood risk. Temporary erosion control measures will be installed in such a way that regulates flow in line with natural variation.	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of pre-construction surveys for potential for change to lugga drainage patterns. Evidence of dynamic risk assessments undertaken for rivers/ streams and drainage lugga crossings. Evidence of channel morphology monitoring, including any remedial or maintenance actions.
WQT-07	Water Quantity	Construction activities for flow line development near or within seasonal rivers/ streams and drainage luggas.				

ID	Topic/Aspect	Source of Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				Work on ephemeral rivers, smaller streams/luggas will be planned to take place during the dry seasons when no flow is anticipated. If unavoidable, flow will be diverted and redirected into same watercourse further downstream. A dynamic risk assessment (completed within a reasonable period before works commence and updated regularly) will be completed on an individual case basis. The amount of time trenches or other excavations will be open will be minimised. Where the lugga will be lost due to the presence of Project infrastructure within the watercourse, a suitable permanent diversion will be put in place to redirect water further downstream in the same watercourse, or to another watercourse in the same catchment. Monitoring (channel morphology) will be completed throughout construction and one year after construction with further inspections following any extreme rainfall/flood events (1 in 30-year return period flows). This will confirm whether sediment transport and erosion		

ID	Topic/Aspect	Source of Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				patterns have not been adversely altered. Maintenance activities and actions for management if there are issues will be outlined.		
WQT-08	Water Quantity	Construction activities near or within watercourses relating to infrastructure development and flowline development, leading to a reduction in recharge in shallow groundwater receiving recharge from surface water.	Construction	Where the lugga will be lost due to the presence of Project infrastructure within the watercourse, a suitable permanent diversion will be put in place to redirect water further downstream in the same watercourse, or to another watercourse in the same catchment. **Repeated Mitigation – Water Quantity 05 – Monitoring Shallow Groundwater Used by Humans.**	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of the assessment of suitable permanent watercourse diversion. Evidence of completion of a hydrocensus. Evidence of hand-dug well water level monitoring data and monthly photo log. Evidence of communication to existing water users of the location and availability of alternative water supplies.
WQT-09	Water Quantity	Construction activities near or within watercourses relating to infrastructure development and flowline development, impacting water users of shallow hand dug wells in the dry riverbeds downstream of infrastructure.				
WQT-10	Water Quantity	Abstraction of water from Turkwel Gorge Reservoir for make-up water requirements during the latter stages of the construction phase.	Construction	Procedures will be prepared to describe abstraction volume monitoring, reservoir levels and actions to maintain security of supply throughout the abstraction period. Prior to construction, continuous monitoring of water levels in the Turkwel Gorge Reservoir will be	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring	Evidence of abstraction volume monitoring. Evidence of evaluation of action required in event of unprecedented changes in reservoir level. Evidence of generation of water balance model and

ID	Topic/Aspect	Source of Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				established in coordination with KVDA. Water levels will be monitored throughout the abstraction period during construction and for a period of at least 12 months after the cessation of abstraction for water supply from the reservoir by the Project. Water level data will be disclosed publicly. **Repeated Mitigation – Water Quantity 06 - Predictive Water Balance for Turkwel Gorge Reservoir and Triggers:** A predictive water balance model for the Turkwel Gorge Reservoir will be prepared, calibrated to historic data and using best predictions of inputs and outputs to the water balance for the entire abstraction period of the project. Climatic inputs will be adjusted to predict inputs throughout the abstraction period for RCP 8.5 ('business as usual' scenario with continued high GHG emissions and an absence of climate change policies)[2] and one other less conservative scenario to provide a range of climate change predictions on which to define the	implementation of mitigation.	setting of action levels and contingencies (with KVDA). Evidence of public disclosure of water level data. Evidence of predictive water balance model for the Turkwel Gorge Reservoir. Evidence of correspondence with KVDA to set and agree Turkwel Gorge Reservoir action levels and contingencies. Evidence of contingency water supply plans.

[2] IPCC, 2014: Climate Change 2014: Synthesis Report.

ID	Topic/Aspect	Source of Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				water levels (including consideration for natural seasonal fluctuations) below which abstraction will become unsustainable (given other water users and electricity generation requirements) or affect security of water supply for the Project (action level). Action levels and appropriate contingencies will be established in coordination with KVDA. Action levels will describe the action to be taken if the water level in the reservoir falls below a specific level, when contingency water supply plans for the Project will be implemented.		
WQT-11	Water Quantity	Flood Risk on human residences downstream of infrastructure.	Construction	Works in periods of extreme rainfall will be minimised, to limit the impact on flood risk. Temporary erosion control measures will be installed prior to earth-moving activities, and be maintained throughout construction activities, to attenuate flood flows up maintain the natural runoff regime for events up to 1 in 30-year return period. Following any extreme rainfall/flood events (greater than 1 in 30-year	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of inspection of erosion control measures and any remedial actions. Evidence of channel morphology monitoring, including any remedial or maintenance actions. Evidence of assessment of suitable permanent watercourse diversion.

ID	Topic/Aspect	Source of Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				return period rainfall) all erosion control measures will be inspected and, if required, reinstated as soon as practicably possible after an event. Monitoring (channel morphology) will be completed throughout construction and one year after construction with further inspections following any extreme rainfall/flood events (1 in 30-year return period flows). This will confirm whether flood flow conveyance have not been adversely altered. Maintenance activities and actions for management if there are issues will be outlined. Where the lugga will be lost due to the presence of Project infrastructure within the watercourse, a suitable e.g. (constructed to convey up to 100-year return period flows) permanent diversion will be put in place to redirect water further downstream in the same watercourse, or to another watercourse in the same catchment.		
WQT-12	Water Quantity	Continued abstraction from Turkwel Gorge Reservoir for	Operation	Procedures will be prepared to describe abstraction volume monitoring, reservoir levels and actions to maintain security of	The Operator	Evidence of abstraction volume monitoring. Evidence of evaluation of

ID	Topic/Aspect	Source of Impact	Project Phase	Mitigation	Responsibility	Means of Verification
		make-up water requirements – including climate change.		supply throughout the abstraction period. Continuous monitoring of water levels in the Turkwel Gorge Reservoir will be maintained throughout operations in coordination with KVDA. Water levels will be monitored throughout the abstraction period and for a period of at least 12 months after the cessation of abstraction for water supply from the reservoir by the Project. Water level data will be disclosed publicly. **Repeated Mitigation – Water Quantity 06 -_Predictive Water Balance for Turkwel Gorge Reservoir and Triggers.** The water balance model will be reviewed on a yearly basis and update adaptive management procedures for abstraction management including consideration of climate change predictions, in coordination with KVDA.		action required in event of unprecedented changes in reservoir level. Evidence of generation of water balance model and setting of action levels and contingencies (with KVDA). Evidence of public disclosure of water level data. Evidence of annual review of water balance model. Evidence of predictive water balance model for the Turkwel Gorge Reservoir. Evidence of correspondence with KVDA to set and agree Turkwel Gorge Reservoir action levels and contingencies. Evidence of contingency water supply plans.

Table 9.3-4: Water Quality

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
WQL-01	Water Quality	Construction activities for project infrastructure, including wellpads and CFA, located within catchment of the Kalabata River. Impacts include ground disturbance, construction, contamination due to storage and use of hazardous or non-hazardous substances, leaching from backfill materials and/or concrete batching.	Construction	Soil erosion management controls will be prepared to prevent increases in sediment transport towards the Kalabata during construction and to monitor water quality throughout construction. **Repeated Mitigation – Water Quality 01 – Erosion Control:** Works in, or within watercourses shall not take place without consent from NEMA (as per the EMCA (Water Quality) Regulations, 2006). Works planned during periods of extreme rainfall and rainy seasons will be managed, as far is it is practicable, to limit the generation and mobilisation of suspended solids into the water environment and to manage safety of workers. Temporary erosion control measures will be installed prior to earth-moving activities, to limit the likelihood of sediment mobilisation to the water environment. Suspended solid management	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of regular auditing of construction practices to confirm they are in accordance with prescribed erosion control measures. Evidence of installation of erosion control measures. Evidence of monthly groundwater quality monitoring, and actions taken should any trigger values be exceeded.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				techniques will be used. The procedures being followed will be audited and monitored throughout construction. The amount of time the trenches will be open will be minimised, reducing the time per location when excavated soils are exposed to limit the likelihood of sediment mobilisation to the water environment. Any materials, which could lead to contamination, placed in trenches by third parties or otherwise, will be removed before trenches are backfilled to remove potential sources of contamination. Construction activities in seasonal rivers and smaller streams/luggas will be scheduled for dry season periods or when no flow is anticipated. Any cleared areas within the footprint where topsoil is salvageable, measures will be taken to store topsoil and maintain the existing seed bed. If additional re-seeding is required during		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				rehabilitation, it will be seeded/replanted with locally sourced seed/plants of suitable species. Topsoil management will allow reestablishment/re-generation of vegetation on bare areas and limit the erosion potential. **Repeated Mitigation – Water Quality 02 – Triggers and Actions:** Procedures will be prepared to: ■ Define trigger values for action should they be exceeded. Trigger values for all parameters will be set as no less stringent than an exceedance of 20% beyond the range of normalised concentrations observed during the baseline at the closest baseline monitoring location, or the Kenyan water quality standard (whichever is the most conservative); and ■ Actions will be set out to identify the construction		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				activities leading to the source of any exceedances, and subsequent improvements to erosion control and environmental protection will be set out should trigger values be exceeded. **Repeated Mitigation – Water Quality 03– Groundwater Quality Monitoring:** All monitoring locations will be established (boreholes drilled, installed and verified) prior to construction. Monitoring will be completed throughout construction and one year after construction on a monthly basis, with further inspections following any extreme rainfall/flood events (greater than 1 in 30-year return period rainfall) Groundwater monitoring will comprise as a minimum: - Monthly groundwater sampling and laboratory analysis (by an ISO accredited lab) plus in-situ field analysis. Laboratory analysis will		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				include all parameters reported in the baseline including major ions, nutrients, organics and oils, polyaromatic hydrocarbons, inorganics and bacteriological (full suite in Annex I). In-situ field analysis will be completed for pH, Temperature, Dissolved Oxygen, Electrical Conductivity, Turbidity. Monthly groundwater quality data will be gathered at two shallow groundwater monitoring locations sited downgradient of all infrastructure in construction, including wellpad locations, waste facilities and CFA located along the downgradient groundwater contours identified in the baseline (Figure 6.8-11); and ■ If surface water is present during monthly groundwater sampling rounds, *ad hoc* surface water sampling will		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				occur at the sampling locations (including hand dug wells) used in the baseline downgradient of the wellpad locations, waste facilities and CFA. Laboratory analysis (by an ISO accredited lab) will include all parameters reported in the baseline including major ions, nutrients, organics and oils, polyaromatic hydrocarbons, inorganics and bacteriological (full suite in Annex I). In-situ field analysis will be completed for pH, Temperature, Dissolved Oxygen, Electrical Conductivity, and Turbidity.		
WQL-02	Water Quality	Discharges/ releases from waste storage and disposal activities and facilities to the Kalabata River.	Construction	Procedures will be prepared to avoid disturbance of and release of contaminants from any existing waste storage. **Repeated Mitigation – Water Quality 02 – Triggers and Actions.**	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring	Evidence of monthly groundwater quality monitoring, and actions taken should any trigger values be exceeded.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				Repeated Mitigation – Water Quality 03 – Groundwater Quality Monitoring.	implementation of mitigation.	
WQL-03	Water Quality	Water Discharges from hydrotest water leading to change in water quality in the Kalabata River.	Construction	**Repeated Mitigation - Water Quality 04 – Hydrotest Discharge Management:** ▪ The need for chemicals in hydrotest water will be minimised, by reviewing hydrotest water requirements considering chemical effectiveness and stability, toxicity, compatibility with other additives used and reactivity towards other materials and compounds used. ▪ Procedures will be prepared relating to abstraction, use, storage, and disposal of water used during hydrotest of pipelines and how water reuse will be maximised. ▪ Where possible, evaporation from fenced, lined ponds will be used to dispose of hydrotest water. Any evaporite remaining will be	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence demonstrating review of hydrotest water requirements. Evidence of correspondence with NEMA relating to any disposal methods into the environment, and evidence of permitting and compliance with permit requirements.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				packaged up with the liner and disposed of. ■ Should disposal of hydrotest water to the environment be required and evaporation is not possible. The disposal location and method of disposal will be in line with Kenya legislation and details of permitting agreed with the Kenya regulator, and. criteria for water quality monitoring of discharge will meet permitting requirements.		
WQL-04	Water Quality	Construction activities for project infrastructure, including wellpads and CFA, located within or near seasonal rivers/streams and drainage luggas. Impacts include ground disturbance, construction, contamination due to storage and use of hazardous or non-hazardous substances, leaching from backfill materials and/or concrete batching.	Construction	Procedures will be prepared to prevent increases in sediment transport towards and within luggas during construction and to monitor water quality throughout construction. The amount of time trenches or other excavations will be open will be minimised. Work on ephemeral rivers/luggas will be planned to take place during the dry seasons when no or low flow	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence demonstrating regular auditing of construction practices to confirm they are in accordance with prescribed erosion control measures. Evidence demonstrating pre-construction surveys and micro-alignment where possible.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				is anticipated. If unavoidable, flow will be diverted and redirected into same watercourse further downstream. Riparian vegetation (e.g., trees and shrubs) and areas that may be sensitive to erosion will be avoided with micro alignment, where possible, identified during the pre-construction survey. **Repeated Mitigation – Water Quality 01 – Erosion Control.** **Repeated Mitigation – Water Quality 05 – Scour:** A pre-construction survey of each lugga/watercourse crossing will be completed to verify the assumptions and outcome of the desk-based scour assessment, which will be completed to understand hydraulics and sediment transport for up to a 1 in 100-year return period and provide the scour potential and scour depth at each crossing, plus any additional measures required to manage scour during construction		Evidence of desk-based scour assessments. Evidence of pre-construction survey and verification of the desk-based scour assessment and mitigation. Evidence of visual and photographic inspection of channel to identify any changes to morphology. Evidence of measures to rehabilitate the channel and minimise sedimentology changes, if required.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				and maintain downstream water quality below trigger levels. **Repeated Mitigation – Water Quality 06 – Channel Morphology:** Procedures will be prepared for a visual and photographic inspection of the channel, to identify if construction works have changed the channel morphology. Procedures outline how to rehabilitate the channel to minimise changes to sedimentology in the channel, should it be required.		
WQL-05	Water Quality	Discharges/ releases from waste storage and disposal activities and facilities to seasonal rivers/streams and drainage luggas.	Construction	Procedures will be prepared to avoid disturbance of and release of contaminants from waste storage facilities. **Repeated Mitigation – Water Quality 02 – Triggers and Actions.** **Repeated Mitigation – Water Quality 03 – Groundwater Quality Monitoring.**	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of monthly groundwater quality monitoring, and actions taken should any trigger values be exceeded.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
WQL-06	Water Quality	Water Discharges from hydrotest water leading to change in water quality in seasonal rivers/streams and drainage luggas.	Construction	**Repeated Mitigation - Water Quality 04 – Hydrotest Discharge Management.**	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence demonstrating review of hydrotest water requirements. Evidence of correspondence with NEMA relating to any disposal methods into the environment, and evidence of permitting and compliance with permit requirements.
WQL-07	Water Quality	Discharges/ releases from waste storage and disposal activities and facilities to shallow aquifers.	Construction	Procedures will be prepared to avoid disturbance of and release of contaminants from any existing waste storage and to monitor water quality throughout construction. **Repeated Mitigation – Water Quality 02 – Triggers and Actions.** **Repeated Mitigation – Water Quality 03 – Groundwater Quality Monitoring.**	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of monthly groundwater quality monitoring, and actions taken should any trigger values be exceeded.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
WQL-08	Water Quality	Water Discharges from hydrotest water leading to change in water quality in shallow aquifers.	Construction	**Repeated Mitigation - Water Quality 04 – Hydrotest Discharge Management.**	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence demonstrating review of hydrotest water requirements. Evidence of correspondence with NEMA relating to any disposal methods into the environment, and evidence of permitting and compliance with permit requirements.
WQL-09	Water Quality	Discharges/ releases from waste storage and disposal activities and facilities to the Kalabata River, seasonal rivers/streams and drainage luggas, and shallow aquifers.	Operation	**Repeated Mitigation – Water Quality 07 – Operational Waste Facility Management:** Prior to construction of the landfill facility, baseline monitoring will be carried out to establish an environmental baseline of the groundwater conditions beneath the site. The groundwater monitoring points will be installed as a part of the geotechnical investigations undertaken as a part of detailed design of the facility. Monitoring of groundwater will continue from installation of the boreholes throughout the operational life of the site and into closure to monitor the groundwater	The EPC Contractor is responsible for baseline monitoring and detailed design of the landfill facility. The Operator is responsible for groundwater monitoring and analysis during operations and assuring implementation of design mitigation.	Evidence of baseline monitoring (including groundwater, gas and leachate) at and downgradient of waste storage and disposal facilities. Evidence demonstrating regular auditing to confirm surface water management systems and drainage systems are functioning as designed. Evidence of quarterly groundwater quality monitoring, and actions

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				beneath the site to ensure that the site is not have a negative effect on the local and regional groundwater. Gas and leachate monitoring will be undertaken to understand any gas and leachate migration in the landfill. There will be a surface water management system at the landfill. (e.g., drainage ditches and slope design) that will redirect rainfall run-off away from open landfill cells to reduce leachate generation rates. Procedures will be prepared for landfill leachate management. Drainage systems used to capture leaks/leachate/drainage in the IWMF, will be isolated from surface and groundwater. **Repeated Mitigation – Water Quality 02 – Triggers and Actions.** Groundwater monitoring during operations will comprise as a minimum:		taken should any trigger values be exceeded.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				■ Quarterly groundwater sampling and laboratory analysis (by an ISO accredited lab) plus in-situ field analysis. Laboratory analysis will include all parameters reported in the baseline including major ions, nutrients, organics and oils, polyaromatic hydrocarbons, inorganics and bacteriological (full suite in Annex I). In-situ field analysis will be completed for pH, Temperature, Dissolved Oxygen, Electrical Conductivity, Turbidity. ■ Quarterly surface water quality data will be gathered at two shallow groundwater monitoring locations sited downgradient of landfill and the CFA along the downgradient contour of the phreatic surface identified in the baseline. ■ If surface water is present during quarterly groundwater		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				sampling rounds, adhoc surface water sampling will occur at the sampling locations (including hand dug wells) used in the baseline downgradient of the wellpad locations, waste facilities and CFA. Laboratory analysis (by an ISO accredited lab) will include all parameters reported in the baseline including major ions, nutrients, organics and oils, polyaromatic hydrocarbons, inorganics and bacteriological (full suite in Annex I). In-situ field analysis will be completed for pH, Temperature, Dissolved Oxygen, Electrical Conductivity, Turbidity. Monitoring will be completed throughout operations and disclosed publicly.		

Table 9.3-5: Soils

ID	Topic/Aspect	Source of Impact	Project Phase	Mitigation	Responsibility	Means of Verification
SL-01	Soils	Topsoil handling and mixing causing disturbance in construction areas.	Construction	Soil management protocols will be prepared including: ▪ Salvage topsoil in areas where it occurs in the direct soil disturbance footprint of the CFA, wellpads, landfill, roads and camps. Given the major soil types in these areas, it is expected that topsoil will be limited to the areas of the luggas. ▪ Procedures for rehabilitation and revegetation.	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Where topsoil is salvageable, records of salvaged topsoil and planned rehabilitation and revegetation. Procedures for rehabilitation and revegetation.
SL-02	Soils	Soil erosion of Regosols caused by construction activities, primarily in locations with low slope gradients.	Construction	Soil erosion management controls will be prepared, including: ▪ Temporary erosion control measures will be installed prior to earth-moving activities, to limit the likelihood of sediment mobilisation to the water environment. Suspended solid management techniques will be used. The procedures being followed will be audited and	EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Records/plans of where and when temporary erosion controls are used and when they are decommissioned. Evidence demonstrating regular auditing to confirm temporary erosion controls are functioning as intended and limiting sediment mobilisation.

ID	Topic/Aspect	Source of Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				monitored throughout construction. ■ Works in periods of extreme rainfall and rainy seasons will be managed, as far is it is practicable, to limit the generation and mobilisation of suspended solids into the water environment and to manage safety of workers. ■ The amount of time the trenches will be open will be minimised, reducing the time per location when excavated soils are exposed to limit the likelihood of sediment mobilisation to the water environment. Any materials, which could lead to contamination, placed in trenches by third parties or otherwise, will be removed before trenches are backfilled to remove potential sources of contamination.		Evidence of monitoring of trenching and records of removal of material leading to contamination, prior to backfilling. Evidence of reseeding with locally sourced seed/plants as required.

ID	Topic/Aspect	Source of Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				■ Where topsoil is salvageable, it will be stored for no more than 6 months. ■ Any cleared areas within the footprint, where topsoil is salvageable, measures will be taken to store topsoil and maintain the existing seed bed. If additional re-seeding is required during rehabilitation, it will be seeded/replanted with locally sourced seed/plants of suitable species. Topsoil management will allow reestablishment/re-generation of vegetation on bare areas and limit the erosion potential.		

Table 9.3-6: Landscape and Visual

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
LV-01	Visual	Works associated with the construction activities of wellpads (initial well drilling) and associated infrastructure (e.g., access roads) may result in temporary impacts such as plant mobilisation, transport and lighting emissions on permanent human receptors (settlements – nomadic view) within the area identified in the ESIA.	Construction	Stakeholders will be engaged in affected areas to inform them where, when and for how long temporary works are taking place. **Repeated Mitigation– Landscape & Visual 01– Retention of Existing Vegetation:** The retention and preservation of existing vegetation will be maximised, both outside and in proximity to the infrastructure fence-lines (particularly large trees and shrubs located along luggas), to act as natural screening of Project facilities. **Repeated Mitigation– Landscape & Visual 05 – Earth Bunding:** Earth bunding will be developed and maintained around wellpad fencelines to provide screening. Grievances will be monitored and remediated through the Grievance Management Procedure.	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of engagement with affected stakeholders on potential visual effects. Evidence of vegetation retention and preservation around infrastructure fencelines and along luggas. Evidence of bunding formation and maintenance around wellpad fencelines. Grievance register logging any complaints received relating to visual impacts, including a record of the investigation and/or remedial actions taken as a result of the complaints.
LV-02		Works associated with the construction of the CFA (and CPF) and associated infrastructure (e.g., access roads) may result in temporary impacts associated with construction works such as plant mobilisation, transport and lighting emissions on permanent human receptors (settlements – nomadic view) within the area identified in the ESIA.				
LV-03		Works associated with the construction of the OHTL on permanent human receptors (settlements – nomadic view) within the area identified in the ESIA.				

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
LV-04	Visual	Clearance/ removal of vegetation (screening elements) and soils during construction on permanent human receptors.	Construction	**Repeated Mitigation– Landscape & Visual 01– Retention of Existing Vegetation.** Grievances will be monitored and remediated through the Grievance Management Procedure.	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of vegetation retention and preservation around infrastructure fencelines and along luggas. Grievance register logging any complaints received relating to visual impacts, including a record of the investigation and/or remedial actions taken as a result of the complaints.
LV-05	Visual	Site activity and plant movement during construction (dust plumes, lighting emissions, material and waste storage/stockpiles) on permanent human receptors.	Construction	An information campaign will inform local stakeholders of the construction activity dates and the potential for increased visual disturbance from dust and artificial lighting. Signage will be put in place to inform people where, when and for how long temporary dust generating works are taking place. **Repeated Mitigation– Landscape & Visual 01– Retention of Existing Vegetation.** **Repeated Mitigation– Landscape & Visual 05 – Earth Bunding.**	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of vegetation retention and preservation around infrastructure fencelines and along luggas. Grievance register logging any complaints received relating to visual impacts, including a record of the investigation and/or remedial actions taken as a result of the complaints. Evidence of bunding formation and maintenance around wellpad fencelines.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				Daily visual dust monitoring around infrastructure fencelines will be undertaken. If high levels of dust are observed dust netting/ barriers will be used around high dust generating activities to limit the dispersion of dust. **Repeated Mitigation– Landscape & Visual 02 – Artificial Lighting:** Light pollution will be limited with the following measures: Use of lighting will be minimised and light spill controlled where possible by using directional lighting focussed downwards and the application of cowls; The wattage/ power of the lighting will be considered, and lights will be of the correct power for the application; Lighting will be used where required and unnecessary lighting avoided; and Blue light tones will be avoided, as these light tones are more disruptive to sleep patterns. Yellow tone lights		Evidence of audits of artificial lighting to minimise light spill and remedial actions where required. Evidence of a lighting design plan, including the location, direction, power and tone of the lighting and where motion sensors, cowls and timers were considered (and justifications where not included). Records of employee driver training, documentation and auditing of driver standards. Evidence of speed limit signage. Records of approvals for night- time driving.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				or white lights which filter out blue or UV light will be used where possible. **Repeated Mitigation– Landscape & Visual 03 – Transport Management System:** Dust trackout and dispersal will be managed via: ■ Project speed limits to be established and complied with by all Project vehicles; ■ Night-time driving will be prohibited unless specifically authorised; and ■ Off-road driving will be prohibited. Grievances will be monitored and remediated through the Grievance Management Procedure. Any complaints will be investigated and followed up.		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
LV-06	Visual	Location of above ground wellpads and supporting infrastructure on permanent human receptors.	Operation	**Repeated Mitigation– Landscape & Visual 01– Retention of Existing Vegetation.** **Repeated Mitigation– Landscape & Visual 04 – Project Infrastructure Design:** Where possible, Project infrastructure will be designed to blend in with the existing landscape. Where practicable and in particular for towers and elevated structures, metal surfaces will be matt (non-reflective finish) and painted surfaces will be muted with natural colours, to minimise visual impact. **Repeated Mitigation– Landscape & Visual 05 – Earth Bunding** Grievances will be monitored and remediated through the Grievance Management Procedure.	The EPC Contractor is responsible for detailed design mitigation. The Operator is responsible for grievance management during operations and assuring detailed design mitigation.	Evidence of vegetation retention and preservation around infrastructure fencelines and along luggas. Evidence of regular auditing of wellpad and infrastructure condition/maintenance. Evidence of options assessment of surface colours and finishes of Project infrastructure. Evidence of engagement with affected stakeholders on potential visual effects, Evidence of bunding formation and maintenance around wellpad fencelines, Grievance register logging any complaints received relating to visual impacts, including a record of the investigation and/or remedial actions taken as a result of the complaints,

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
LV-07	Visual	Location of above ground OHTL on permanent human receptors.	Operation	Grievances will be monitored and remediated through the Grievance Management Procedure.	The Operator	Grievance register logging any complaints received relating to visual impacts, including a record of the investigation and/or remedial actions taken as a result of the complaints.
LV-08	Visual	Location of above ground CFA (CPF) and supporting infrastructure (flaring at CPF and flue gas stack at IWMF) on permanent human receptors.	Operation	**Repeated Mitigation– Landscape & Visual 01– Retention of Existing Vegetation.** **Repeated Mitigation– Landscape & Visual 04 – Project Infrastructure Design.** Grievances will be monitored and remediated through the Grievance Management Procedure.	The Operator	Evidence of regular auditing of CFA facilities condition/maintenance. Evidence of engagement with affected stakeholders on potential visual effects. Evidence of options assessment of surface colours and finishes of Project infrastructure. Grievance register logging any complaints received relating to visual impacts, including a record of the investigation and/or remedial actions taken as a result of the complaints.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
LV-09	Visual	Site activity and plant movement during operations (dust plumes, lighting emissions) on permanent human receptors.	Operation	**Repeated Mitigation– Landscape & Visual 02 – Artificial Lighting.** **Repeated Mitigation– Landscape & Visual 03 – Transport Management System.** Dust monitoring will be carried out. If high levels of dust are observed, actions to limit the dispersion of dust will be set out. Grievances will be monitored and remediated through the Grievance Management Procedure.	The Operator	Evidence of audits of artificial lighting to minimise light spill and remedial actions where required. Evidence of a lighting design plan, including the location, direction, power and tone of the lighting and where motion sensors, cowls and timers were considered (and justifications where not included). Records of employee driver training, documentation and auditing of driver standards. Evidence of speed limit signage. Records of approvals for night- time driving. Evidence of regular auditing of infrastructure condition/maintenance.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
						Grievance register logging any complaints received relating to visual impacts, including a record of the investigation and/or remedial actions taken as a result of the complaints.

Table 9.3-7: Biodiversity, Ecology and Protected Areas

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
BI-01	Biodiversity	Sensory disturbance from light and noise impacting on fauna in rocky ridges habitats.	Construction	Any blasting within rocky ridges habitats, if required for borrow pits, must be carried out in line with good industry practice. **Repeated Mitigation – Biodiversity 01 - Transport Management System:** The biodiversity specific transport management controls will require the following: ■ All employees and contractor workers will be trained in the Operator Code of Conduct, ensure all drivers hold a valid driver's licence and meet Project driver standards and international standards as set out in IOGP Land Transport Safety Recommended Practice 365; ■ Vehicles will be fitted with inward and outward facing cameras to monitor driver performance and external hazards;	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of undertaking blasting in accordance with GIP. Evidence of employee driver training, documentation and auditing of driver standards. Maintenance records for vehicle cameras. Evidence of speed limit signage. Evidence of approvals for night- time driving. Evidence of notifying NEMA where noise levels exceed statutory limits. Evidence of a lighting design plan, including the location, direction, power and tone of the lighting and where motion sensors, cowls and timers were considered (and

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				■ Project speed limits will be established and complied with by all Project vehicles; ■ Night-time driving will be prohibited unless specifically authorised; and ■ Off-road driving will be prohibited. **Repeated Mitigation – Biodiversity 05 – Sensory Disturbance:** Use of lighting will be minimised and light spill controlled where possible by using directional lighting focussed downwards and the application of cowls; ■ The wattage/ power of the lighting should be considered, and lights should be of the correct power for the application; ■ Lighting should be used where required and unnecessary lighting avoided; and		justifications where not included).

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				■ At locations where construction noise will temporarily exceed statutory limits (criteria is defined in Section 7.2– noise and vibration), NEMA will be notified.		
BI-02	Biodiversity	Land take, vegetation clearance, increased use by humans, and introduction of alien invasive species impacting on Northern *Acacia-Commiphora* bushlands and thickets.	Construction	Procedures to manage potential impacts on the Northern *Acacia-Commiphora* bushlands and thickets will include: ■ the appointment of an EPC Biodiversity Supervisor; ■ contractor and staff environmental inductions on wildlife protection and biodiversity, and protocols for incident management. ■ requirements for minimising land take and vegetation rehabilitation post construction; and ■ Cordon off infrastructure areas during construction to keep livestock, wildlife and people out.	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of appointment of EPC Biodiversity Supervisor. Evidence of employee inductions on biodiversity and wildlife protection. Evidence of land take minimisation and rehabilitation (SOC – 07). Evidence of cordoning off of infrastructure. Evidence of employee driver training, documentation and auditing of driver standards. Maintenance records for vehicle cameras.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				Repeated Mitigation – Biodiversity 01 - Transport Management System. **Repeated Mitigation – Biodiversity 03 - Population Influx (Construction) - SOC-01.** **Repeated Mitigation – Biodiversity 02 - Invasive Species:** Procedures will be prepared for identification and removal of invasive species, and to prevent establishment and spread of invasive species after the ground has been disturbed in all Project footprint areas. Alien invasive species will be managed in accordance with species specific best practice. Procedures will include: ■ The appointed EPC Biodiversity supervisor will undertake monitoring to hygiene specifications for vehicles, cargo and site clearance and rehabilitation. Specifications and records of		Evidence of speed limit signage. Evidence of approvals for night- time driving. Evidence relating to influx management (SOC-01). Evidence of hygiene inspections relating to invasive species. Evidence of monthly footprint inspections for invasive species and any remedial actions. Evidence of list and map of vegetation suitable for revegetation, including planting protocols, maintenance and monitoring procedures. Evidence of soil strip monitoring and management.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				monitoring will be maintained on the occurrence and spread of invasive species. ■ The appointed EPC Biodiversity supervisor will undertake monitoring inspections of the Project footprint at monthly intervals during construction and the Operator Environmental Supervisor for the operational life of the Project in order to identify invasive species colonisation and actions for management (e.g., removal of invasive species). **Repeated Mitigation – Biodiversity 04 – Re-vegetation and Remediation:** Procedures for vegetation rehabilitation will include: ■ Developing a list and map of appropriate vegetation to be used in different areas of the project according to, provenance, endemicity, planting protocols,		Evidence of monthly footprint inspections for vegetation rehabilitation and revegetation. Evidence of NEMA approvals for borrow pits. Preparation of a rehabilitation plan for borrow pits, and evidence of conformance with this plan. Evidence of undertaking blasting in accordance with GIP.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				maintenance and monitoring procedures. ■ Soil strip management and storage, soils reinstatement and post-construction monitoring ■ Any cleared areas within the footprint where topsoil is salvageable, measures will be taken to store topsoil and maintain the existing seed bed. If additional re-seeding is required during rehabilitation it will be re-seeded/replanted with locally sourced seed/plants of suitable species; and if required. Topsoil management will allow reestablishment/re-generation of vegetation on bare areas and limit the erosion potential; The appointed EPC Biodiversity supervisor will undertake monitoring inspections of the Project footprint at monthly intervals during construction and for two		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				years post construction in order to monitor rehabilitation and take alternative action should further re-vegetation be required to re-establish pre-construction conditions. Specifically, for borrow pits, for which locations are not yet fixed: ■ NEMA approval will be obtained prior to commencing onsite activities. Borrow pits and quarries to be located more than 100 metres from watercourses to minimise storm water runoff into watercourse and mitigate potential conflicts; ■ Borrow Pit locations will be sited in modified habitat wherever practicable and will have minimum negative impacts on access to water points, breeding, feeding and wild animals' paths; and ■ Prior to pit development, prepare a rehabilitation plan with details of final shape,		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				method of achieving it, drainage, sediment control, soil reinstatement and revegetation measures.		
BI-03	Biodiversity	Sensory disturbance, increased persecution, human-wildlife conflict, and increased vehicle traffic collisions impacting on leopard, striped hyaena and other mammal SoCC.	Construction	Procedures will be prepared to manage any encounters between the construction team and Leopard, striped Hyaena and other mammal SoCC, including: ■ **Repeated Mitigation – Biodiversity 01 - Transport Management System**. ■ **Repeated Mitigation – Biodiversity 03 - Population Influx (Construction) equivalent to SOC-01.** ■ **Repeated Mitigation – Biodiversity 05 – Sensory Disturbance**. ■ **Repeated Mitigation – Biodiversity 06 – Measures Relating to Critical Habitat Triggering Species (Construction):**	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation and will offer SoCC monitoring support to KWS.	Evidence of employee driver training, documentation and auditing of driver standards. Maintenance records for vehicle cameras. Evidence of speed limit signage. Evidence of approvals for night- time driving. Evidence relating to influx management (SOC - 01). Evidence of notifying NEMA where noise levels exceed statutory limits. Evidence of a lighting design plan, including the location, direction, power and tone of the lighting and

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				The EPC contractor will engage with the relevant authority (likely NEMA/KWS and/or NGOs) (with Operator support) to identify any seasonal or temporal constraints in environmentally significant areas which will require demarcation as *No-Go* areas. Procedures for demarcation of the species-specific critical habitat on construction plans. In the unlikely event that *Neuracanthus kenyensis* and *Xerophyta schnizleinia* (restricted range plants) are identified during pre-construction surveys these species will be avoided via micro-placement of Project footprint. The EPC contractor will provide procedures for contractor and staff environmental inductions on wildlife protection and biodiversity, and protocols for incident management and SoCC species identification; Provide detailed wildlife rescue procedures, including, as a minimum, protocols for safe		where motion sensors, cowls and timers were considered (and justifications where not included). Evidence of engagement with relevant authority to identify areas which will be demarcated as no go areas. Evidence of mapping of demarcated areas on EPC construction plans. Evidence of employee biodiversity inductions including SoCC identification and wildlife rescue. Evidence of communication with KWS regarding SoCC monitoring.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				extraction of wildlife trapped in excavations, protocol for hazardous and non- hazardous spill in an Environmental Incident Reporting Procedure; The Operator will offer SoCC monitoring support to KWS.		
BI-04	Biodiversity	Sensory disturbance, increased persecution, loss of critical habitat, and direct mortality from collisions with Project infrastructure impacting on vultures and other bird SoCC.	Construction	Procedures will be prepared to manage any encounters between the construction team and vultures and Bird SoCC including: **Repeated Mitigation – Biodiversity 01 - Transport Management System.** **Repeated Mitigation – Biodiversity 06 – Measures Relating to Critical Habitat Triggering Species.** ■ The Operator will continue to engage with the relevant authority (likely NEMA/KWS and/or NGOs) and offer monitoring support (i.e. sharing of *ad hoc* observations and data captured during construction with KWS);	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigations and engagement with KWS.	Evidence of employee driver training, documentation and auditing of driver standards. Maintenance records for vehicle cameras. Evidence of speed limit signage. Evidence of approvals for night- time driving. Evidence of meetings or communications with relevant authorities e.g. NEMA, KWS regarding monitoring data and observations of critical habitat triggering species.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				■ Procedures will be prepared for contractor and staff environmental inductions on wildlife protection and biodiversity, and protocols for incident management and SoCC species identification; ■ Detailed Wildlife rescue procedures will be prepared relevant to operational infrastructure, including, protocol for hazardous and non- hazardous spill in an Environmental Incident Reporting Procedure; ■ The Operator will continue to report notable wildlife sightings/and any potential security issues such as persecution of protected species to KWS; ■ The EPC appointed Biodiversity Supervisor will undertake and manage the delivery of bi-annual (wet and dry season) bird surveys in order to monitor SoCC bird		Evidence of environmental inductions and training of staff on wildlife protection, biodiversity incident management and SoCC species identification. Preparation of wildlife rescue procedures and evidence of conformance. Records of notable wildlife sightings and evidence of communication of sightings with KWS. Evidence of bi-annual bird surveys and communication with KWS. Evidence showing that bird flight diverters and electrocution protectors included in infield OHTL design. Evidence of pre- operation ornithological survey of infield OHTL to aid the placement and location of

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				species against baseline conditions. This will include the monitoring of flight diverters and review of other electrocution protection measures pertaining to bird safety (refer further below). Population increases or decreases would trigger management actions as required. The results of the bird monitoring will be formally shared with KWS; ■ Bird flight diverters on top lines of the infield OHTL will be installed in areas where low-level migratory bird movements are considered likely, and in other sensitive areas. For the purposes of this mitigation, this will be considered to comprise locations within or adjacent (i.e., within 1 km) of protected areas and identified critical habitat e.g. Amosing Wellpad; ■ Protection on conductors, poles, jump wires and dead ends will be installed to		bird deterrent devices and perching spaces. Evidence of an assessment of bird perching space locations.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				minimise the risk of electrocution to roosting birds in all areas of the infield OHTL; ■ The Biodiversity Supervisor will liaise with an ornithologist experienced in powerline mitigation who will survey the proposed infield powerline route prior to operation of the powerlines, in order to give input to the placement and location of bird deterrent devices, appropriate spacing distances on poles and between wires, and provision of artificial safe perching sites, as necessary; ■ The installation of reflective bird diverters, such as reflective stainless-steel spheres of 70 mm diameter (e.g. Inotec NFD88) is recommended to increase visibility, particularly at dusk within the Amosing wellpad OHTL;		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				■ The spacing interval of bird deterrent devices, and location for installation, should be determined in consultation with the ornithologist; ■ Preferred perching space for birds on pole tops should be well clear of dangerous components; dangerous components should be sufficiently separated by space to ensure that the bird cannot touch them. This distance is recommended to be a minimum of 1.4 m for large raptors and cranes/storks, and 1.8 m for vultures; ■ Insulating coverings will be provisioned over energised parts and/or covering grounded parts with materials appropriate for providing incidental contact protection to birds. If upright insulators or horizontal disconnectors are present, these should be covered safely; and		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				▪ Artificial bird 'safe perches' on poles will be provisioned to be positioned in consultation with the ornithologist.		
BI-05	Biodiversity	Increased direct mortality, increased risk of predation, loss of critical habitat, attraction to water storage facilities, and direct persecution impacting upon Turkana toad and other herpetofauna SoCC.	Construction	Procedures will be prepared to manage any encounters between the construction team and critical habitat triggering Herpetofauna including: ▪ **Repeated Mitigation – Biodiversity 01 - Transport Management System**. ▪ **Repeated Mitigation – Biodiversity 03 - Population Influx (Construction) – SOC-01** ▪ **Repeated Mitigation – Biodiversity 05 - Sensory Disturbance**. ▪ **Repeated Mitigation – Biodiversity 06 - Measures Relating to Critical Habitat Triggering Species**. ▪ In parallel with groundwater monitoring and mitigation	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of employee driver training, documentation and auditing of driver standards. Maintenance records for vehicle cameras. Evidence of speed limit signage. Evidence of approvals for night- time driving. Evidence relating to influx management (SOC - 01). Evidence of notifying NEMA where noise levels exceed statutory limits. Evidence of a lighting design plan, including the location, direction, power

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				(described in the water quantity chapter (Section 7.3), A herpetofauna survey (pitfall trapping and drift fence trapping), within the potentially affected area of the Kalabata catchment, will be undertaken (at least one June survey before construction) to identify the presence (or otherwise) of the Turkana toad. ▪ Based on that data, critical habitat mapping will be revised, future biological monitoring will be evaluated, and sensitivities related to groundwater levels will be evaluated and included in consideration of action levels and associated water supply mitigations including the provision of bowser water. ▪ The EPC Biodiversity Supervisor will record notable wildlife sightings and also communicate security issues such as persecution of SoCC. The Biodiversity Supervisor will share records of SoCC		and tone of the lighting and where motion sensors, cowls and timers were considered (and justifications where not included). Evidence of engagement with relevant authority to identify areas which will be demarcated as no go areas. Evidence of mapping of demarcated areas on EPC construction plans Evidence of employee biodiversity inductions including SoCC identification and wildlife rescue. Evidence of communication with KWS regarding SoCC monitoring. Evidence of pre-construction herpetofauna surveys and any revision and evaluation of critical habitat mapping.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				sightings on a monthly basis with KWS; ■ Water storage facilities used by the project will be designed to reduce ingress of amphibians; Should evidence of the Toad be collected during the aforementioned survey, procedures will be prepared to: ■ Turkana toad surveys will include a twice-yearly focussed survey throughout construction (pitfall trapping and drift fence trapping), including a wet season (May / June survey) at all wellpads and along the Kalabata riparian habitats within the area of influence of abstraction wells used for construction water. This work will indicate whether no net loss or net gain outcomes for this species are being realised; ■ If required, translocation procedures will be developed		Evidence of records of notable wildlife sightings and evidence of communication with KWS. Evidence of bi- annual Turkana toad surveys and analysis of results. Evidence of a Turkana toad population assessment and evidence of communication with KWS.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				by the EPC Biodiversity Supervisor; and - Reporting of population increases or decreases to KWS, and the associated management actions agreed KWS as required.		

BI-06	Biodiversity	Direct mortality and loss of critical habitat due to dewatering of Kalabata resulting in changes in vegetation composition impacting on ground beetle.	Construction	Procedures will be prepared to manage any encounters between the construction team and critical habitat triggering Ground beetle including: **Repeated Mitigation – Biodiversity 04– Re-vegetation and Remediation**. **Repeated Mitigation – Biodiversity 05 – Sensory disturbance**. **Repeated Mitigation – Biodiversity 06 – Measures Relating to Critical Habitat Triggering Species**. - In parallel with groundwater monitoring and mitigation (described in the water quantity chapter (Section 7.3), a beetle survey within the potentially affected riparian area of the Kalabata catchment, will be undertaken (at least one June survey before construction) to identify the presence (or otherwise) of the *Omophron* beetle. Based on that data, critical habitat mapping will be revised, future biological	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of list and map of vegetation suitable for revegetation, including planting protocols, maintenance and monitoring procedures. Evidence of soil strip monitoring and management. Evidence of monthly footprint inspections for vegetation rehabilitation and revegetation. NEMA approvals for borrow pits Preparation of a rehabilitation plan for borrow pits, and evidence of conformance with this plan. Evidence of notifying NEMA where noise levels exceed statutory limits. Evidence of a lighting design plan, including the location, direction, power and tone of the lighting and where motion sensors,

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				monitoring will be evaluated, and sensitivities related to groundwater levels will be evaluated and included in consideration of action levels and associated water supply mitigations including the provision of bower water from the Turkwel Reservoir. ■ The EPC Biodiversity Supervisor will record notable wildlife sightings and also communicate security issues such as persecution of SoCC. The Biodiversity Supervisor will share records of SoCC sightings on a monthly basis with KWS Should evidence of the *Omophron* beetle be collected during the aforementioned survey, procedures will be prepared for: ■ Continued monitoring of changes in humidity levels within the Kalabata riparian zone to establish baseline prior		cowls and timers were considered (and justifications where not included). Evidence of employee biodiversity inductions including SoCC identification. Evidence of a pre-construction beetle survey and any revision and evaluation to critical habitat mapping. Evidence of notable wildlife sightings and communications with KWS. Evidence of humidity monitoring within Kalabata riparian zone. Evidence of annual beetle surveys. Evidence of a beetle population assessment and communication with KWS.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				to commencement of construction; and ■ Beetle survey at all wellpads and along the Kalabata riparian habitats within the area of influence of abstraction wells used for construction water will be repeated on a yearly basis in May/June throughout the period of groundwater abstraction during the construction phase. ■ Reporting of population increases or decreases to KWS, and the associated management actions agreed KWS as required.		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
BI-07	Biodiversity	Edge impacts, the establishment and spread of alien invasive plant species, and sensory disturbance from light and noise impacting on rocky ridges habitat.	Operation	**Repeated Mitigation – Biodiversity 01 - Transport Management System.** **Repeated Mitigation – Biodiversity 05 – Sensory Disturbance.**	The Operator	Evidence of employee driver training, documentation and auditing of driver standards. Maintenance records for vehicle cameras. Evidence of speed limit signage. Evidence of approvals for night- time driving. Evidence of a lighting design plan, including the location, direction, power and tone of the lighting and where motion sensors, cowls and timers were considered (and justifications where not included).
BI-08	Biodiversity	Impacts on leopard, striped hyaena and other mammal SoCC from increased vehicle traffic and increased access as a result of the Project, leading to increased competition for resources,	Operation	**Repeated Mitigation – Biodiversity 01 - Transport Management System.**	The Operator	Evidence of employee driver training, documentation and auditing of driver standards.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
		human-wildlife conflict and increased poaching.		**Repeated Mitigation – Biodiversity 03 - Population Influx (Operations) – SOC – 01.** **Repeated Mitigation – Biodiversity 08 – Measures Relating to Critical Habitat Triggering Species (Operations):** ■ The Operator will continue to engage with the relevant authority (likely NEMA/KWS and/or NGOs) and offer monitoring (i.e. sharing of ad hoc observations and data captured by the Operator during operations) support to KWS; ■ The Operator will provide procedures for contractor and staff environmental inductions on wildlife protection and biodiversity, and protocols for incident management and SoCC species identification; ■ The Operator will provide detailed Wildlife rescue procedures relevant to operational infrastructure, including, protocol for		Maintenance records for vehicle cameras. Evidence of speed limit signage. Evidence of approvals for night- time driving. Evidence related to influx management (SOC – 01) Evidence of meetings or communications with relevant authorities e.g. NEMA, KWS regarding monitoring data and observations of critical habitat triggering species. Evidence of environmental inductions and training of staff on wildlife protection, biodiversity incident management and SoCC species identification. Preparation of wildlife rescue procedures and evidence of conformance.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				hazardous and non- hazardous spill in line with the Operator Environmental Incident Reporting Procedure; ■ The Operator will continue to offer SoCC monitoring support to KWS; and ■ The Operator will continue to report notable wildlife sightings / and any potential security issues such as persecution of protected species to KWS.		Records of notable wildlife sightings and evidence of communication of sightings with KWS.
BI-09	Biodiversity	Direct mortality due to OHTLs and flares impacting on vultures and other bird SoCC.	Operation	**Repeated Mitigation – Biodiversity 01 - Transport Management System.** **Repeated Mitigation – Biodiversity 08 – Measures Relating to Critical Habitat Triggering Species (operations):** ■ The Operator will maintain bird flight diverters throughout operations on top lines of the infield OHTL in areas where low-level migratory bird movements are considered	The Operator	Evidence of employee driver training, documentation and auditing of driver standards. Maintenance records for vehicle cameras. Evidence of speed limit signage. Evidence of approvals for night- time driving.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				likely, and in other sensitive areas. For the purposes of this mitigation, this will be considered to comprise locations within or adjacent (i.e., within 1 km) of protected areas and identified critical habitat. The Operator will maintain protection on conductors, poles, jump wires and dead ends, throughout operations, to minimize the risk of electrocution to roosting birds via design in all areas of the infield OHTL; ■ The Biodiversity Supervisor will liaise with an ornithologist experienced in powerline mitigation who will survey the proposed infield powerline route prior to operation of the powerlines, in order to give input to the 'designing out' of electrocution risk , placement and location of bird deterrent devices, appropriate spacing distances on poles and between wires, and provision		Evidence of maintenance of bird flight diverters in areas within 1km of identified critical habitat and in all infield areas. Evidence of flare start up checks.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				of artificial safe perching sites, as necessary. ▪ The installation of reflective bird diverters, such as reflective stainless-steel spheres of 70 mm diameter (e.g. Inotec NFD88) is recommended to increase visibility, particularly at dusk; ▪ The spacing interval of bird deterrent devices, and location for installation, should be determined in consultation with the ornithologist; ▪ Preferred perching space for birds on pole tops should be well clear of dangerous components; dangerous components should be sufficiently separated by space to ensure that the bird cannot touch them. This distance is recommended to be a minimum of 1.4 m for large raptors and cranes/storks, and 1.8 m for vultures.		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				■ Insulating coverings will be provisioned over energised parts and/or covering grounded parts with materials appropriate for providing incidental contact protection to birds. If upright insulators or horizontal disconnectors are present, these should be covered safely; ■ Adoption of appropriate waste management practice to avoid attracting vultures to waste management facilities; ■ Artificial bird 'safe perches' on poles will be provisioned to be positioned in consultation with the ornithologist; and ■ Implementation of a flare start-up routine that includes checking for the proximity of birds before emergency use, as long as this does not impede the emergency flaring requirement.		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
BI-10	Biodiversity	Direct mortality, attraction to water storage facilities, and persecution impacting on Turkana toad and other herpetofauna SoCC.	Operation	**Repeated Mitigation – Biodiversity 01 - Transport Management System.** **Repeated Mitigation – Biodiversity 08 – Measures Relating to Critical Habitat Triggering Species (operations).** ■ Should evidence of SoCC be collected during the construction period, the following detail and provisions will be implemented: ▪ A Turkana toad operational monitoring programme to include a twice-yearly focussed survey (pitfall trapping and drift fence trapping) at all wellpads and the CFA including a wet season (May / June survey). This work will indicate whether no net loss or net gain outcomes for this species are being realised and if alternative water supplies are required	The Operator	Evidence of employee driver training, documentation, and auditing of driver standards. Maintenance records for vehicle cameras. Evidence of speed limit signage. Evidence of approvals for night- time driving. Evidence of biannual biodiversity survey in the Kalabata catchment for Turkana toad. Evidence that the results of the survey have been used to assess no net loss or no net gain outcomes. Evidence of translocation procedures and activities. Evidence of incorporation of amphibian ingress

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				as mitigation e.g. provision of bowser water; - If required, translocation procedures developed during construction will be upheld by the Operator - Design of water storage facilities that prevent amphibian ingress; - Reporting of population increases or decreases to KWS, and the associated management actions agreed KWS as required.		design measures in water storage facility design. Evidence of Turkana toad population assessment and communication of findings with KWS.
BI-11	Biodiversity	Direct mortality on ground beetle due to loss or modification of habitats including the introduction of invasive species, and habitat pressure from population influx.	Operation	**Repeated Mitigation – Biodiversity 02 - Invasive Species.** **Repeated Mitigation – Biodiversity 07 - Population Influx (Operations) – equivalent to SOC - 25.** **Repeated Mitigation – Biodiversity 08 – Measures**	The Operator	Evidence of hygiene inspections relating to invasive species. Evidence of monthly footprint inspections for invasive species and any remedial actions. Evidence of influx management (SOC – 25).

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				Relating to Critical Habitat Triggering Species (operations). Should evidence of the *Omophron* beetle be collected during the construction period: ■ A Ground beetle monitoring programme at all wellpads and the CFA used for construction water will be repeated twice yearly focussed survey, including a wet season (May / June survey). This work will indicate whether no net loss or net gain outcomes for this species are being realised and if alternative water supplies are required as mitigation e.g. provision of bowser water; and ■ Reporting of population increases or decreases to KWS, and the associated management actions agreed KWS as required.		Evidence of employee biodiversity inductions including SoCC identification. Evidence of notable wildlife sightings and communications with KWS. Evidence of biannual biodiversity survey in the Kalabata catchment for *Omophron* beetle. Evidence that the results of the survey have been used to assess no net loss or no net gain outcomes. Evidence of *Omophron* beetle population assessment and communication of findings with KWS.

Table 9.3-8: Ecosystem Services

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
ES-01	Ecosystem Services	Changes in land cover and associated reduction in supply of grazing/browsing for livestock due to the construction of infield roads, new well pads, and the expansion of existing facilities, as well as increased demand due to population influx and reduction in capacity to supply.	Construction	Prior to construction, the Operator will investigate existing grazing patterns and how they could be affected by the construction of the Project. Sensitive areas that may be subject to grazing pressures because of Project activities will be identified and periodically assessed. This information will be used to design the RLRP with the objective of improving pastureland quality to mitigate the impacts caused by overgrazing. The Operator will identify any particularly potentially vulnerable people affected by the Project as described in the RLRP and provide supplementary assistance to particularly vulnerable and marginalised households in line with IFC Performance Standards. The RLRP and the CDPs will set out how the Operator will provide culturally appropriate livelihood restoration support aimed at improving livestock grazing livelihoods for users of communal	The Operator	Evidence of pre-construction grazing assessments. Inclusion of pastureland quality objectives in the RLRP. Evidence of communication with County Government and GoK during development of livelihood restoration measures. Evidence of identification of particularly potentially vulnerable people affected by the Project. Evidence of any supplementary assistance provided to particularly vulnerable people. Evidence of measures aimed at improving livestock grazing for users of communal land in Project Affected Areas.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				land in Project Affected Areas. Livelihood restoration measures will be developed in consultation with affected communities, stakeholders, County Government and GoK to ensure that they meet the needs of households and communities and fit with local priorities and other government support initiatives. **Repeated Mitigation – Ecosystem Services 01 – Land Use Minimisation – SOC-07.** **Repeated Mitigation – Ecosystem Services 02 – Influx Management (construction):** ■ The Operator will develop influx management procedures to manage speculative influx (and the emergence of informal settlements). Procedures will be developed in coordination with National and County Governments and the respective County Commissioners. Agreed procedures will be presented in the Social Performance Plan.		Evidence of influx management (SOC – 01). Evidence of land use minimisation (SOC – 07).

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
ES-02	Ecosystem Services	Temporary reduction in water supply to ecosystems (riparian woodland) supplying browsing/grazing for livestock within the radius of influence of borehole abstraction	Construction	**Repeated Mitigation – Water Quantity 04 - Biological monitoring**	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of biodiversity survey in the Kalabata catchment for Turkana toad and previously undescribed beetle. Evidence that the results of the survey have been used to review critical habitat mapping and associated monitoring requirements.
ES-03	Ecosystem Services	Reduced wild food plant availability due to reductions in woodland/bush land cover that supports food plant/ animal species, increased demand due to population influx and reduction in capacity to supply. Reduced vegetation cover may limit wild bee's ability to produce honey.	Construction	**Repeated Mitigation – Ecosystem Services 01 – Land Use Minimisation – SOC-07.** **Repeated Mitigation – Ecosystem Services 02 – Influx Management – SOC - 01** **Repeated Mitigation – Ecosystem Services 03 – Vulnerable People and Wild Food/ Medicinal Plants:** Prior to implementation of resettlement and livelihood restoration activities, the Operator will identify any particularly potentially vulnerable people affected by the Project, and who are dependent on wild foods/ medicinal plants, as described in the RLRP,	The Operator	Evidence of influx management (SOC – 01). Evidence of Land use minimisation (SOC – 07). Evidence of identification of particularly potentially vulnerable people affected by the Project. Evidence of any supplementary assistance provided to particularly vulnerable people. Evidence of pre-construction wild food assessments and any

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				and provide supplementary assistance to particularly vulnerable and marginalised households in line with IFC Performance Standards. As part of the RLRP, the Operator will evaluate the productivity of wild foods within the construction footprint and the surrounding areas and will identify any measures to maintain current wild food availability and where possible, enhance productivity.		measures to maintain wild food availability.
ES-04	Ecosystem Services	Reduced availability of traditional medicines/medicinal plants due to reduction in woodland/bush vegetation cover that supports plant species used for traditional medicine, increased demand due to population influx and reduction in capacity to supply.	Construction	**Repeated Mitigation – Ecosystem Services 01 – Land Use Minimisation – SOC-07.** **Repeated Mitigation – Ecosystem Services 02 – Influx Management – SOC – 01.** **Repeated Mitigation – Ecosystem Services 03 – Vulnerable People and Wild Food/ Medicinal Plants.** As part of the RLRP, the Operator will evaluate the use and harvesting of medicinal plants within the construction footprint and the surrounding areas and will identify any measures to maintain current medicinal plant availability and,	The Operator	Evidence of influx management (SOC – 01). Evidence of Land use minimisation (SOC – 07). Evidence of identification of particularly potentially vulnerable people affected by the Project. Evidence of any supplementary assistance provided to particularly vulnerable people. Evidence of pre-construction medicinal

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				where possible, enhance productivity.		plant assessments and any measures to maintain medicinal plant availability.
ES-05	Ecosystem Services	Reduction in the extent of ecosystems supplying tree species that provide wood for fuel and charcoal production	Construction	**Repeated Mitigation – Ecosystem Services 02 – Influx Management** There will be a policy of "*zero tolerance*" for hunting, foraging, unpermitted use of natural resources within the Project AoI applicable to all employees and contractors.	The EPC Contractor will be responsible for implementation. The Operator is responsible for assuring implementation.	Evidence of training staff about hunting and foraging restrictions. Evidence of active enforcement of the "*zero tolerance*" approach.
ES-06	Ecosystem Services	Availability and quality of fresh water for drinking may be compromised by abstraction from groundwater, reliance on TKBV for supply to water points	Construction	Procedures will be prepared to manage the consequences of water abstraction by the Project and water availability during the period of impact. The permitting and contingency strategy will be disclosed and agreed with Turkana County Government (WQL – 01 and WQT – 02). Continuity of supply for local water users will be ensured and temporary alternative water supplies will be provided to all affected water users throughout the period of impact. Relating to reliance on water points, if Project activities and infrastructure	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of water quality monitoring, and actions taken should any trigger values be exceeded (WQL – 01). Evidence of mitigation and management relating to groundwater abstraction during construction and provision of alternative water supplies (WQT – 02).

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				lead to a need to relocate community water points, engagement with Turkana County Government, local stakeholders and communities will be undertaken to discuss and plan the relocation of community water tanks to suitable locations outside of affected land areas.		
ES-07	Ecosystem Services	The loss or disturbance of sacred sites could occur.	Construction	The Operator Social Performance Plan will describe the procedures for micro alignment of the interconnecting network and OHTL within the RoW to avoid direct impact to known graves, where feasible. Project Affected Communities and site guardians will be consulted to agree procedures for demarcation (e.g., demarcation and communication of 'no go' culturally sensitive locations. Detailed steps will be prepared for identifying previously unrecorded graves within the development footprint, prior to construction and set out requirements for protocols, and training to be provided to all construction contractors to assist in grave identification and the implementation of the protocol.	The EPC Contractor is responsible for implementation of mitigations. The Operator is responsible for assuring implementation of mitigations.	Procedures for identification of sacred trees and graves (CH -06). Evidence of staff training in these procedures. Evidence of training of staff in cultural awareness.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				See Section 7.10 (cultural heritage) for further commitments relating to sacred sites, including graves. **Repeated Mitigation – Ecosystem Services 04 – Cultural Awareness Training:** Cultural Awareness Training will be implemented for all site staff / contractors as part of the Project site induction process for all field-based staff during construction. The training will include: ■ Specific local taboos / respectful behaviours with regard to sacred trees etc. ■ A calendar of culturally significant events. ■ Constraints mapping to highlight sensitive areas or no-go areas.		
ES-08	Ecosystem Services	Construction-phase changes in the visual, noise aesthetics of the landscape.	Construction	The Operator will complete an information campaign to inform local stakeholders of the construction activity dates and the potential for increased noise levels and	The EPC Contractor is responsible for implementation of mitigation.	Evidence of training of staff in cultural awareness. Grievance register logging any complaints received relating to visual and noise

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				construction activities. Community members will be encouraged through community participation to avoid the area where the construction activities are taking place. **Repeated Mitigation – Ecosystem Services 04 – Cultural Awareness Training.** **Repeated Mitigation – Ecosystem Services 05 – Grievance Management Procedure:** The Operator will monitor grievances and improvements through a Grievance Management Procedure. Any complaints will be investigated and followed up to ensure a form of remediation is in place to prevent recurrence.	The Operator is responsible for assuring implementation of mitigation.	impacts, including a record of the investigation and/or remedial actions taken as a result of the complaints
ES-09	Ecosystem Services	Influx of people and livestock to water off-take points on grazing/browsing for livestock, wild foods, medicinal plants, biomass fuel, and wood and fibre.	Operation	The Operator will develop influx management procedures to manage speculative influx occurring during Project operation. Procedures will be developed in coordination with County Governments and the respective County Commissioners. (SOC – 25).	The Operator	Evidence of Influx management (SOC-25) Evidence of implementation of livestock grazing support

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				The Operator will maintain culturally appropriate livelihood restoration support aimed at improving livestock grazing livelihoods for users of communal land in Project affected areas during operation. The Operator will have a policy of "*zero tolerance*" for hunting, foraging, unpermitted use of natural resources within the Project AoI applicable to all employees and contractors. Livelihood restoration measures will continue to be developed in consultation with affected communities, stakeholders, County Government and National Government throughout the operation of the Project to ensure that they meet the needs of households and communities and fit with local priorities and other government support initiatives. The Operator will minimise the use of land acquired by GoK such that only land required for Project Facilities is used exclusively by the Project, (i.e., with access restricted by security fencing). This will mean that existing land users will be able to continue use of gazetted land until and unless it is required.		for users of communal land in Project affected areas. Grievance register logging any complaints received, including a record of the investigation and/or remedial actions taken as a result of the complaints. Evidence of training of staff in relation to hunting and foraging restrictions. Evidence of active enforcement of the "*zero tolerance*" approach. Evidence of training of staff in cultural awareness. Records of communication with affected communities, stakeholders, County Government and National Government regarding continued development of restoration measures.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				The Operator will continue to consult with Project Affected Communities during project operation to identify areas of acute resource pressure and record issues as part of its Grievance Management Procedure. **Repeated Mitigation – Ecosystem Services 05 – Grievance Management Procedure.**		
ES-10	Ecosystem Services	Presence of Project in landscape impacting on spiritual values, and educational and inspirational values.	Operation	The Operator will continue to consult with Project Affected Communities and site guardians to monitor the effectiveness of procedures in place to manage culturally sensitive locations. Cultural Awareness Training will continue to be implemented for all site staff / contractors as part of the Project site induction process during operation. Full mitigation will only be possible when the facility is decommissioned and the site rehabilitated. **Repeated Mitigation – Ecosystem Services 05 – Grievance Management Procedure.**	The Operator	Grievance register logging any complaints received, including a record of the investigation and/or remedial actions taken as a result of the complaints. Evidence of training of staff in cultural awareness.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
ES-11	Ecosystem Services	Presence of Project in landscape, changes in the visual aesthetics and sense of place.	Operation	Cultural Awareness Training will continue to be implemented for all site staff / contractors as part of the Project site induction process for all field-based staff during operation. Full mitigation will only be possible when the facility is decommissioned and the site rehabilitated. **Repeated Mitigation – Ecosystem Services 05 – Grievance Management Procedure.**	The Operator	Evidence of training of staff in cultural awareness. Grievance register logging any complaints received, including a record of the investigation and/or remedial actions taken as a result of the complaints.

Table 9.3-9: Social

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
SOC – 01	Social	Project induced Influx and in-migration leading to economic opportunities Indirect effect of increased salaried employment and procurement.	Construction	Prior to start of construction, the Operator will work with National Government, County Administration and key stakeholders to support the monitoring of population changes in key settlements (Lokichar, Nakukulas, Lokori) to identify significant changes in population. Prior to start of construction, the Operator will also develop a methodology to monitor growth of homesteads and physically monitor numbers and location of homesteads in the immediate areas surrounding Project facilities. Monitoring data will be gathered for up to 3 years and used to identify in-migration “hot spots” and develop appropriate mitigation options. The Operator will determine thresholds for action should they be exceeded to reduce the impacts of population influx. The approach to in-migration management will be linked with other social performance activities relating to Community Health, Local Content and Security. The Operator will work with National Government, County Administration and key stakeholders to establish and develop the terms of reference	The Operator is responsible for planning and coordination with County and National Government. The EPC Contractor is responsible for implementing requirements relating to employment. The Operator will assure implementation. The Operator will develop the Code of Conduct and Local Content Development Plan, which will be implemented by the EPC Contractor. The Operator will assure implementation.	Evidence of support to population change monitoring and communications with National Government, County Administration and key stakeholders Evidence of methodology and homestead growth monitoring, including monitoring reports, identification of in- migration hotspots, thresholds for action and appropriate mitigation Generation of ToR for influx working group and collation of working group meeting records clearly stating actions, timeframes and review process for agreed influx mitigation and monitoring. Evidence of communication with Turkana County Administration relating to locations for alternative water supply boreholes and a record of the agreed water

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				for an Influx working group, which will be chaired by a representative of county government and will include representatives from National and County government departments, and relevant CSOs. The Operator will sit as a member on the working group. The aim of the group will be to review, monitor and support actions to manage Project-induced influx. The Operator will work with Turkana County Administration to identify locations for alternative water supply boreholes away from Project facilities to encourage households to move to other, less congested, locations. Incentive reduction for in-migration, will be communicated broadly in the region. Key principles and contractor requirements include: ▪ No informal ("at the gate") recruitment; and ▪ Clear definitions and criteria will be established for hiring of "local" and "local-local" workers, including a verification process to confirm their residency status.	The Operator will develop requirements relating to retrenchment. The EPC Contractor will implement the requirements. The Operator will assure implementation.	supply alternatives and agreed actions. Signed employee training records to demonstrate completion of code of conduct training. Written definition and criteria for what "local" and "local-local" workers and evidence of its communication regionally. Evidence of communication that there will be no at the gate recruitment Employee records to confirm residency status. Evidence, including meeting records of communication of Local Content Development Plan and Workforce Training Strategy. Employment contracts will contain information on the length of employment and redundancy arrangements.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				Repeated Mitigation – Social 01 – The Operator Code of Conduct: The Operator will train all employees and contractor workers in the Code of Conduct, including worker rights and human rights, in line with the commitment to implement the UN Guiding Principles on Business and Human Rights and the Voluntary Principles on Security and Human Rights (Voluntary Principles) **Repeated Mitigation – Social 02 – Local Content Development Plan and Workforce Training Strategy Communication:** The Operator will undertake a campaign to communicate the Local Content Development Plan and Workforce Training Strategy to stakeholders. This will explain local employment and local content opportunities. It will also describe the recruitment procedures to be followed. The campaign will focus efforts on priority groups and communities identified in the Local Content Development Plan as		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				coming from target communities for employment. **Repeated Mitigation – Social 03 – Contractor Demobilisation:** The Operator will undertake advance planning and management of retrenchment and demobilisation of Project and contractor workers in line with Kenyan Labour Law and international good practice. Contractor demobilisation requirements will include the following: ■ Any Collective Redundancies will be undertaken within the framework of a Retrenchment Plan (as described in the Operator Social Performance Plan). ■ At the time of hiring, the period of employment assignment and the conditions for hiring and layoff will be clearly explained to the new recruits and recorded in individual employment contract; and		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				■ The Operator will establish company retrenchment procedures and contractor demobilisation procedures including returning workers to the place from where they were recruited or to their domicile.		
SOC - 02	Social	Additional infrastructure and activities relating to the Project.	Construction	Prior to construction, the Operator will work with National Government, County Administration and key stakeholders to agree on the terms of reference and projects for community investment, building on existing initiatives, as part of the CDP, aligned to County Integrated Development Plans. Although the focus will be on communities in Turkana County, there will be two CDPs (one for Turkana and one for West Pokot) which will clearly define all voluntary actions the Operator will take for social investment in community projects. The Operator will establish an engagement process to consider and agree social investment proposals. The Operator will instigate CDP working groups, which will be headed by leadership at the County and Sub-county level, including representatives of	The Operator	Evidence of engagement with National Government, County Administration and key stakeholders to agree on the terms of reference and projects for community investment. Generation of CDPs for both Turkana and West Pokot, including written ToRs for community investment, clear guidelines on criteria for investment and a list of agreed projects for potential investment stating timeframes and the plan to execute. Records of communication of the criteria for community investment

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				government departments, private sector, NGOs and potentially religious institutions. The Operator will engage with this CDP working group to develop a transparent process, through which they can communicate concepts and align annual budgets to be considered for social investment. The CDPs will provide clear guidelines for, and present how the Operator will support the development of the following: ■ Required criteria to be met and structure of proposals for social investment projects, including how they supplement (and don't replace) existing initiatives that are provided by the County Administration or National Government. ■ Evidence of engagement with local stakeholders required for The Operator to consider social investment proposals. ■ Definition of how the local community, including underrepresented groups, vulnerable and marginalised people, will benefit from social		Evidence of attendance at and minutes of CDP working group meetings. Grievance register logging any complaints received relating to social investment, including a record of the investigation and/or remedial actions taken as a result of the complaints Publication of CDP and evidence of revision checks and updates Evidence of encouragement of sustainable use of community water offtake points Grievance register logging any complaints received relating to sustainable use of community offtakes, including a record of the investigation and/or remedial actions taken as a result of the complaints

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				investment projects. The planned distribution of CDP projects throughout the local community should be documented to avoid inter-area competition. ■ Definition of the “ownership“ model of proposed social investment projects, key performance indicators and success criteria. ■ Method of tracking successful implementation and delivery of the investment projects. ■ How performance will be communicated annually in sustainability reports and to County governments. ■ Required methods of communication and mandatory information to be provided (e.g., period of funding, amount, project type) to local communities once investment projects have been agreed.		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				■ Expected sustainability, governance, auditing and monitoring throughout the investment projects and required reporting format. **Repeated Mitigation – Social 04 – CDP Availability and Update:** The Operator CDP will be publicly available and updated in timely fashion with agreed social investment projects. The Operator will present how investment projects distribute benefits transparently and fairly among affected communities, how the investment projects mitigate Project-induced in-migration. **Repeated Mitigation – Social 05 – Sustainable use of Community Offtakes:** The Operator commits to seek opportunities to encourage sustainable use of community offtake water points on the water pipeline to discourage overgrazing at water off take points, via the Upstream Water Framework Agreement, and collaboratively address issues submitted through		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				the Grievance Management Procedure.		
SOC – 03	Social	Tax and other payments linked to Project.	Construction	**Repeated Mitigation – Social 06 – Taxes and Payments:** The Operator will conduct periodic engagement on the Social Performance Plan, including the CDPs, with relevant County-level board of trustees[3].	The Operator is responsible for disclosure of taxes paid in annual reports.	Disclosure of financial information. Evidence of engagement with the County-level board of trustees on the Social Performance Plan and the CDPs.
SOC – 04	Social	Contractor managed construction and employment opportunities.	Construction	The National Content Development Plan and Local Content Development Plan will be issued to prospective EPC tenderers who will be required to prepare Contractor National and Local Content Development Plans to implement the Operator requirements. The Operator National Content Development Plan and Local Content Development Plan will set out specific objectives, procedures and requirements related to contractor employment and procurement, Key Performance	The Operator is responsible for preparing the policies and Plans. The EPC Contractor is responsible for implementing requirements of the policies and Plans. The Operator is responsible for assuring	Evidence of issue of National and local Content Development Plans to EPC tenders. Production of a Workforce training Strategy. implementation plan and communication strategy. Quarterly contractor employment data reporting. Evidence of communication of Local Content

[3] A County-level board of trustees is described in the Petroleum Act as the body that will oversee the utilisation of funds levied from oil and gas operations "*for the benefit of present and future generations*".

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				Indicators (KPIs) for national and local content inclusion and performance requirements, minimum requirements and expectations for contractor employment, monitoring and audit of contractor managed construction and employment opportunities and requirements relating to contractor employment for EPC bidders to include in their National Content Development Plans. The Operator will develop a Workforce Training Strategy and associated Implementation Plan, which will describe how the Operator, and their contractors will: ■ Define how local residents from the Project Area of Influence will be given preference for vocational training; ■ Collaborate with selected training partners to develop a range of bridging /job-readiness training packages for potential local employees.	implementation by EPC Contractor of the policies and Plans.	Development Plan regionally. Employment contracts stating length of contract/ employment. Employee induction records. Public disclosure of Human Rights policy.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				■ Support existing technical and vocational training programmes to enhance the qualifications and training of local workers ■ Ensure all employment opportunities will be open to both men and women on an equal basis and how this will be tracked to determine if there are barriers to be addressed. ■ Assist members of the local workforce, who are less qualified, with gaining access to existing technical and vocational training programmes (e.g., a programme available to support basic training, literacy, numeracy and Health and safety). The Local Content Development Plan will define the following, adherence to which will be mandatory for all contractors: ■ There will be no informal ("at the gate") recruitment;		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				■ Procedures for the hiring of unskilled and low-skilled workers for local residents in the Project Area of Influence, and for workers likely to travel to the project on a speculative basis in search of work; ■ Definitions and criteria will be established for hiring of "local" and "local-local" workers; ■ Procedures describing that there will be "*zero tolerance*" for any form of discrimination based on sex, gender, age, religion, ethnicity and disability; ■ Procedures describing that there will be "*zero tolerance*" for hunting, foraging, unpermitted use of natural resources within the Project AoI; ■ All contractors will track and report quarterly Contractor Employment data by gender; and ■ Adoption of the Grievance Management Procedure.		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				Repeated Mitigation – Social 02 – Local Content Development Plan and Workforce Training Strategy Communication, **Repeated Mitigation – Social 03 – Contractor Demobilisation.** **Repeated Mitigation – Social 07 – Human Rights Policy:** The Operator will state its commitment to implement the UN Guiding Principles on Business and Human Rights and the Voluntary Principles on Security and Human Rights (Voluntary Principles). This Policy will be publicly disclosed and will be applicable to all who work for or on behalf of the Operator. The Local Content Development Plan will include details of how the Human Rights Policy will be implemented and monitored including explicit detail on the Operator and contractor's compliance with ILO Core Conventions, including child labour and forced labour.		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
SOC – 05	Social	Procurement opportunities linked to the Project – business opportunities and local content.	Construction	Objectives, procedures and requirements will be stated related to business opportunities and procurement, KPIs for national and local content inclusion and performance requirements, minimum requirements and expectations for suppliers, monitoring and audit of the Operator and contractor managed procurement. The Operator will also set out requirements relating to procurement for EPC bidders and will be included in their Local Content Development Plans The Operator will undertake a campaign to communicate Local Content Development Plan to local suppliers and businesses. The communication campaign will explain local procurement opportunities and how to qualify for tendering processes, including procurement opportunities with contractors and length of contracts. It will also describe the procurement procedures to be followed.	The Operator is responsible for preparing the policies and Plans. The EPC Contractor is responsible for implementing requirements of the policies and Plans. The Operator is responsible for assuring implementation by EPC Contractor of the policies and Plans.	Evidence of communication of local Content Development Plan to local suppliers and businesses. Audits of Project related procurement. Monitoring reports for changes to business opportunities and local content performance. Evidence of local capacity building including assistance to access existing training n programmes.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				The Operator and its contractors will: - collaborate with local businesses to assess and develop local business capacity; - set out commitments for local business capacity building, including assisting local businesses to gain access to existing technical and vocational training programmes; - ensure all procurement for the project will be transparent and on an equal basis; and - identify key performance indicators to monitor changes in business opportunities and local content performance.		
SOC – 06	Social	Indirect effect of increased salaried employment and procurement on inflation.	Construction	The Operator will coordinate with the NDMA to collect data similar, but supplementary, information to NDMA monthly surveys on socio-	The Operator	Evidence of communications with NDMA. Reporting of monthly socio-economic monitoring results and proposed interventions.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				economic indicators throughout the construction period. The Operator will review data on a quarterly basis with County Administration to identify local Project-induced price inflation.		Evidence of quarterly reviews undertaken with County Administration.
SOC – 07	Social	Long term loss of community land due to land acquisition to develop the facilities required for the Project.	Construction	Prior to construction, the RLRP will be disclosed publicly and will be maintained throughout the construction process. The RLRP will set out: - Procedures for Government-led land acquisition in line with national statutory land acquisition processes set out in Kenyan law. GoK will acquire the Project Land and act as landlord to the Project. - The Project's timing and description of the supplemental activities and entitlements that will assist relocation of households, businesses and institutions and meet international standards (IFC Performance Standard 5). - How the GoK data gathering processes, valuation methodologies, compensation rates, engagement processes with affected persons,	The Operator	Public disclosure of RLRP following FID. Public disclosure of final categorisation of supplemental entitlements. Audits of project land use to ensure minimisation. Evidence of baseline surveys to establish socio-economic characteristics of affected households and identification of particularly vulnerable persons, plus evidence of engagement with these parties. Public disclosure of agreed supplemental entitlements
SOC – 08	Social	Temporary land restrictions on land use - notably pastoral grazing and settlement access, during construction, to develop the facilities required for the Project.				
SOC – 09	Social	Land acquisition to develop the facilities required for the Project - Loss of occupied homesteads (physical displacement).				
SOC – 10	Social	Land acquisition to develop the facilities required for the Project - Loss of household structures other than homesteads, e.g.				

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
		animal shelters or dug water holes.		businesses, institutions and communities, including agreement of statutory compensation by Project-affected households. ▪ How GoK compensation and the statutory 15% disturbance allowance equates to "full replacement cost". ▪ How the Operator will provide supplemental assistance, on a voluntary basis, to physically displaced households, businesses and institutions, who meet pre-agreed assistance criteria. This will include relocation assistance from Project affected areas including transport assistance, transitional support and additional assistance to particularly vulnerable households. ▪ The criteria for defining particularly vulnerable and marginalised households. The Operator will be responsible for identifying and providing supplementary assistance to vulnerable and marginalised households in line with IFC Performance Standards. ▪ The monitoring and evaluation process to assess the		
SOC – 11	Social	Land acquisition to develop the facilities required for the Project - Loss of business structures – shops.				

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				effectiveness of measures to restore livelihoods and the proposed independent auditing. The Operator will minimise use of the land acquired by GoK such that only land required for Project Facilities is used exclusively by the Project, (i.e., with access restricted by security fencing). This will mean that existing land users will be able to continue use of gazetted land until and unless it is required. Following GoK data gathering processes and prior to implementation of resettlement and livelihood restoration activities, The Operator will supplement data with additional baseline surveys as required to establish the socio-economic characteristics of affected households and identify particularly vulnerable persons. Additional engagement with particularly vulnerable people affected by the project will facilitate the definition of supplemental entitlements to assist relocation and ensure access to and effective delivery of livelihood restoration.		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				Operator led supplementary activities will be carried out in a culturally appropriate way and in consultation with affected stakeholders. Supplementary entitlements will be recorded in a supplemental entitlements schedule to be provided to affected households, businesses and institutions separately to the statutory Compensation and Awards Schedule provided by the GoK process. Final categorisation of supplemental entitlements will be disclosed publicly.		
SOC - 12	Social	Land acquisition to develop the facilities required for the Project - Temporary loss of access to or use of TCG operated community water tanks.	Construction	If Project activities and infrastructure lead to a need to relocate community water points, County Government, local stakeholders and communities will be engaged to discuss and plan the relocation of community water tanks to suitable locations. Key elements of this approach will include: ▪ Equivalent water supplies will be provided to water users of existing community water points that require relocation. ▪ Prior to commencement of construction, baseline surveys will be completed to establish	The EPC Contractor is responsible for implementation of the mitigation. The Operator is responsible for consultation with County Government and for assurance of implementation of mitigation.	Evidence of engagement relating to community water point relocation. Evidence of which equivalent water supplies provided to affected people. Development of water supply monitoring procedure and action levels. Monitoring reports for water users, access to alternative supplies and adequacy of alternative supplies.
SOC – 13	Social	Land acquisition to develop the facilities required for the Project - Increased travel/ walking distances to TCG operated community water tanks.				

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				the water requirements and ensure that alterative water supplies are appropriately sized to meet community water demand. ■ A monitoring and evaluation process will be developed to assess the effectiveness of measures to maintain water supplies and the triggers for action to take place if the measures have not been effective. ■ Affected households will be monitored to ensure that affected water users are able to access the alternate water supply.		
SOC – 14	Social	Land acquisition to develop the facilities required for the Project - Impacts on livelihoods due to loss of communal land (economic displacement).	Construction	**Repeated Mitigation – Social 08 – Livelihood Restoration Support for Livestock Grazing:** The Operator will provide culturally appropriate livelihood restoration support aimed at improving livestock grazing livelihoods for users of communal land in Project Affected Areas. Livelihood restoration measures will be developed in	The Operator	Evidence of consultation with stakeholders in project affected areas. Evidence of livelihood restoration measures agreed with County Administration and GoK, including a programme and dates for completion, and

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				consultation with affected communities, stakeholders, County Administration and GoK to ensure that they meet the needs of households and communities and fit with local priorities and other government support initiatives.		definition of success criteria for implementation.
SOC-15	Social	Land acquisition to develop the facilities required for the Project – impact on graves.	Construction	Mitigation is provided in CH-06	The EPC Contractor will be responsible for implementation. The Operator is responsible for assuring implementation.	Procedures for identification of graves (CH -06).
SOC – 16	Social	Introduction of outside workforce, financial incentives for vulnerable persons, and transport for Project construction - Sexually transmitted infections.	Construction	**Repeated Mitigation – Social 09 – Sexually Transmitted Infections:** Procedures for the development, implementation and maintenance of mitigation measures relating to Community Health Safety and Security, including the establishment and maintenance of a Community Health Information System (CHIS). These procedures will include: ■ Implementation of a HIV Policy and Programme for all	The Operator will develop the Community Health Information System. The EPC Contractor is responsible for implementing any requirements where they	Evidence of audits relating to employee and subcontractor compliance with HIV Policy. Employee training records for code of conduct training.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				employees and requirements for Contractors to adhere to the Operator HIV Policy and Programme; ■ Development and implementation/ maintenance of a "*95-95-95*" strategy, which sets targets for awareness, treatment and demonstrating performance in viral suppression; ■ Operation of all construction accommodation as "*closed camps*"; ■ All employees and contractor workers will be trained in the Code of Conduct; ■ Providing training to all drivers (including contractors) on pre-designated routes and ensuring transport rest stops will have been surveyed and approved; ■ KPIs relating to Community Health and Safety and how KPIs will be monitored through the CHIS; and	relate to contractor personnel. The Operator is responsible for assuring implementation of mitigation.	Employee training records for driver training. Audit and approval reports for rest stops. Employee records for medical fitness to work. Generation of CDPs for both Turkana and West Pokot, including written ToRs for community investment, clear guidelines on criteria for investment and a list of agreed projects for potential investment stating timeframes and the plan to execute. Evidence of consultation/ communication of the criteria for community investment and potential community health programmes with

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				■ Medical Fitness to Work requirements for all workers and contractors. Prior to construction, the Operator will work with National Government, County Administration, key stakeholders to agree on the terms of reference for investment in Community Health programmes as part of the CDPs, aligned to County Integrated Development Plans. The Operator will build on existing social investment for specific Health Systems Strengthening activities in areas at higher risk for HIV transmission due to Project impacts. **Repeated Mitigation – Social 04 – CDP Availability and Update.**		stakeholders, County Administration and GoK. Evidence of CDP Working group records and minutes.
SOC – 17	Social	Alteration of the physical environment - Vector related diseases.	Construction	The following procedures will be developed: ■ Establishment and implementation of Malaria Management procedures; ■ All construction camps will provide first aid / and first aiders and health clinics or paramedic services for workers;	The Operator will develop the Community Health Information System. The EPC Contractor is responsible for implementation of mitigations.	Evidence of a functioning Community Health Information System. Employee training records malaria training. Employee training records/ qualifications for first aid/ medical.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				■ Establish and implement KPIs for Project related impacts under the CHIS, in collaboration with authorities in Turkana and West Pokot Counties; and ■ The Operator will monitor KPIs through the CHIS.	The Operator is responsible for assuring implementation of mitigations.	Evidence of audits of construction camp medical facilities. Production of vector related disease KPIs and monitoring of performance against KPIs.
SOC – 18	Social	Introduction of outside workforce and transport for Project construction - Communicable diseases.		Sufficient capacity will be provided in accommodation facilities to prevent overcrowding and to ensure that all Project-related workers are accommodated in camps and not in local communities. Procedures relating to Community Health Safety and Security will be developed and will include: ■ Camp cleanliness and hygiene requirements; ■ The operation of all construction accommodation as "*closed camps*"; and ■ All construction camps will provide first aid / and first aiders and health clinics or paramedic	The Operator will develop the Community Health Information System. The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of audits of camp cleanliness and hygiene. Employee training records/ qualifications for first aid/ medical. Evidence of audits of construction camp medical facilities. Employee training records for code of conduct training. Employee records for medical fitness to work. Evidence of waste management audits.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				services for workers, including provision for management of snake and scorpion bites. **Repeated Mitigation – Social 01– The Operator Code of Conduct:** ■ Maintain Medical Fitness to Work procedures for all workers and contractors. ■ Establish and maintain effective waste management procedures. ■ Align food hygiene programmes with good industry practice standards and monitor performance. ■ Establish and implement an Infectious Disease Health Policy and Programme (particularly related to HIV and TB) and establish KPIs under the CHIS, in collaboration with authorities in Turkana and West Pokot Counties.		Employee training records for food hygiene. Evidence of food hygiene audits. Production and communication of a Pandemic Preparedness Plan (including Covid). Generation of ToR and identification of projects for investment in Community Health programmes as part of the CDPs. Production of communicable disease KPIs and records of monitoring of performance against KPIs.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				■ Establish and implement a Pandemic Preparedness Plan (including Covid). ■ Monitor KPIs through a CHIS. Following FID and prior to construction, the Operator will coordinate with the respective County Administrations and agree on the terms of reference and projects for investment in Community Health programmes as part of the Community Develop Plan (CDP)s, aligned to County Integrated Development Plans. The Operator will provide social investment to specific Health Systems Strengthening activities in areas at higher risk for Communicable disease transmission due to Project impacts. **Repeated Mitigation – Social 04 – CDP Availability and Update.**		
SOC – 19	Social	Waste from Project activities – Zoonotic diseases.	Construction	**Repeated Mitigation – Social 10 - Zoonotic Diseases:** Procedures will be developed for the implementation (maintenance during operations) of Pest Control procedures for the landfill and other Project facilities	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for	Evidence of implementation of pest control methods and activities.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
					assuring implementation of mitigation..	
SOC – 20	Social	Transport for Project construction - Accidents and injuries.	Construction	Procedures will be developed for transport management to mitigate impacts relating to Community Health Safety and Security. The transport management system will include the following requirements: **Repeated Mitigation – Social 01– The Operator Code of Conduct** - Minimum safety and equipment standards for Project vehicles including maintenance in accordance with Manufacturer recommendations and through regular scheduled maintenance. - There will be regular safety audits of all project vehicles, and rectifying actions should any non-conformance be identified. - All drivers of Project vehicles will be required to hold a valid driver's licence.	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Employee training records for code of conduct training. Vehicle maintenance records. Vehicle safety audit reports and remedial actions. Records of employee driver training, documentation and auditing of driver standards. Maintenance records for vehicle cameras. Maintenance records for vehicle audible alarms. Evidence of speed limit signage. Records of approvals for night- time driving.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				■ All drivers will meet the Operator driver standards and international standards as set out in IOGP Land Transport Safety Recommended Practice 365. A training needs assessment of Contractor drivers will be undertaken by the Operator and the Contractor, and a training plan will be agreed with the Operator and implemented as required. ■ All vehicles will be fitted with inward and outward facing cameras to monitor driver performance and external hazards. ■ Audible reversing alarms and other safety devices shall be fitted and maintained in good working order on all contractor vehicles. ■ Project speed limits to be established and complied with by all Project vehicles. ■ Signage will be installed, in coordination with County		Records relating to JMP requests and approvals Transport route survey reports. Production of Hazard Identification and Mitigation booklet. Evidence of Community Safety Outreach Programme and record of engagement activities. Production and implementation of emergency response plan. Production of traffic management KPIs and monitoring of performance against KPIs. Documentation relating to any grievances received and responses.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				Administration, to draw driver's attention to specific hazards along approved routes. ■ Night-time driving will be prohibited unless specifically authorised. ■ Off-road driving will be prohibited. ■ Guidelines for wet weather driving and training will be provided to all drivers. ■ A Journey Management Plan will be prepared by the Contractor for all heavy vehicle convoy journeys, submitted to, and approved by, the Operator prior to each convoy. ■ All transport routes will be surveyed and a Hazard Identification and Mitigation booklet will be developed for the principal routes. All significant hazards are detailed in the book including a photograph and mitigation measure, e.g., reduction in		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				speed. Coordinates for hazards will be linked with vehicle GPS systems to provide driver with advanced warning of approaching hazards. ■ All drivers and co-drivers will be provided with the Hazard Identification and Mitigation booklet and trained in how to use it. ■ A Community Safety Outreach Programme will be developed and implemented to inform local communities of vehicle related hazards along Project in-field transport routes. In particular, schools along transport routes will be identified and will be engaged as part of a Schools Safety Outreach Programme, led by the Operator. ■ A Project Emergency Response Plan will be prepared identifying procedures should an incident occur and how to manage and minimise any		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				consequences of a road traffic accident. - The Operator will monitor key performance indicators relating to traffic management and potential effects, grievances and improvements will be monitored.		
SOC – 21	Social	Infrastructure affecting movement of pastoralists, indirect impact of in-migration - Change in access to education.	Construction	Based on previous social investment related to education, the Operator will develop a strategy for future social investment in education for project affected people. The Operator will develop a monitoring and evaluation process to assess the effectiveness of measures to maintain access to education and the triggers for action to take place if the measures have not been effective.	The Operator	CDPs to include written ToRs for investment in education, clear guidelines on criteria for investment and a list of agreed projects for potential investment stating timeframes and the plan to execute. Monitoring reports relating to access to education and triggers for remedial actions.
SOC – 22	Social	Indirect effect of increased salaried employment and procurement - Crime, commercial sex work and other nuisances from growth.	Construction	Prior to construction, the Operator will work with National Government, County Administration and key stakeholders to agree on the terms of reference and projects for investment to support information programmes that seek to identify and provide support for key social	The Operator	Evidence of engagement activities to agree terms of reference for support to social maladies. Employee training records for code of conduct training.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				maladies (e.g., gender-based violence, drug and alcohol abuse). Such programmes will be aligned to County Integrated Development Plans. Requirements relating to mitigation of Social Maladies will include: **Repeated Mitigation – Social 01– The Operator Code of Conduct:** ■ Influx management procedures to manage speculative influx. Procedures will be developed in coordination with Turkana and West Pokot Governments and the respective County Commissioners. ■ Establishing KPIs relating to Social Maladies relating to the Project in coordination with the respective County Administrations. ■ Monitor KPIs through the CHIS.		Evidence of engagement with Turkana and West Pokot Governments and the respective County Commissioners to develop speculative influx management. Production of social maladies KPIs and monitoring of performance against KPIs.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
SOC – 23	Social	Project operating in region with history of inter-ethnic violence and raiding - Inter-ethnic conflict.	Construction	**Repeated Mitigation – Social 07 – Human Rights Policy** **Repeated Mitigation – Social 11– Inter Ethnic Conflict and Security:** Requirements for mitigation measures relating to Inter Ethnic conflict and security will include: ■ All transportation activities will be undertaken under the advice of the Police. If the Police advise that security escorts are required to support the movement of vehicles, security will be provided by the Police and will be under the control of the Police at all times.; ■ Liaison with the National Police Forces on at least a weekly basis to obtain briefings on regular monitoring by the Police of security incidents, including vandalism, crime, cattle raiding and inter-communal clashes; ■ An Incident Reporting System will be maintained for monitoring of security incidents;	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Public disclosure of Human Rights policy. Evidence communication with Police regarding security escorts and weekly briefings. Evidence of establishment and use of Incident Reporting System. Publication of results of risk assessment and measures taken to minimise impacts. Regular auditing of social performance to confirm measures relating to security are adhered to.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				■ Risk assessments will be undertaken to identify potential impacts and risks to communities, and identify opportunities for the Project to minimise sources of potential grievance and insecurity as an inadvertent consequence of its activities; ■ A suitably licenced and experienced security company will be engaged, working to recognised international standards, to provide and manage trained guards for access control and security within its fenced locations; ■ If the National Police advise that security escorts are required to support the movement of vehicles, security will be provided by the Police and will be under the control of the Police at all times; ■ All guards engaged will be un-armed;		

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				■ Engagement with the National Police Force will be in line with Kenyan regulatory requirements to ensure the criteria on which security services are deployed are clearly understood; ■ All security outside fenced locations will be provided by the National Police force and they will not be under the control or direction of the Operator; and ■ Security training will be established and maintained for all employees, contractors and visitors during induction.		
SOC – 24	Social	Introduction of outside workforce - Community cohesion within Turkana and West Pokot County.	Construction	**Repeated Mitigation – Social 12– Community Cohesion within Turkana and West Pokot County:** The Operator will work with National Government, respective County Administrations and key stakeholders relating to community cohesion, to inform management of influx, social maladies, security and community health and safety.	The Operator	Evidence of Operator working with National Government, respective County Administrators and key stakeholders to support management of community cohesion. Evidence of community engagement and messaging in relation to project employment,

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				Procedures will be developed to coordinate messaging on project employment, recruitment and hiring and will describe how regular community engagement outreach will be maintained to address rumour and other misunderstandings identified through regular engagement. The Operator Community Liaison teams will comprise experienced qualified staff, who are well trained in community relations and maintain links with traditional leadership throughout the project affected areas and maintain a comprehensive understanding of key cultural sensitivities		recruitment and hiring procedures. Evidence of Community Liaison team activities.
SOC – 25	Social	Economic opportunities linked to a multi-billion investment. Indirect effect of increased salaried employment and procurement - Project-induced influx and in-migration.	Operation	The Operator will maintain influx management procedures established during construction, which were agreed in coordination with Turkana and West Pokot County Administrations. The Operator will work with National Government, County Administration and key stakeholders to support the monitoring of population changes in key settlements (Lokichar, Nakukulas, Lokori). The Operator will work with the relevant county and	The Operator	Publication of influx management procedures in the Operator Social Performance Plan. Regular auditing of social performance to confirm influx management procedures being implemented. Reporting of population change monitoring.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				national administrations to monitor growth and location of homesteads in the immediate areas surrounding Project facilities and enact actions to manage influx. The Operator will attend the Influx working group. The Operator will implement the Local Content Development Plan and Workforce Training Strategy to reduce incentives for in-migration. **Repeated Mitigation – Social 01– The Operator Code of Conduct** **Repeated Mitigation – Social 02 - The Operator Local Content Development Plan and Workforce Training Strategy Communication** The Operator will undertake a campaign to communicate operational requirements under the Operator Local Content Development Plan.		Evidence of attendance at meetings on the Influx working group. Regular auditing of social performance to confirm Local Content Development Plan and Workforce Training Strategy are being implemented. Employee training records for code of conduct training. Evidence of communication of Local Content Development Plan.
SOC –26	Social	Additional infrastructure and activities – Infrastructure.	Operation	The Operator will coordinate with County Administrations, in line with the Community Develop Plan (CDP), aligned to the County Integrated Development Plan.	The Operator	Evidence of coordination with County Administrations.

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				Repeated Mitigation – Social 04 – Operator CDP Availability and Update. The Operator will communicate social investment projects annually in sustainability reports publicly. The Operator will continue to meet sustainability, governance, auditing and monitoring requirements described in the CDP. **Repeated Mitigation – Social 05 – Sustainable Use of Community Offtakes**		Publication of CDP and evidence of revision checks and updates. Evidence of sustainable use of community water offtake points. Evidence of any grievances received and responses. Publication of details of social investment projects in annual sustainability reports. Evidence of continued adherence to sustainability, governance, auditing and monitoring requirements described in the CDP.
SOC – 27	Social	Tax and other payments linked to Project - Taxes and payments.	Operation	**Repeated Mitigation – Social 06 – Taxes and Payments**	The Operator	Disclosure of financial information. Evidence of engagement with the County-level board of trustees on the Social Performance Plan and the CDPs.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
SOC – 28	Social	Contractor or third-party workers during operations – employmen.t	Operation	The Operator will maintain procedures and requirements related to contractor employment and procurement, KPIs for national and local content inclusion and performance requirements, minimum requirements and expectations for contractor employment, monitoring and audit of contractor managed construction and employment opportunities. **Repeated Mitigation – Social 01 – The Operator Code of Conduct.** **Repeated Mitigation – Social 02 – The Operator Local Content Development Plan and Workforce Training Strategy Communication.** **Repeated Mitigation – Social 07 – Human Rights Policy**	The Operator	Publication of Operator National Content Development Plan and Local Content Development Plan. Regular auditing of social performance to confirm measures in Operator National Content Development Plan and Local Content Development Plan are being implemented. Employee training records for code of conduct training. Evidence of communication of Local Content Development Plan. Public disclosure of Human Rights policy.
SOC – 29	Social	Procurement opportunities linked to the Project - Business opportunities and local content.	Operation	The Operator will maintain procedures and requirements related to business opportunities and procurement, KPIs for national and local content inclusion and performance requirements,	The Operator	Evidence of audits the Operator Local Content Development Plan. Evidence of communication campaign prior to operations regarding

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				minimum requirements and expectations for suppliers, monitoring and audit of the Operator and contractor managed procurement. Prior to commencement of operations, the Operator will undertake a campaign to communicate operational requirements for local suppliers and businesses. The communication campaign will explain local procurement opportunities and procedures to be followed.		operational requirements for local suppliers and businesses.
SOC – 30	Social	Indirect effect of increased salaried employment and procurement – Inflation.	Operation	At the commencement of operations, the Operator will review inflation monitoring established during construction to inform ongoing management and mitigation for operations. Inflation monitoring will continue during the initial period of operations (3 years), thereafter alternative monitoring may be sought based on the review if considered necessary. The Operator will continue to coordinate with NDMA to collect data similar, but supplementary, information to NDMA monthly surveys on socio-economic	The Operator	Reporting of monitoring results and proposed interventions.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				indicators throughout the operational period.		
SOC – 31	Social	Land acquisition to develop the facilities required for the Project - Loss of occupied homesteads (physical displacement).	Operation	The Operator will continue monitoring and evaluation of the implementation of the RLRP to assess the effectiveness of measures to restore livelihoods. The Operator will complete or commission a completion audit (initially after 1 year, in line with IFC requirements) to confirm that livelihoods have been restored to pre-Project levels as a minimum.	The Operator	Regular reporting on RLRP implementation. Evidence of audit of livelihood restoration and publication of completion audit results (after 1 year).
SOC – 32	Social	Land acquisition to develop the facilities required for the Project- Impacts on livelihoods due to loss of communal land (economic displacement).	Operation	**Repeated Mitigation – Social 08 – Livelihood Restoration Support for Livestock Grazing**.	The Operator	Evidence of consultation with stakeholders. Evidence of communication with County Administration and GoK.
SOC – 33	Social	Introduction of outside workforce, financial incentives for vulnerable persons, and transport for Project construction - Sexually transmitted infections	Operation	**Repeated Mitigation – Social 09 – Sexually Transmitted Infections:** The Operator will continue providing social investment to specific Health Systems Strengthening activities in areas at higher risk for HIV transmission due to Project impacts.	The Operator	Evidence of audits relating to employee and subcontractor compliance with HIV Policy. Employee training records for code of conduct training.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
						Employee training records for driver training. Audit and approval reports for rest stops. Employee records for medical fitness to work. Evidence of consultation/ communication with stakeholders, County Administration and GoK on community health programmes. Evidence of CDP Working group records and minutes.
SOC – 34	Social	Alteration of the physical environment - Vector related diseases.	Operation	Prior to operations all procedures and objectives relating to vector related diseases will be reviewed, in light of construction phase monitoring. Updated procedures will include: ▪ Updated KPIs relating to Community Health and Safety agreed in coordination with	The Operator	Evidence of review of Malaria Management Plan. Employee training records for malaria training. Employee training records/ qualifications for first aid/ medical.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				County Government and the DCCs; ■ Malaria Management procedures; ■ All worker accommodation will provide first aid / and first aiders and health clinics or paramedic services for workers; and ■ The Operator will monitor KPIs through the CHIS.		Evidence of audits of worked accommodation medical facilities. Review of vector related disease KPIs and monitoring of performance against KPIs.
SOC – 35	Social	Introduction of outside workforce and transport for Project construction - Communicable diseases.	Operation	Prior to operations all procedures and objectives relating to Community Health Safety and Security will be reviewed, in light of construction phase monitoring. Updated procedures will include the following: ■ Camp cleanliness and hygiene requirements; ■ The operation of all worker accommodation as "*closed camps*"; and ■ All camps will provide first aid / and first aiders and health clinics or paramedic services for workers.	The Operator	Evidence of review of all Community health, Safety and Security procedures Evidence of update to all required procedures. Evidence of audits of camp cleanliness and hygiene. Employee training records/ qualifications for first aid/ medical. Evidence of audits of operation camp medical facilities.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				Repeated Mitigation – Social 01– The Operator Code of Conduct: ■ Maintain Medical Fitness to Work procedures for all workers and contractors. ■ Maintain effective waste management procedures, in line with procedures and performance monitoring in the Operator Environmental Performance Plan. ■ Align food hygiene programmes with good industry practice standards and monitor performance. ■ Maintain an Infectious Disease Health Policy and Programme (particularly related to HIV and TB) and establish KPIs under the CHIS, in collaboration with authorities in Turkana and West Pokot Counties. ■ Maintain a Pandemic Preparedness Plan (including Covid).		Employee training records for code of conduct training. Employee records for medical fitness to work. Evidence of waste management audits. Employee training records for food hygiene. Evidence of food hygiene audits. Review of Pandemic Preparedness Plan (including Covid). Review of communicable disease KPIs and monitoring of performance against KPIs.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				■ Monitor KPIs through a CHIS. The Operator will continue providing social investment to specific Health Systems Strengthening activities in areas at higher risk for HIV transmission due to Project impacts.		
SOC – 36	Social	Waste from Project activities - Zoonotic diseases.	Operation	**Repeated Mitigation – Social 10 - Zoonotic Diseases**	The Operator	Evidence of implementation of pest control methods and activities. Evidence of pest control audits.
SOC – 37	Social	Transport for Project construction - Accidents and injuries.	Operation	Review and update procedures established during construction for maintaining the transport management system to mitigate impacts relating to Community Health Safety and Security. At commencement of operations, the Operator will revisit the Community Safety Outreach Programme to inform local communities of vehicle related hazards along Project in-field transport routes. In particular, schools along transport routes have been identified by the Operator and will be engaged as part of a Schools	The Operator	Evidence of review of safety outreach programme and re-engagement. Evidence of review of Emergency Response Plan. Evidence of review of traffic management KPIs and monitoring of performance against KPIs. Evidence of any grievances received and responses.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				Safety Outreach Programme, led by the Operator. The Operator will maintain procedures should an incident occur and how to manage and minimise any consequences of a road traffic accident. The Operator will monitor key performance indicators relating to traffic management and potential effects, grievances and improvements will be monitored		
SOC – 38	Social	Infrastructure affecting movement of pastoralists, indirect impact of in-migration - Change in access to education.	Operation	The Operator will monitor households affected by the change in access to education to ensure that households are not disadvantaged by in migration relating to the project or change of access to education. The Operator will review and maintain a strategy for future social investment in education for project affected people.	The Operator	Monitoring reports relating to access to education and triggers for remedial actions. Review and maintenance of social investment strategy.
SOC – 39	Social	Indirect effect of increased salaried employment and procurement - Crime, commercial sex work and other nuisances from growth.	Operation	The Operator will continue to support the engagement process with National Government, County Administration and key stakeholders to consider and agree social investment proposals established	The Operator	Evidence of engagement with National Government, County Administration and key stakeholders to agree on the terms of reference and projects for investment.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				during construction, to maintain a transparent process, through which the Operator can communicate concepts and annual budgets to be considered for social investment to support information programmes that seek to identify and provide support for key social maladies (e.g., gender-based violence, drug and alcohol abuse). Continued implementation of mitigation measures relating to Social Maladies will be undertaken.		Development of CDPs for both Turkana and West Pokot, including written ToRs for investment, clear guidelines on criteria for investment and a list of agreed projects for potential investment stating timeframes and the plan to execute. Evidence of continued engagement activities to continue to support key social maladies. Evidence of continued implementation of mitigation measure for social maladies.
SOC – 40	Social	Project operating in region with history of inter-ethnic violence and raiding - Inter-ethnic conflict.	Operation	**Repeated Mitigation – Social 07– Human Rights Policy.** **Repeated Mitigation – Social 11 – Inter Ethnic Conflict and Security.**	The Operator	Public disclosure of Human Rights policy. Evidence communication with Police regarding

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
						security escorts and weekly briefings. Evidence of establishment and use of Incident Reporting System. Publication of results of risk assessment and measures taken by the Operator to minimise impacts. Evidence of appointment of security company. Regular auditing of social performance to confirm measures relating to security are adhered to.
SOC – 41	Social	Introduction of outside workforce - Community cohesion within Turkana and West Pokot County.	Operation	**Repeated Mitigation – Social 12 – Community Cohesion within Turkana and West Pokot County.**	The Operator	Evidence of Operator working with National Government, respective County Administrators and key stakeholders. Evidence of community engagement and messaging in relation to project employment,

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
						recruitment and hiring procedures. Evidence of Community Liaison team activities.

Table 9.3-10: Cultural Heritage

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
CH-01	Cultural Heritage	Ground disturbance/change in land surface within Project footprint on archaeological surface remains.	Construction	A Chance Finds Procedure will cover all potential disturbance of tangible cultural heritage during ground disturbance activities. Compliance with the Chance Finds Procedure will be mandatory for all staff and contractors. All cultural heritage finds will be communicated to NMK and an archiving protocol will be agreed with NMK for collected artefacts which either the Project cultural heritage advisor, or an NMK advisor, has indicated are of research and conservation value. In particular, the Operator will make available to NMK the obsidian materials, collected during baseline and pre-construction surveys, and associated baseline data and reports.	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigations and providing obsidian materials to NMK.	Regular auditing of construction practices to confirm Chance Finds Procedure being appropriately implemented. Documentation of communication with NMK regarding chance finds and archiving.
CH-02	Cultural Heritage	Ground disturbance/change in land surface within Project footprint on potential archaeological settlement sites.	Construction	The Operator will work with NMK to develop and implement an archaeological clearance plan to investigate the potential settlement and/ or industrial Site within the CFA footprint, prior to construction. The archaeological clearance plan will include a sampling strategy for	The Operator	Reporting of results from archaeological clearance investigation.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				the collection of archaeological remains identified during the investigation. The plan will comply with NMK requirements for archaeological investigation.		
CH-03	Cultural Heritage	Change in environmental condition as a result of construction dust, which could impact sacred tree health.	Construction	Local stakeholders to be informed of the construction activity dates, which will take account of any identified culturally sensitive days. A procedure will be developed for daily visual monitoring by the Environmental Supervisor. If high levels of dust are observed causing a nuisance to sacred trees, any appropriate changes to working practices (e.g. dust barriers or netting) will be undertaken to limit the dispersion of dust. Procedures will be developed for consultation with the local communities who use identified sacred trees as a meeting point with regard to this proposed visual monitoring strategy and if any remedial actions e.g., dust netting are required. Grievances and improvements will be monitored.	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of appropriate communication of construction schedule/ duration with PAP prior to commencement of construction, along with any subsequent material changes to schedule. Record of routine dust monitoring including any remedial actions. Grievance register logging any complaints received relating to dust, including a record of the investigation and/or remedial actions taken as a result of the complaints.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
CH-04	Cultural Heritage	Change in environmental condition as a result of construction noise in the vicinity of sacred trees.	Construction	Local stakeholders to be informed of the construction activity dates and the potential for increased noise levels, which will take account of any identified culturally sensitive days. Grievances and improvements will be monitored.	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of appropriate communication of construction schedule/ duration and increased noise levels with PAP prior to commencement of construction, along with any subsequent material changes to schedule. Grievance register logging any complaints received relating to noise, including a record of the investigation and/or remedial actions taken as a result of the complaints.
CH-05	Cultural Heritage	Change in environmental conditions as a result of visual changes to setting of sacred trees from construction activities.	Construction	An information campaign will be undertaken to inform local stakeholders of the construction activity dates and the potential for increased visual disturbance, particularly from dust and artificial lighting. Signage will be put in place to inform people where, when and for how long construction works are taking place. Grievances and improvements will be monitored.	EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of stakeholder engagement and consultation regarding the construction schedule and potential visual effects. Evidence of publication of Grievance Management Procedure. Evidence relating to any grievances received and responses.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
CH-06	Cultural Heritage	Ground disturbance/change in land surface on graves and burials.	Construction	Procedures will be developed for identifying unrecorded graves within the development footprint, prior to construction and for cultural heritage late finds protocols. Training will be provided to all construction contractors to assist in grave identification and the implementation of the protocol. Procedures will be developed for micro alignment of the interconnecting network and OHTL within the RoW to avoid direct impact to graves (including CH-017, CH-026, CH-028 and CH-090), where feasible. ■ The Operator will consult with affected communities and site guardians to agree procedures for demarcation (e.g., demarcation and communication of 'no go' sensitive locations and mapping and communication of cultural heritage 'constraints'). ■ For graves where this is unavoidable (including CH-105), the procedures for	EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of stakeholder engagement and consultation relating to impacts upon graves. Evidence of review and revision of interconnecting network and OHTL within RoW route. Regular auditing of construction practices to confirm process for identifying graves are being implemented. Reporting of instances where graves are required to be relocated and evidence of the processes followed.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				relocation will be in line with national statutory land acquisition processes set out in Kenyan law, which recognises graves and the costs of rituals required to relocate graves. Where graves have to be relocated, it will be done in consultation with site guardians, PAP, County Government and in line with Kenyan cultural heritage requirements.		
CH-07	Cultural Heritage	Ground disturbance/Change in land surface on fire pits.	Construction	Procedures will be developed for micro alignment of the interconnecting network and OHTL within the RoW to avoid direct impact to the fire pits, where feasible. There will be consultation with affected communities and site guardians to agree procedures for demarcation (e.g., demarcation and communication of 'no go' sensitive locations and mapping and communication of cultural heritage 'constraints').	EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of stakeholder engagement and consultation regarding impacts to fire pits.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				Where direct impacts cannot be avoided through micro alignment and relocation is required, this will be done in consultation with site guardians, PAP, County Government and in line with Kenyan cultural heritage requirements.		
CH-08	Cultural Heritage	Change in environmental condition as a result of construction dust at fire pits.	Construction	Local stakeholders will be informed of construction activity dates and the potential for increased dust emissions, which will take account of any identified culturally sensitive days. A procedure will be developed for daily visual monitoring by the Environmental Supervisor. If high levels of dust are observed causing a nuisance to fire pits, any appropriate changes to working practices (e.g. dust barriers or netting) will be undertaken to limit the dispersion of dust. Procedures will be developed for consultation with the local communities who use identified sacred trees as a meeting point with regard to this proposed visual monitoring strategy and if any remedial actions e.g., dust netting are required.	EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of stakeholder engagement and consultation regarding construction dust. Reporting of daily visual monitoring results. Evidence of publication of Grievance Management Procedure. Evidence relating to any grievances received and responses.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				Grievances and improvements will be monitored.		
CH-09	Cultural Heritage	Change in environmental conditions as a result of visual changes to setting of fire pits from construction activities.	Construction	An information campaign will be undertaken to inform local stakeholders of the construction activity dates and the potential for increased visual disturbance particularly from dust and artificial lighting. Signage will be put in place to inform people where, when and for how long temporary dust generating works are taking place. Grievances and improvements will be monitored.	EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of stakeholder engagement and consultation regarding visual effects. Evidence of publication of Grievance Management Procedure. Evidence relating to any grievances received and responses.
CH-10	Cultural Heritage	Ground disturbance/Change in land surface on *akiriket* site.	Construction	Procedures will be developed for consultation and engagement with affected community and site guardians at CH-108, and if the location is fundamental to the asset's use, procedures will be agreed to support the sustainability of traditional practices, including those conducted at this asset.	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of stakeholder engagement and consultation regarding *akiriket* site.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
CH-11	Cultural Heritage	Ground disturbance/change in land surface on Turkana culture and nomadic pastoralism.	Construction	An information campaign will be undertaken to inform local stakeholders of the construction activity dates and the potential for increased disturbance during construction. A strategy (timetable) will be developed for the continuation of community consultation and liaison, to provide a platform to listen to and address community concerns and develop and mechanisms to support the sustainability of traditional practices in response to issues as they may arise during the construction phase. Cultural Awareness Training will be implemented for all site staff / contractors as part of the Project site induction process for all field-based staff during construction. The training will include: ■ Specific local taboos / respectful behaviours with regard to sacred trees; ■ A calendar of culturally significant events; and	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of stakeholder engagement and consultation. Evidence of staff inductions and delivery of Cultural Awareness Training. Evidence of publication of Grievance Management Procedure. Evidence relating to any grievances received and responses.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				■ Constraints mapping to highlight sensitive areas or no-go areas. Grievances and improvements will be monitored.		
CH-12	Cultural Heritage	Change in socio-economic conditions in Turkana affecting Turkana culture and nomadic pastoralism.	Construction	The Operator will develop influx management procedures to manage speculative influx (emergence of informal settlements) as outlined in SOC-01. Agreed procedures will include consideration for potential changes in culturally sensitive practices. Cultural Awareness Training will be implemented for all site staff / contractors as part of the Project site induction process for all field-based staff during construction. The training will include: ■ Specific local taboos / respectful behaviours with regard to sacred trees; ■ A calendar of culturally significant events; and	The Operator will develop influx management procedures. The EPC Contractor will be responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigations.	Evidence relating to influx management (SOC-01). Evidence of stakeholder engagement and consultation. Evidence of staff inductions and delivery of Cultural Awareness Training. Evidence of publication of Grievance Management Procedure. Evidence relating to any grievances received and responses.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
				■ Constraints mapping to highlight sensitive areas or no-go areas. Grievances and improvements will be monitored.		
CH-13	Cultural Heritage	Ground disturbance/change in land surface on environmental subsistence.	Construction	A strategy (timetable) will be developed for the continuation of community consultation and liaison, to provide a platform to listen to and address community concerns and to develop mechanisms to support the sustainability of traditional subsistence practices, specifically the transfer of traditional knowledge and skills. This will include the mapping and provision of continued access to natural resources which support subsistence activities.	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of stakeholder engagement and consultation. Evidence of steps taken to promote the transfer of traditional knowledge and skills.
CH-14	Cultural Heritage	Change in environmental conditions as a result of visual changes to setting from the OHTL on sacred trees.	Operation	Grievances and improvements will be monitored.	The Operator	Evidence of stakeholder engagement and consultation. Evidence of publication of Grievance Management Procedure. Evidence relating to any grievances received and responses.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
CH-15	Cultural Heritage	Change in socio-economic conditions in Turkana affecting Turkana culture and nomadic pastoralism.	Operation	A timetable will be developed for the continuation of regular dialogue between the Operator and stakeholders during Project operation, to provide a platform to listen to and address community concerns and develop participatory mechanisms to support any ongoing concerns about effects the project operation may have on local culture and cultural practices. Cultural Awareness Training will be implemented for all site staff / contractors as part of the Project site induction process for all field-based staff during operation. The training will include: ■ Specific local taboos / respectful behaviours with regard to sacred trees; ■ A calendar of culturally significant events; and ■ Constraints mapping to highlight sensitive areas or no-go areas. Grievances and improvements will be monitored.	The Operator	Evidence of stakeholder engagement and consultation. Evidence of staff inductions and delivery of Cultural Awareness Training Evidence of publication of Grievance Management Procedure. Evidence relating to any grievances received and responses.

Table 9.3-11: Emergency, Accidental and Non-Routine Events

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
ERA-01	Natural Hazard	Natural seismicity (earthquakes) causing damage to built structures, flowlines, vibration-sensitive built structures or equipment, leading to release to the environment.	Construction and Operation	Preparation of Emergency Preparedness and Response Plan. Spill response kits should be available at wellpads and the CFA and used as soon as possible following an event.	During Construction, the EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigations. During Operations, the Operator is responsible for implementation of mitigation.	Evidence of audits of spill kit availability and condition.
ERA-02	Industrial Hazard	Failure or rupture of a storage tank leading to release of production fluid to environment.	Operation	Preparation of Emergency Preparedness and Response Plan. Spill response kits should be available at wellpads and the CFA and used as soon as possible following an event.	The Operator	Evidence of audits of spill kit availability and condition.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
ERA-03	Industrial Hazard	Perforation or rupture of a flowline or spillage due to poor working practices leading to release to the environment.	Operation	Preparation of Emergency Preparedness and Response Plan and Environmental Performance Plan. Flowlines will be buried. Due to the waxy properties of the oil, if there are any breaks to the flowlines it is likely that the oil will solidify quickly (crude is solid below 57°C). Spill response kits will be available at well-pads and the CFA and used as soon as possible following an event.	The Operator	Evidence of audits of spill kit availability and condition.
ERA-04	Industrial Hazard	Road traffic accidents on access roads leading to spillage of hazardous materials, injury, or death.	Operation	Preparation of Emergency Preparedness and Response Plan and implementation of a Traffic Management System. Project speed limits will be adhered to. Education programme for drivers and passengers. Compliance with the Kenyan Road Traffic Act.	The Operator	Evidence of delivery of transport awareness programme. Employee training records for code of conduct training. Records of employee driver training, documentation and auditing of driver standards.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
ERA-05	Industrial Hazard	Road traffic accidents on public roads leading to spillage of hazardous materials, damage to public infrastructure, injury, or death.	Operation	Preparation of Emergency Preparedness and Response Plan and implementation of a Traffic Management System. National and Project speed limits will be adhered to. Education programme for drivers and passengers. Community awareness programme for traffic awareness. Compliance with the Kenyan Road Traffic Act.	The Operator	Evidence of speed limit signage. Records of approvals for night- time driving. Records relating to JMP requests and approvals. Evidence of Community Safety Outreach Programme and record of engagement activities.
ERA-06	Industrial Hazard	Induced seismicity due to well testing/ oil production, leading to loss of containment of production fluid.	Operation	Preparation of Emergency Preparedness and Response Plan and Environmental Performance Plan. Flowlines will be buried. Due to the waxy properties of the oil, if there are any breaks to the flowlines it is likely that the oil will solidify quickly (crude is solid below 57°C). Spill response kits will be available at wellpad and the CFA and used as soon as possible following an event.	The Operator	Evidence of audits of spill kit availability and condition.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
ERA-07	Industrial Hazard	Blow outs from wells, explosions or integrity failure resulting in emergency releases of gas from wells or the CPF.	Operation	Preparation of Emergency Preparedness and Response Plan and Environmental Performance Plan. Each well will be fitted with a BOP; the CPF is equipped with an appropriate flare system.	The Operator	Evidence of audits of flare systems.
ERA-08	Industrial Hazard	Well casing/cement integrity failure during drilling and production, leading to leakage of production fluids.	Operation	Preparation of Emergency Preparedness and Response Plan and Environmental Performance Plan. Due to the waxy properties of the oil, if there are any breaks to the flowlines it is likely that the oil will solidify quickly (crude is solid below 57°C). Spill response kits will be available at wellpad and the CFA and used as soon as possible following an event.	The Operator	Evidence of audits of spill kit availability and condition.

Table 9.3-12: Cumulative Impacts

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
CU-01	Cumulative (LLCOP) – Noise and Air Quality	Concurrent work on LLCOP in the same location as the Project, resulting in cumulative construction noise and air quality (dust) impacts.	Construction	Engage with the LLCOP project proponent to plan construction programmes so any concurrent works in the same location are minimised as far as practicable. Where concurrent work is required, the project proponents will: ■ Engage to plan construction programmes so any work within 250 m of each project is minimised as far as practicable. ■ Work together to identify additional measures and controls to limit the significance and duration of activities.	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of engagement with LLCOP project proponent. Evidence of steps taken to minimise concurrent work or any measures/controls implemented.
CU-02	Cumulative (LLCOP) – Social	Influx of people and workers as a result of both LLCOP and the Project resulting in cumulative increased risk of HIV/AIDS and other STIs.	Construction and Operation	Engagement with the LLCOP proponent to work together to align proposed mitigation measures defined for community health and safety relating to the potential increased risk of HIV/AIDS and STIs and identify if any additional measures and controls are required to limit significance.	The EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Evidence of engagement with LLCOP project proponent. Evidence of steps taken to align mitigation measures or identification of any additional measures.

ID	Topic/Aspect	Impact	Project Phase	Mitigation	Responsibility	Means of Verification
CU-03	Cumulative (Make-up water pipeline) – Water Quality, Water Quantity and Social	Changes to water quality and quantity due to construction activities, leading social impacts relating to water offtakes.	Construction	Make-up water pipeline construction programme to meet water demands by month 22 of the Project construction. If concurrent construction work is required on the pipeline and the Project, the project proponents will work together to identify additional measures and controls to limit the significance and duration of activities	EPC Contractor is responsible for implementation of mitigation. The Operator is responsible for assuring implementation of mitigation.	Publication of make-up water pipeline construction programme.
CU-04	Cumulative (KETRACO OHTL) – Biodiversity	Risk of direct mortality to bird species from KETRACO OHTL construction	Construction	Engagement with the KETRACO OHTL contractor to encourage consideration on routing and bird-friendly OHTL design measures.	The Operator is responsible for assuring implementation of mitigation.	Evidence of engagement with KETRACO OHTL contractor.

9.4 Project Decommissioning Framework

9.4.1 Introduction

The Project has a design life of 25 years. At this stage it is not possible to anticipate the requirements for decommissioning at that time. This ESIA presumes that within this 25-year period both the receiving environment as well as available technology will be significantly different to the present day. As a result, it is not possible to set out a detailed decommissioning plan. The most effective approach to this issue is to set out the broad principles that, at this time, are anticipated to be applicable or relevant to Project closure and decommissioning.

9.4.2 Decommissioning Philosophy

In line with GIP, the following Decommissioning Philosophy will be adopted:

- Five years prior to the planned End of Project, a Decommissioning Plan will be developed for agreement with the appropriate authorities;
- Underground equipment will be emptied of oil product, left in a clean state and left *in situ* unless good practice at the time dictates otherwise; and
- Above ground infrastructure will be evaluated for dismantling, removal and rehabilitation. This will be undertaken in consultation with Affected Communities and County Government to identify any facilities than can be safely handed over for community use.

The Decommissioning Plan will be submitted to NEMA and other relevant government authorities for review and approval prior to implementation.

10.0 CONCLUSIONS

This ESIA has systematically reviewed and evaluated the potential impacts on existing environmental and social receptors within the Project's AoI over the lifetime of the Project. The assessment was undertaken in accordance with Kenyan legislative, regulatory and policy requirements, including the Environmental (Impact Assessment and Audit) Regulations (2003). Where relevant, reference was made to international standards as part of Good Industry Practice (GIP) (i.e. IFC Performance Standards on Environmental and Social Sustainability (2012) and WBG EHS Guidelines (2007a, 2007b)). It has also been prepared to align with international conventions to which Kenya is a signatory. The ESIA has been prepared with due consideration for the multiple stakeholders within the administrative framework of Kenya, at community, County and National level.

The ESIA has assessed potential impacts of the Project based on the Project description and covers all activities and infrastructure associated with the construction, operation and decommissioning of the Project. The ESIA describes the baseline conditions and has evaluated potential impacts on the following:

- air quality;
- noise and vibration;
- water quantity;
- water quality;
- soils, terrain, geology and seismicity;
- landscape and visual;
- biodiversity, ecology and protected areas;
- ecosystem services;
- social and socio-economics; and
- cultural heritage.

The ESIA has identified that adverse impacts brought about by the Project are mostly during the construction phase and are associated with land acquisition, influx, water abstraction, vegetation clearance, groundworks, drilling, and construction of buried flowlines. Impacts during normal operation are associated with influx and emissions from facilities and water abstraction during the construction phase

Residual **Moderate** impacts identified include:

- Impacts on noise during construction within 75m from the fenceline (wellpads, infield flowlines, CFA and landfill)
- Visual impacts during construction of wellpads, the CFA and the OHTL;
- Visual impacts for PAP, from sacred trees and ritualistic fire pits from the OHTL during operations;
- Impacts on Turkana toad and *Omophron* beetle during construction due to groundwater abstraction;
- Impacts on vultures during construction and operations;
- Impacts leading to the loss or disturbance of cultural sites including sacred trees and ritualistic fire pits during construction;

- Impacts on spiritual values during construction and operations and educational and inspirational values during operations;
- Impacts caused by Project induced influx and in-migration during construction and operations;
- Increased risk of accident or injury from Project traffic during construction; and
- Impacts due to ground disturbance and change in land surface during construction leading to direct impacts on fire pits, graves and burials during construction.

For impacts to the socio-economic environment associated with the Project, some impacts are expected to be positive, with **Moderate** or **Major** positive impacts relating to transparent tax payments, access to education, additional infrastructure, employment and business opportunities. The Project intends to target construction and operation employment opportunities at communities within the Project's AoI and provide the necessary pre-employment training to ensure local uptake of jobs. In addition, livelihood restoration and enhancement measures will be developed in consultation with affected communities, stakeholders, County Administration and GoK. The Project also has the potential to contribute positively to community health through health awareness and disease prevention programs associated with its workforce.

A number of other major developments have been identified within the Project AoI that have the potential to generate cumulative impacts with the Project. Impacts associated with the LLCOP project and the development of the make-up water pipeline (final design pending and subject to separate environmental and social impact assessment) present the greatest potential for cumulative impacts to occur. Cumulative impacts are largely expected to occur during the construction phase of the projects relating to the concurrent construction schedules and during the operational phase relating to community health and safety. The Operator will coordinate with the make-up water pipeline and LLCOP project to identify additional measures and controls to limit the significance and duration of any cumulative impacts.

The Operator is committed to engage with other associated and third-party projects to encourage implementation of specific mitigation measures including OHTL routing and bird-friendly design.

In accordance with Kenyan requirements, an outline Environmental and Social Management Plan (ESMP) has been developed for the Project (Chapter 9.0). The ESMP compiles a set of management, mitigation and monitoring measures to be taken pre-construction, during construction (groundworks, construction and installation), operation (including maintenance) and decommissioning to manage key potential environmental and social impacts identified in this ESIA.

The Operator will develop an ESMS for the life of the Project, under which the commitments outlined in the ESMP (Chapter 9.0) will be implemented. During construction, the EPC Contractor will implement the majority of the Operator's environmental and social requirements (a contracted requirement), but as "owner", the Operator will assure that all of its requirements are implemented via its ESMS and appropriate resourcing will be provided to do this.

The SEP will continue to evolve and will be the framework for stakeholder engagement and communication throughout the construction, operation and eventual decommissioning of the Project. The Project will continue to implement and improve the grievance mechanism for all stakeholders and the EPC contractor will similarly develop a grievance mechanism which will be applicable for all contractor and sub-contractor employees engaged by the Project.

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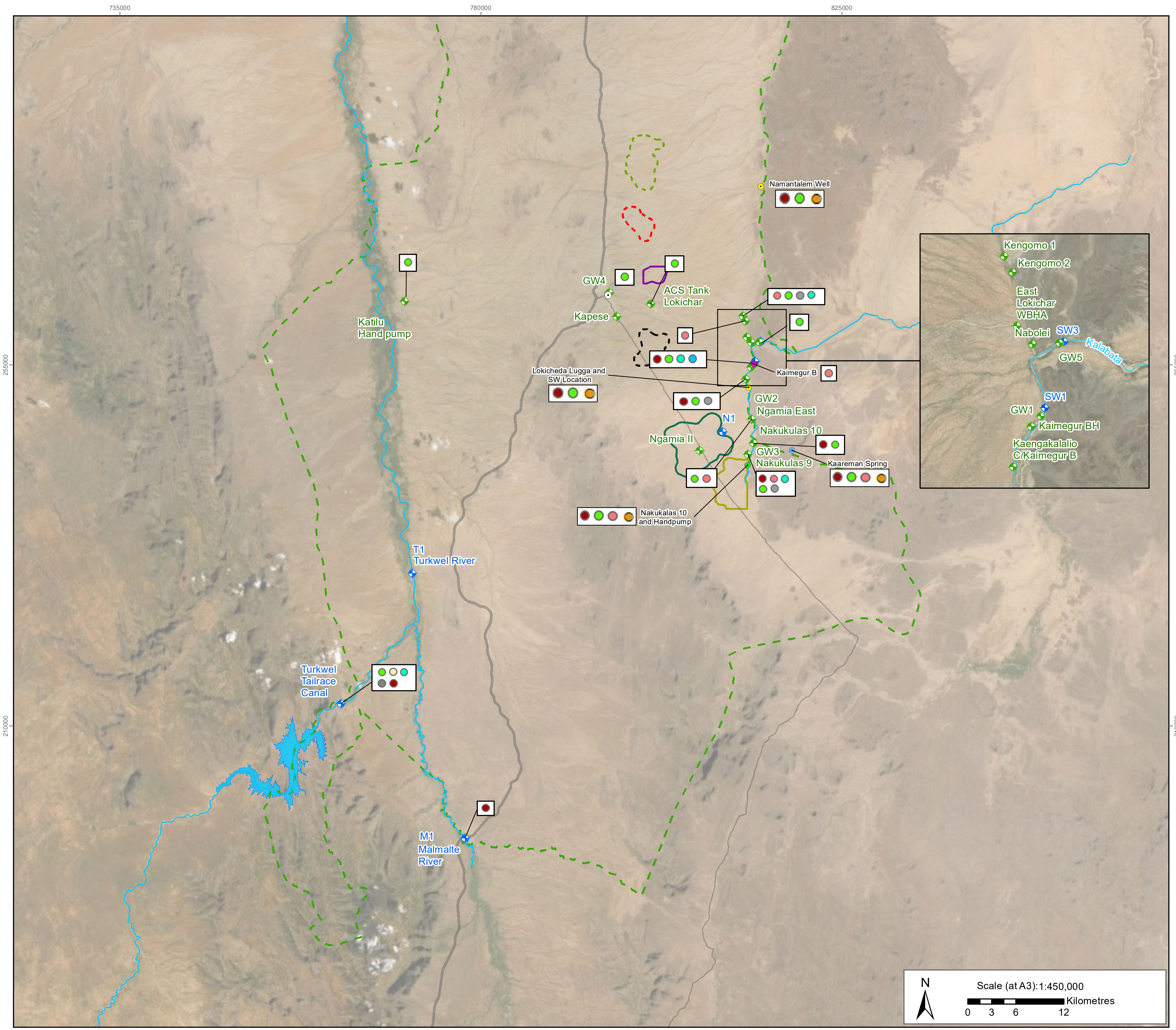
DRAWINGS

DRAWINGS



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Drawing 6.7-1: Locations of Project Water Quality Standard Concentration Exceedances, Metals and Trace Elements

Key

- Groundwater Monitoring Location
- Surface Water Monitoring Location

Concentration Exceedances of Project Water Quality Standards

- Aluminium
- Boron (as B or as Boric Acid)
- Cadmium
- Copper
- Iron (Total)
- Nickel
- Selenium
- Zinc

- Hand Dug Well
- Handpump
- Production Borehole
- Spring
- Water Point
- Town/Village
- A1
- C46
- Watercourse
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)
- Biophysical Area of Influence (AoI)
- Lake Turkana
- Turkwel Gorge Reservoir / Project Water Source

Data sources:
Infrastructure data sourced from Tullow and Worley Parsons. Surface water data is licensed under the Open Data Commons Open Database License (ODbL) by the OpenStreetMap Foundation (OSMF).

Coordinate System: WGS 1984 UTM Zone 36N

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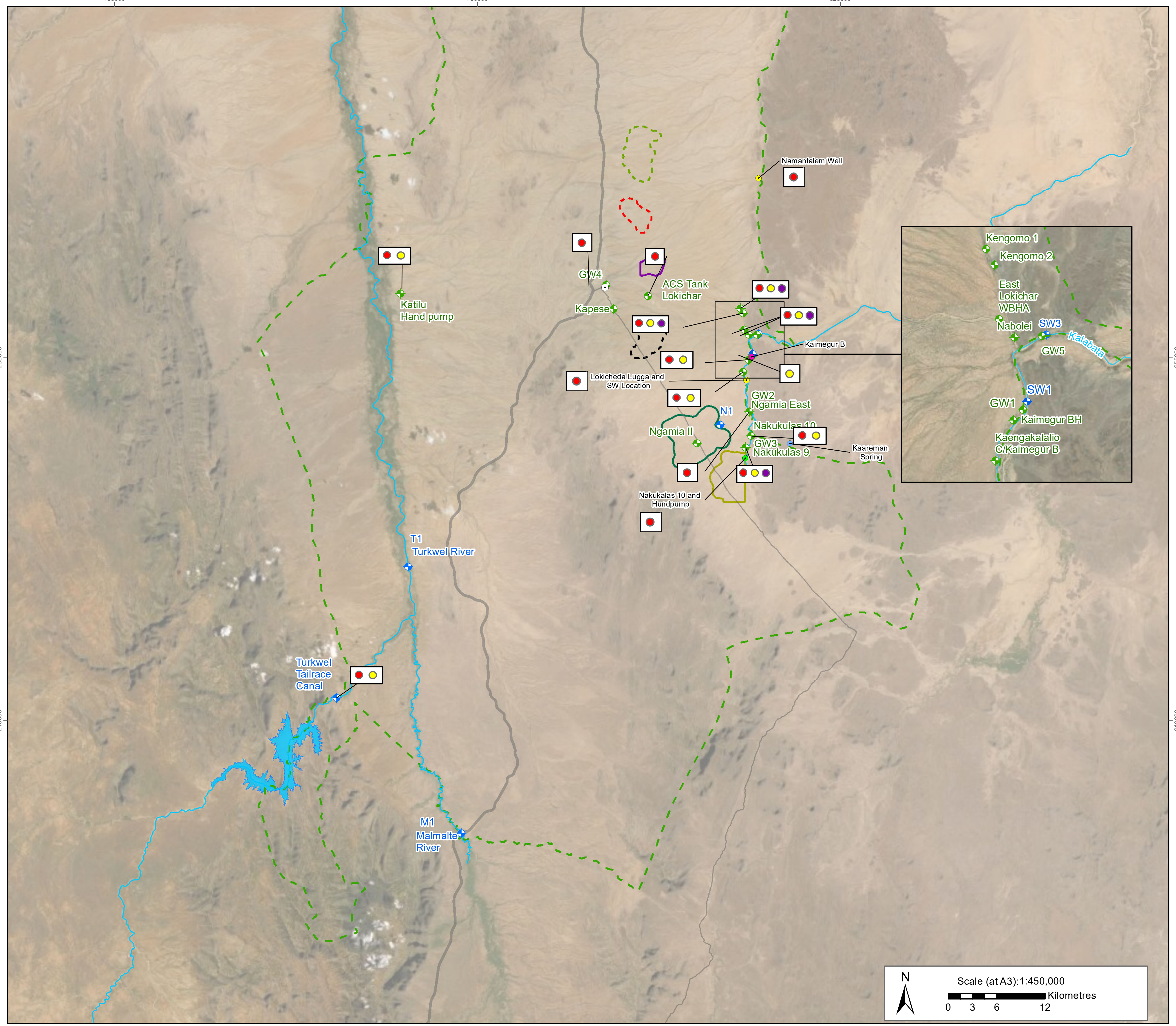
PROJECT OIL KENYA

GOLDER MEMBER OF WSP

Cavendish House,Cores End Road,Bourne End,SL8 5AS,UK



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Drawing 6.7-2: Locations of Project Water Quality Standard Concentration Exceedances, Major Ions

Key

- Groundwater Monitoring Location
- Surface Water Monitoring Location

Concentration Exceedances of Project Water Quality Standards

- Chloride
- Fluoride
- Sodium
- Town/Village
- A1
- C46
- Watercourse
- Hand Dug Well
- Handpump
- Production Borehole
- Spring
- Water Point
- Town/Village
- A1
- C46
- Watercourse
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)
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PROJECT OIL KENYA

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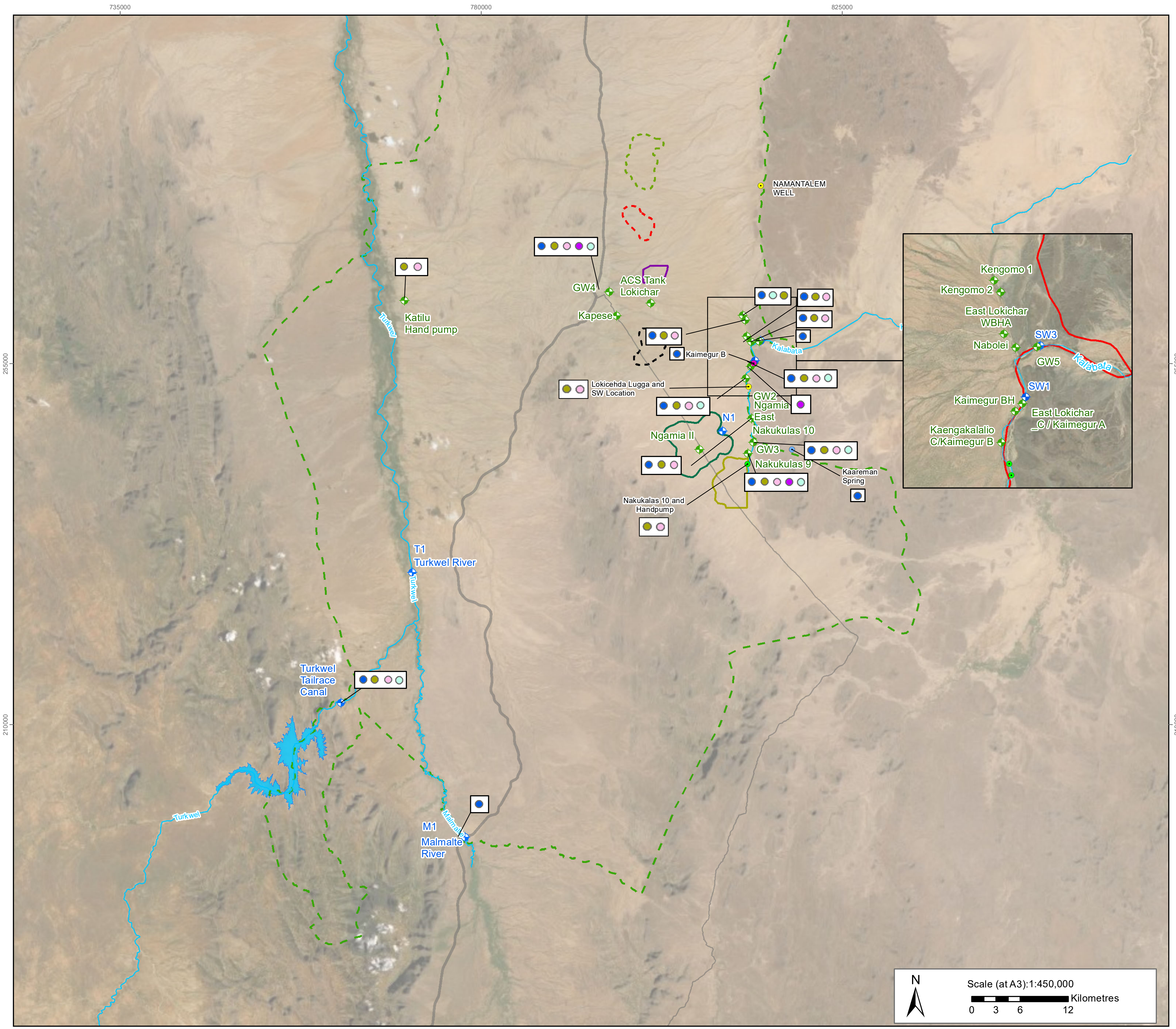
Drawing 6.7-3: Locations of Project Water Quality Standard Concentration Exceedances, Nutrients and Organics



Key

- Groundwater Monitoring Location
- Surface Water Monitoring Location

Concentration Exceedances of Project Water Quality Standards

- Ammonia (as NH3 or as N)
- Benzene
- Nitrate as NO3
- Nitrite
- Ortho Phosphate as PO4
- Hand Dug Well
- Handpump
- Production Borehole
- Spring
- A1
- C46
- Watercourse
- Biophysical Area of Influence (AoI)
- Lake Turkana
- Turkwel Gorge Reservoir / Project Water Source
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)

Data sources:
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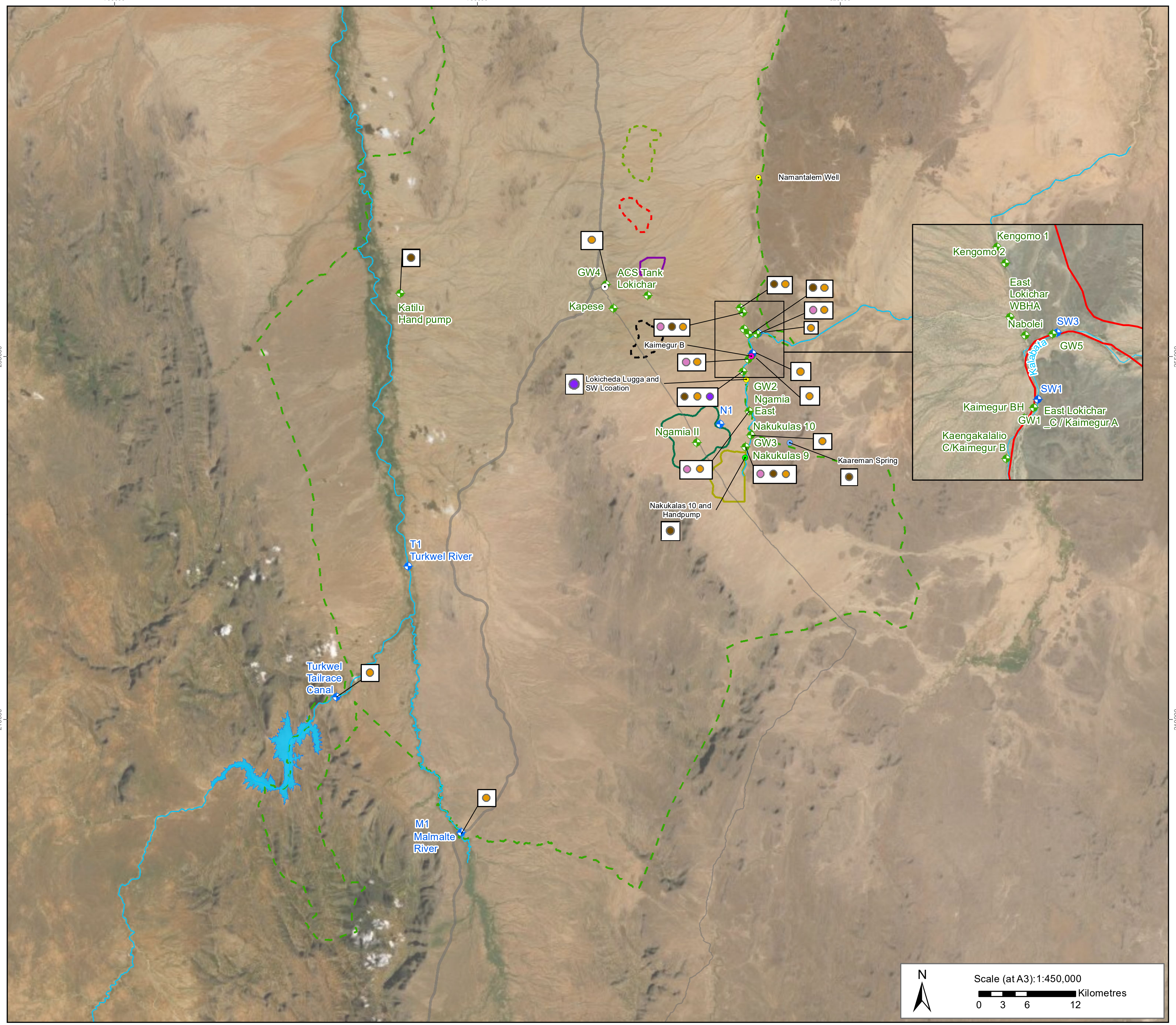

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Drawing 6.7-4: Locations of Project Water Quality Standard Concentration Exceedances, Other Parametres

Key

- Groundwater Monitoring Location
- Surface Water Monitoring Location

Concentration Exceedances of Project Water Quality Standards

- pH
- Total Dissolved Solids
- Total Hardness Dissolved (as CaCO3)
- Total Suspended Solids
- Hand Dug Well
- Handpump
- Production Borehole
- Spring
- Water Point
- Town/Village
- A1
- C46
- Watercourse
- Biophysical Area of Influence (AoI)
- Lake Turkana
- Turkwel Gorge Reservoir / Project Water Source
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)

Data sources:
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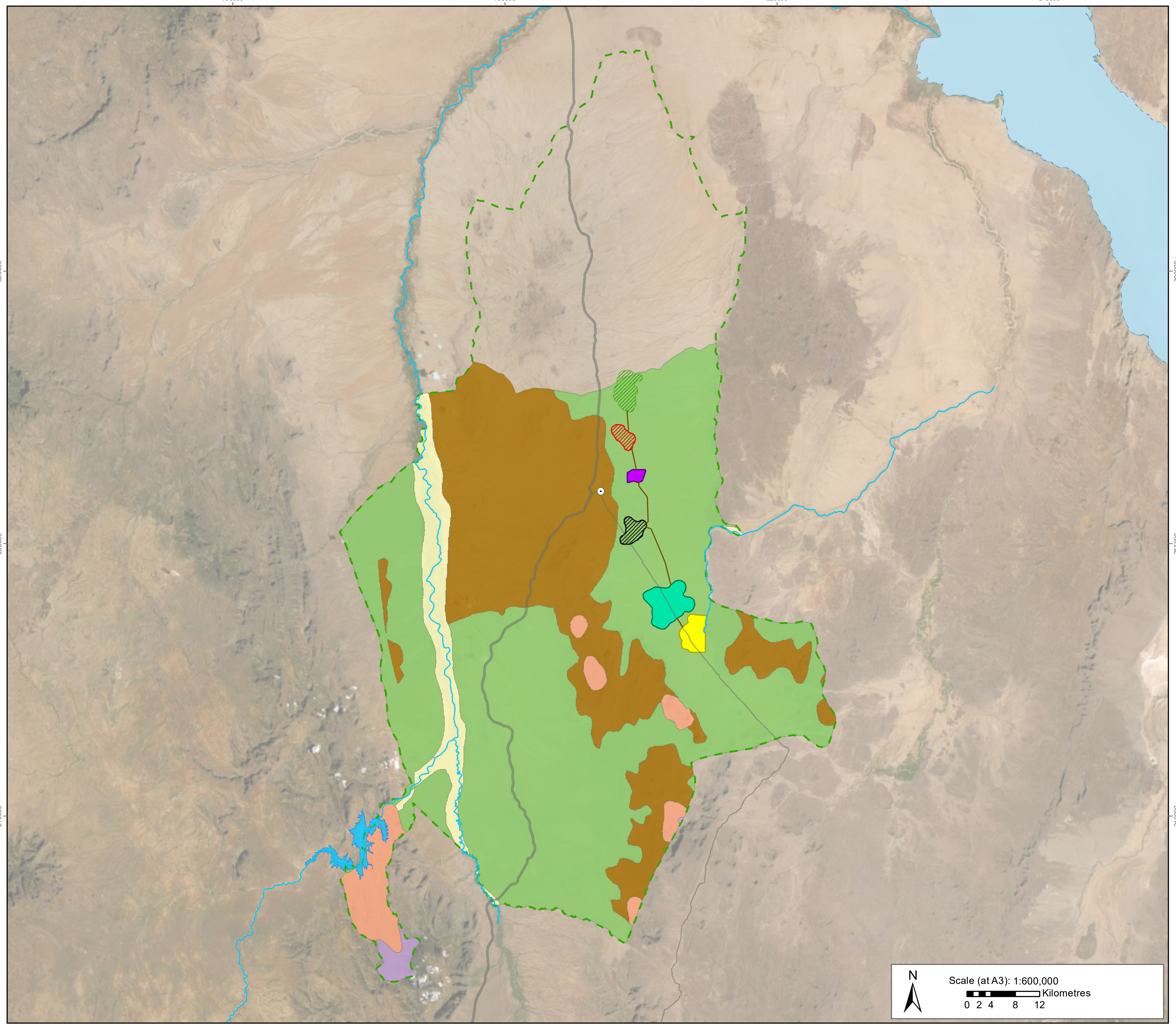

Drawing 6.9-1: Vegetation and Climate Change in Eastern Africa

Key

- Town/Village
- Interconnecting Network
- A1
- C46
- Watercourse
- Biophysical Area of Influence (AoI)
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)
- Lake Turkana
- Turkwel Gorge Reservoir / Project Water Source

Vegetation

- Acacia-Commiphora Stunted Bushland
- Afromontane Undifferentiated Forest
- Evergreen and Semi-Evergreen Bushland and Thicket
- Riverine Wooded Vegetation
- Somalia-Masai Acacia-Commiphora Deciduous Bushland and Thicket

Data sources:
Base data available from Tullow and Worley Parsons.
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Vegetation data available from VECEA 2015

Coordinate System: WGS 1984 UTM Zone 36N

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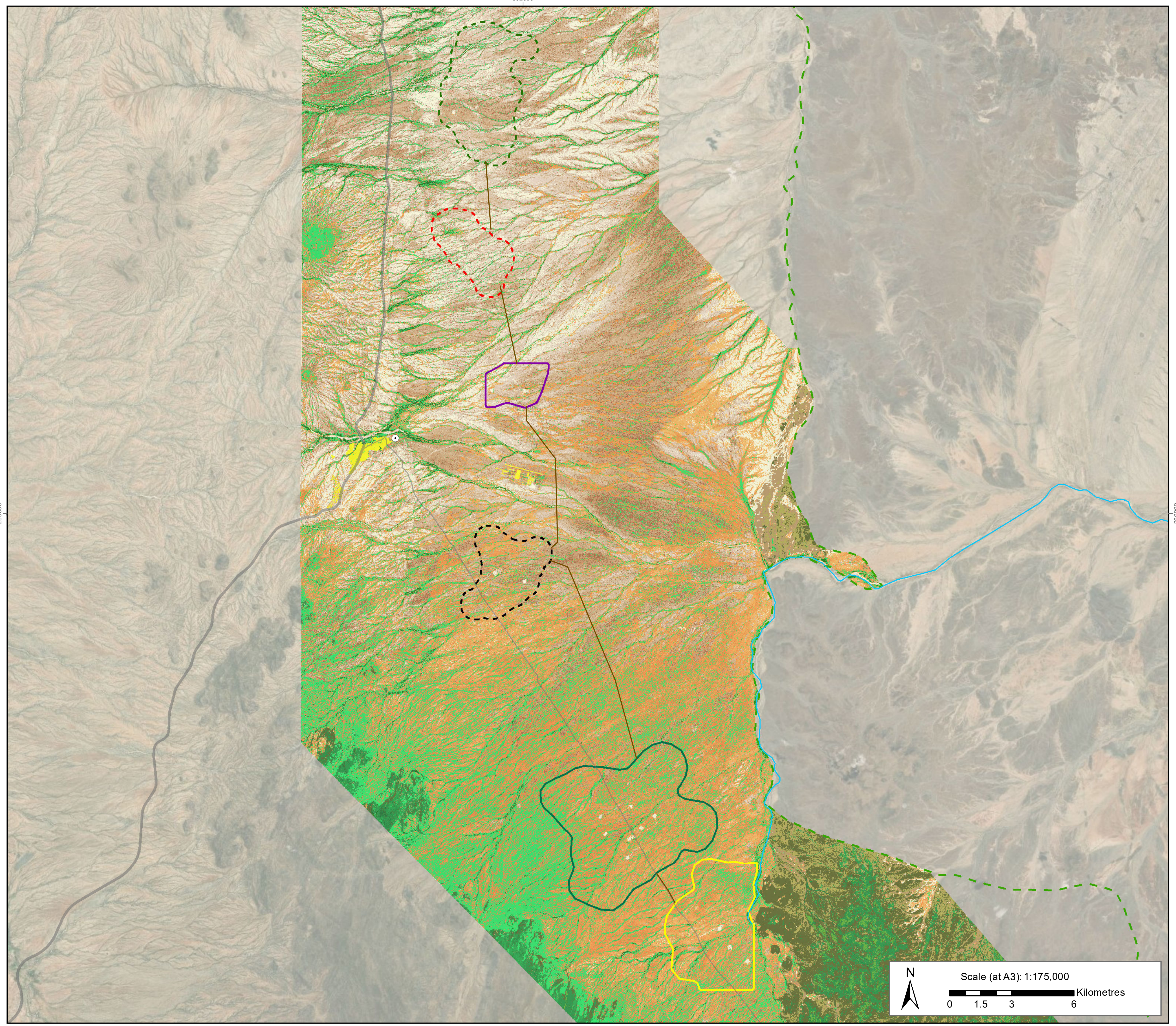

Drawing 6.9-2: Landcover Classification

Key

Landcover Classification

- Acacia Dominated Forest (Tall Trees) Along Major Riparian Zone
- All Cultivated Land, Including Both Currently Active and Old, Long Term Fallow / Abandoned Field
- Acacia and Other Spp Dominated Forest (Tall Trees) Along Major Riparian Zone
- Dense Bush and/or Taller Shrub (Most Dense Bush Dominated Class), on Mountain or Rocky Hill
- Dense Bush and/or Taller Shrub (But Less Dense Than Dense Bush Class #1, on Mountain or Rocky Hill
- Dense Bush and/or Taller Shrub (But Less Dense Than Dense Bush Class #2, on Mountain or Rocky Hill
- Dense Bush and/or Taller Shrubs (But Less Dense Than Dense Bush Class #3: Least Dense, But More Dense Than Open Bush Classes), on Mountains or Rocky Hills
- Dense Low Shrub and/or Grass Cover, With Only A Few Bushe, on Mountain or Rocky Hill
- Dense Tree and Tall Bush Combination Class, on Mountain or Rocky Hill
- Grass Dominated Areas, With Only A Few Trees, Bush or Shrub, on Mountain or Rocky Hill
- Open and/or Scattered Bush and Shrub Cover, on Mountain or Rocky Hill.
- Open and/or Scattered Bush and/or Shrub, on Mountain or Rocky Hill
- Sparse to Open Grass Cover Area, Typically Containing Scattered Bush and Shrub, on Mountain or Rocky Hill
- Sparse Low Shrub and/or Grass Cover, With only A Few Bushes on Mountains or Rocky Hill
- Sparse Non-Riparian Woodland Cover on Plain
- Dense Non-Riparian Woodland Cover on Plain
- Open Non-Riparian Woodland Cover on Plain
- Open / Semi-Dense Non-Riparian Woodland Cover on Plain
- Low Shrubland on Plains, Dense Cover
- Medium Height Shrubland on Plain, Dense Cover
- Low or Tall Shrubland On Plains, Sparse Cover
- Tall Shrubland on Plains, Dense Cover
- Riparian Woodland (not Closed Canopy, Taller Forest) Along Major Riparian Zone
- Non-Vegetated Bare Sand Area
- All Settlement and Built-up Areas In the Extended Western Pipe Transect, this Includes Small "kraal" Concentrations as Well as Established Settlements and Built-up Area
- Water in Lake and Major River System
- Shallow Water in Pan System
- Town/Village
- Interconnecting Network
- A1
- C46
- Watercourse
- Biophysical Area of Influence (AoI)
- Lake Turkana
- Turkwel Gorge Reservoir / Project Water Source
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)

Data sources:
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PROJECT OIL KENYA

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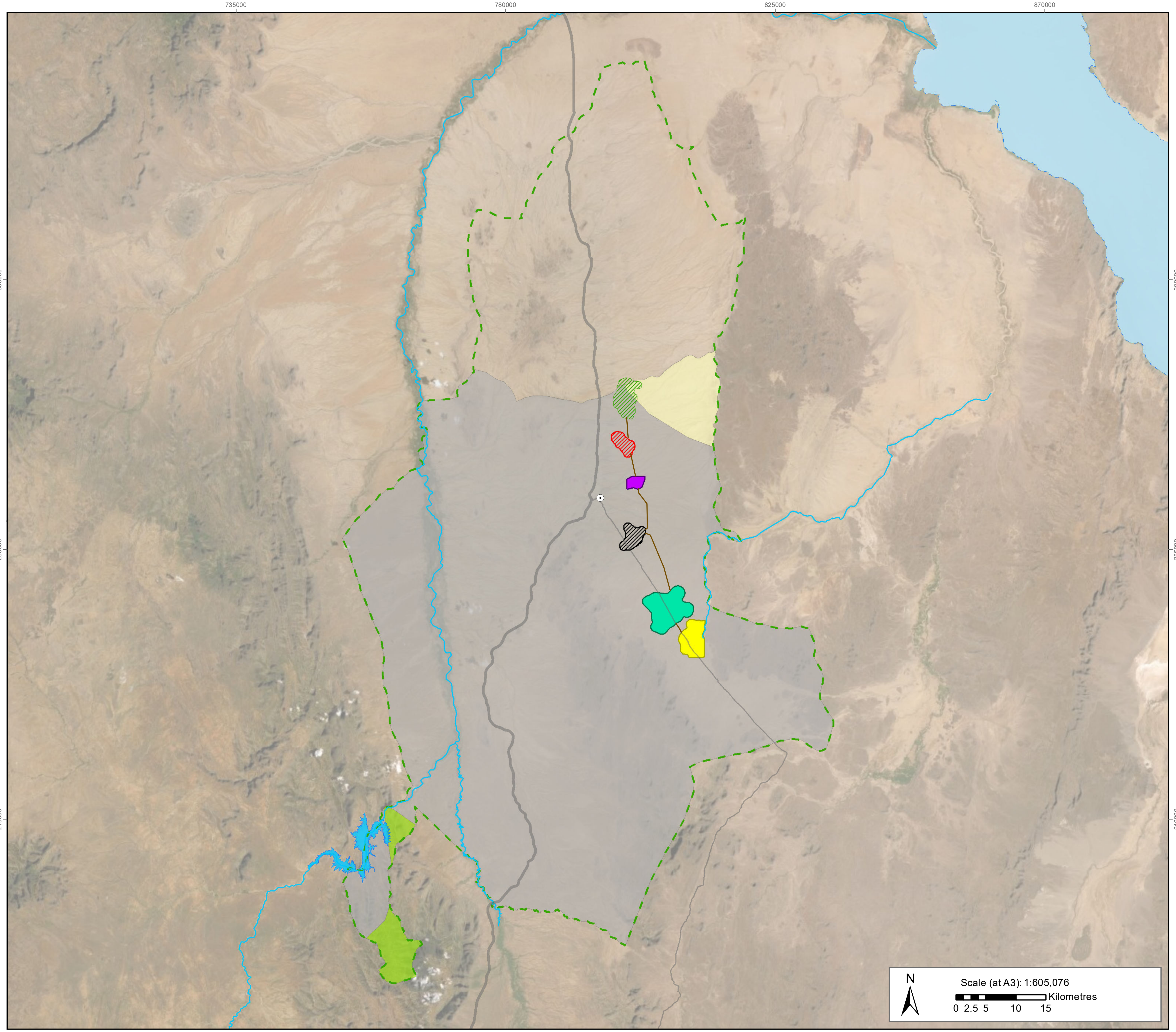

Drawing 6.9-3: WWF Ecoregions

Key

- Town/Village
- Interconnecting Network
- A1
- C46
- Watercourse
- Biophysical Area of Influence (AoI)
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)
- Lake Turkana
- Turkwel Gorge Reservoir / Project Water Source

WWF Ecoregion

- East African Montane Forests
- Masai Xeric Grasslands And Shrublands
- Northern Acacia-Commiphora Bushlands And Thickets

Data sources:
Infrastructure data sourced from client. Road data is licensed under the Open Data Commons Open Database License (ODbL) by the OpenStreetMap Foundation (OSMF). Ecoregions available from WWF © 2019 World Wildlife Fund

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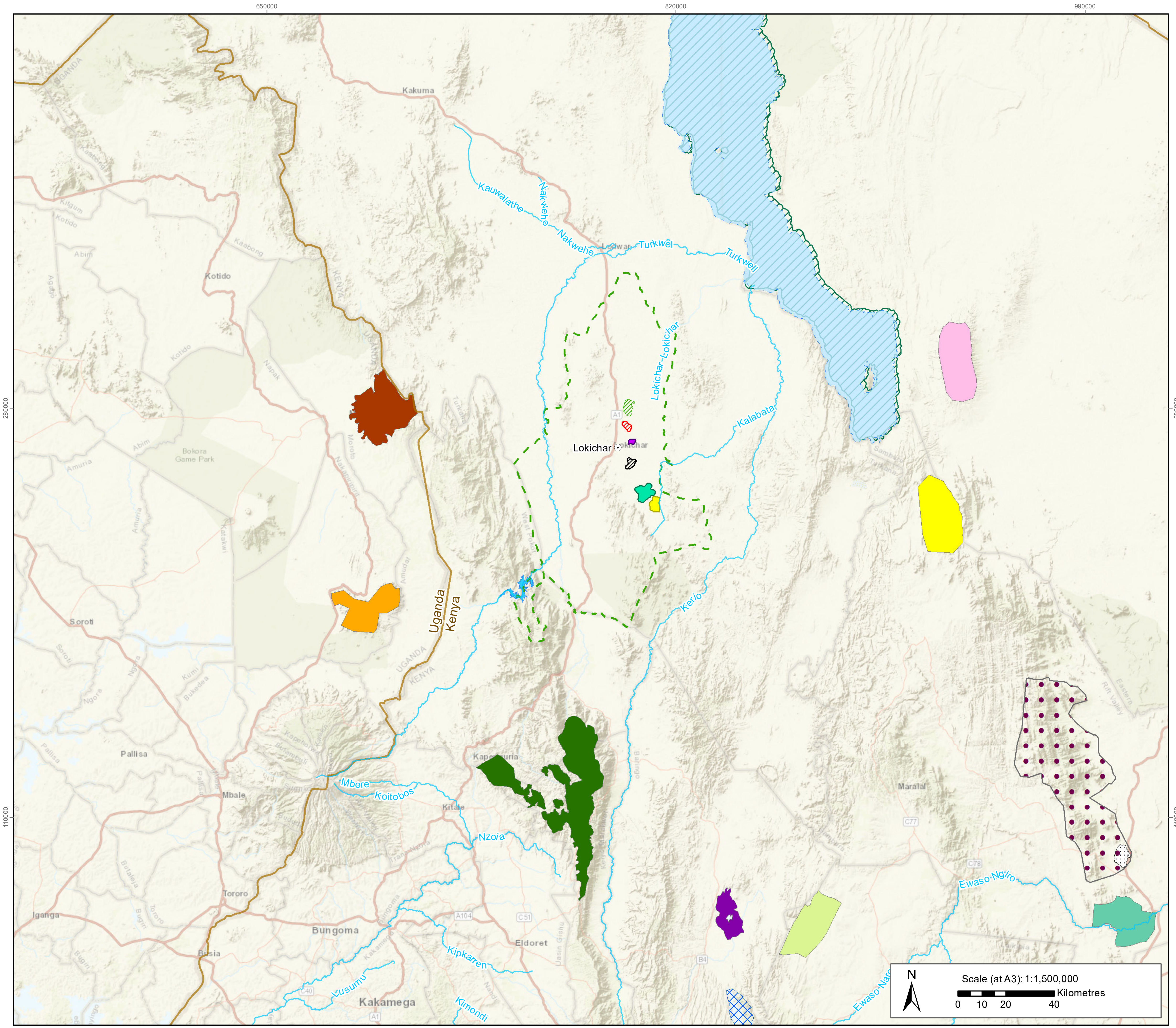

Drawing 6.9-4: Golbal Key Biodiversity Areas

Key

Global Key Biodiversity Area (KBA)

- Cherangani Hill
- Laikipia National Reserve
- Lake Baringo
- Lake Bogoria National Reserve
- Lake Turkana
- Matthews Range
- Mount Kadam
- Mount Kulal Forest
- Mount Moroto Forest Reserve
- Mount Nyiru Forest Reserve
- Ol Donyo Sabache
- Samburu and Buffalo Springs National Reserves
- Town/Village
- Watercourse
- Biophysical Area of Influence (AoI)
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)
- Lake Turkana
- Turkwel Gorge Reservoir / Project Water Source

Data sources:
Base data available from Tullow and Worley Parsons. Surface water data islicensed under the Open Data Commons Open Database License (ODbL) by the OpenStreetMap Foundation (OSMF).Key Biodiversity Areas available from IBAT 2018

Coordinate System: WGS 1984 UTM Zone 36N

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PROJECT OIL KENYA

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Sources: Esri, USGS, NOAA

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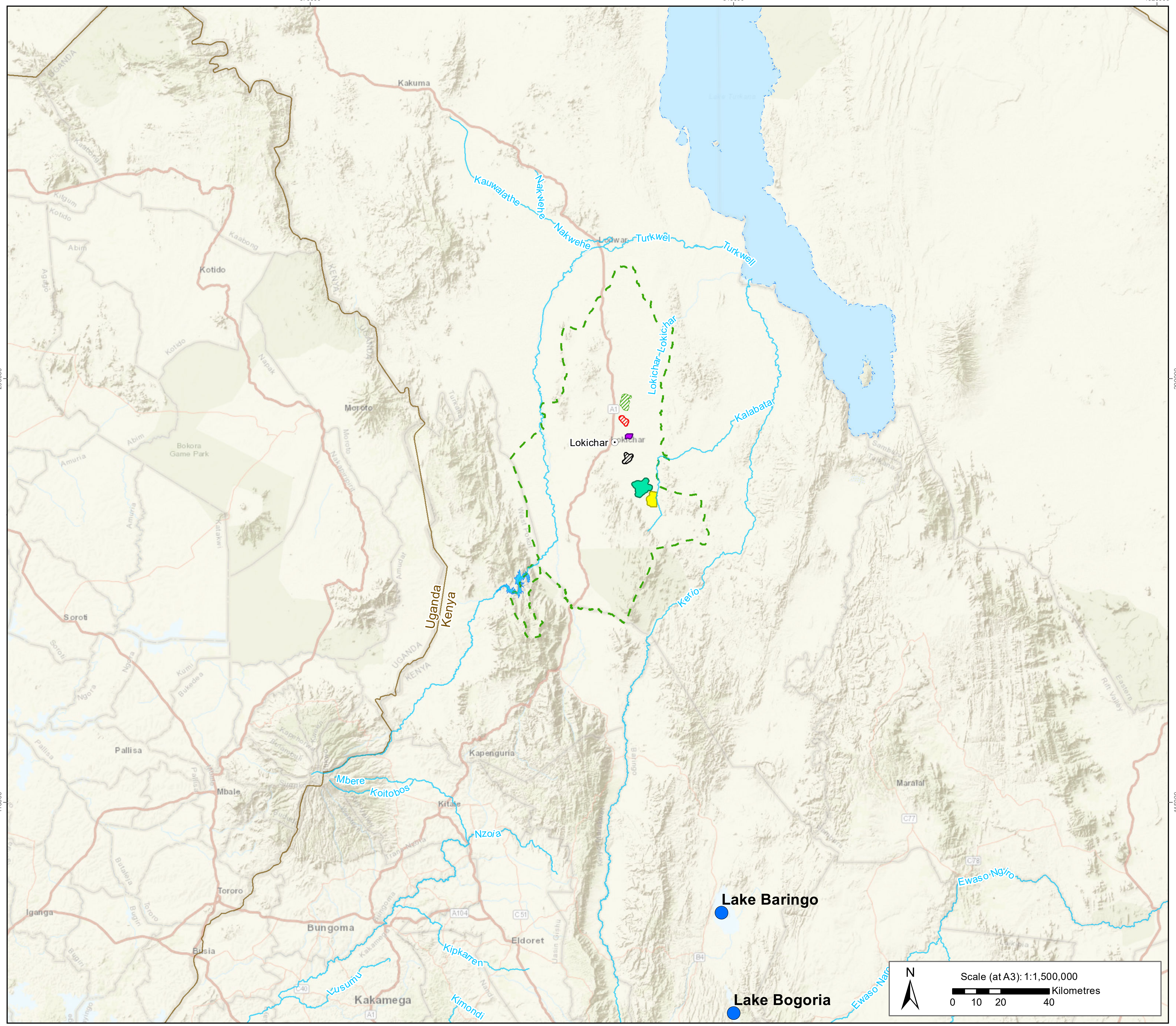

Drawing 6.9-5: Ramsar Sites

Key

- Town/Village
- RAMSAR Site
- Country Boundary
- Watercourse
- Biophysical Area of Influence (AoI)
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)
- Lake Turkana
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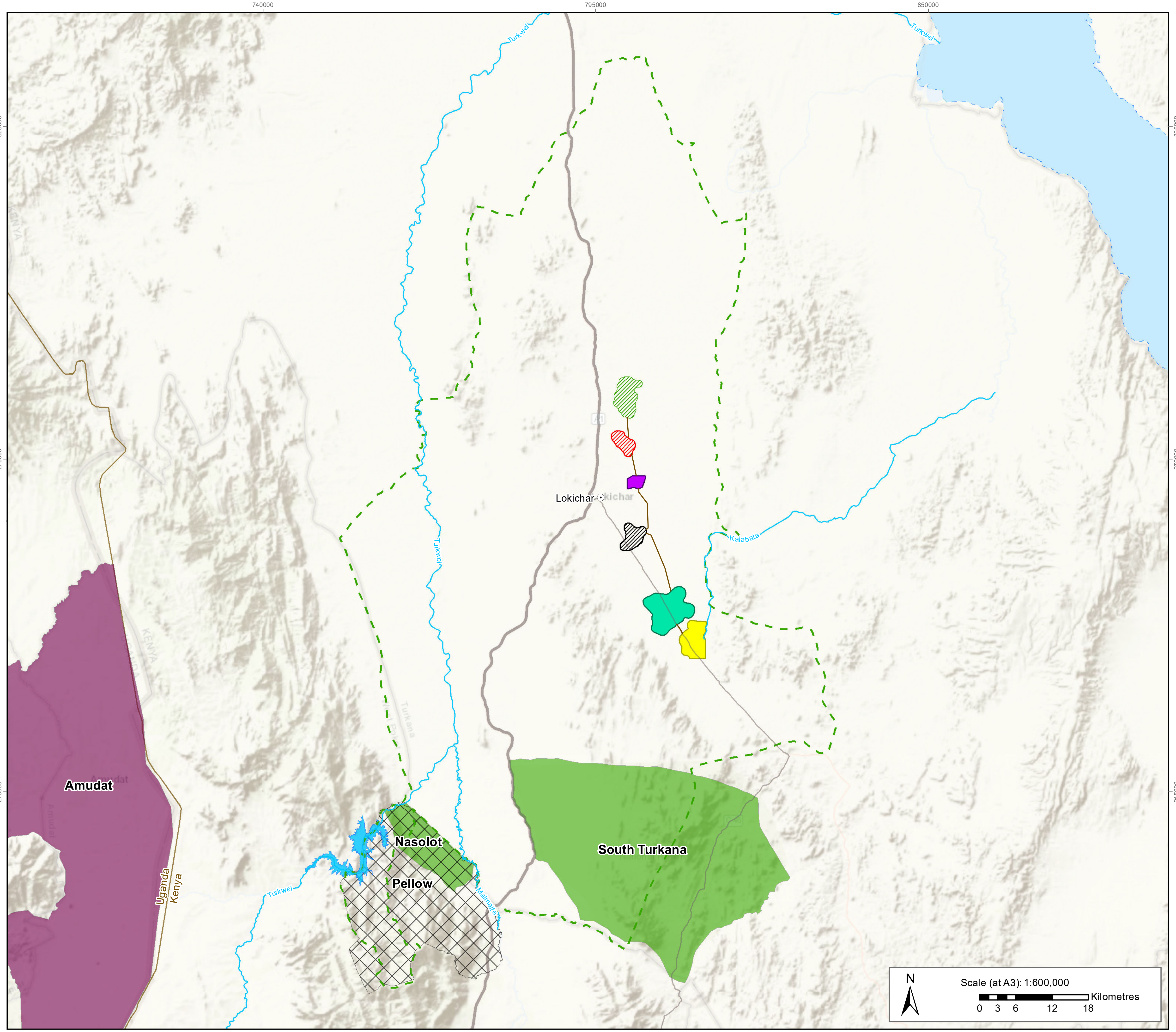

Drawing 6.9-6: Protected Areas

Key

- Town/Village
- A1
- C46
- Watercourse
- Interconnecting Network
- Country Boundary

Protected Areas

- Community Wildlife Management Area
- National Reserve
- Community Conservancy
- Biophysical Area of Influence (AoI)
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)
- Lake Turkana
- Turkwel Gorge Reservoir / Project Water Source

Data sources:
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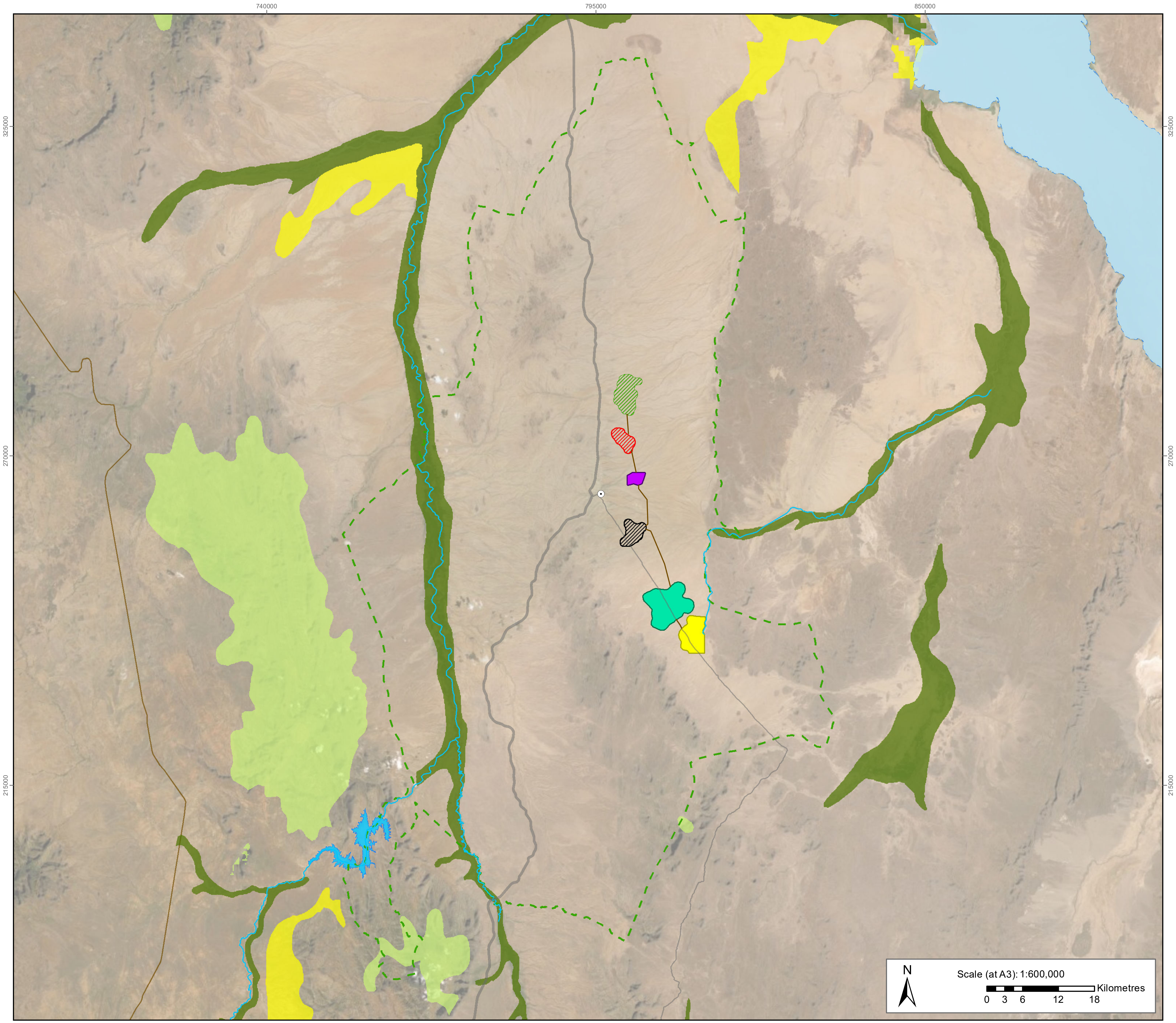


Drawing 6.9-7: Important Habitats

Key

- Town/Village
- Interconnecting Network
- A1
- C46
- Watercourse
- Biophysical Area of Influence (AoI)
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)
- Lake Turkana
- Turkwel Gorge Reservoir / Project Water Source
- Country Boundary

Important Habitats

- Acacia Tortilis Wooded Grassland
- Afromontane Undifferentiated Forest
- Riverine Wooded Vegetation

Data sources:
Based data available from Tullow and Worley Parsons.
Surface Water data is licensed under the Open Data Commons Open Database License (ODbL) by the OpenStreetMap Foundation (OSMF).
Vegetation data available from VECEA 2015

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1433956	KP 18-11-2019	PK 18-11-2019	AM 18-11-2019

PROJECT OIL KENYA

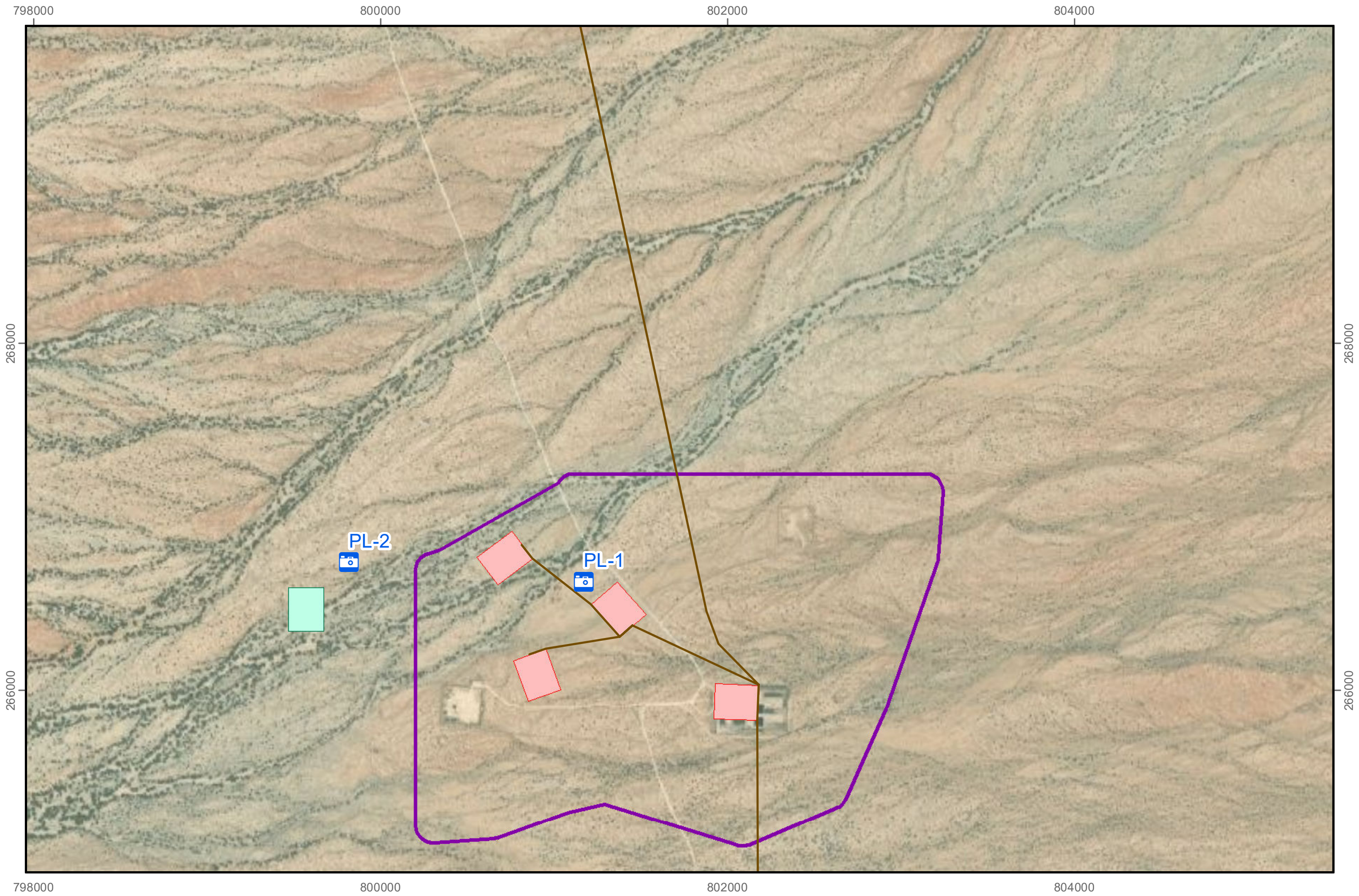
GOLDER MEMBER OF WSP

Cavendish House,Cores End Road,Bourne End,SL8 5AS,UK

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Map path:E:\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1433956\1433956_678_BIO_BASELINE\02_PRODUCTION\MXD\1433956_678_BIO_OG_2077_Habitats_D007.mxd

PL-1



PL-2

Drawing 6.11-1: Photo Locations at Twiga

Key

- Photo Location
- Interconnecting Network
- Twiga (gazetted)
- Wellpad (Contingent)
- Wellpad (Firm)

N

Scale (at A3): 1:40,000

Kilometres

1 0.5 0

Data sources:
Data source from Tullow and Worley Parsons

Coordinate System:

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1433956	KP 18-11-2019	HR 18-11-2019	AM 18-11-2019

PROJECT OIL KENYA

GOLDER MEMBER OF WSP

Cavendish House,Cores End Road,Bourne End,SL8 5AS,UK

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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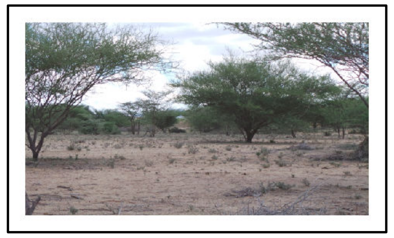
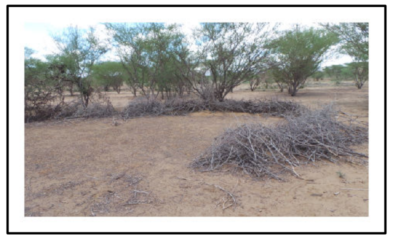
Drawing 6.11-2: Photo Locations at Ngamia

PL-3





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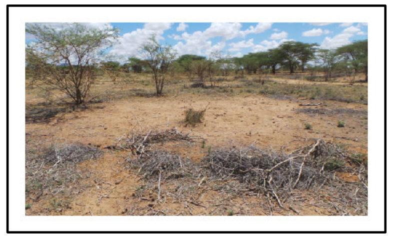

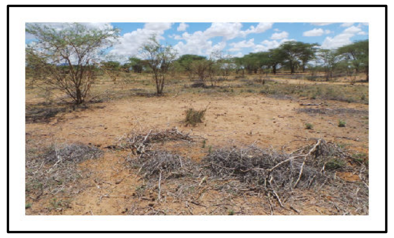

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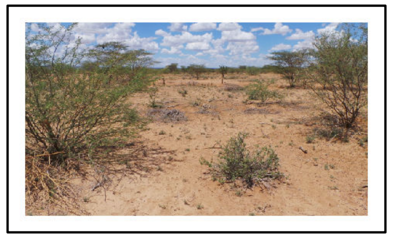
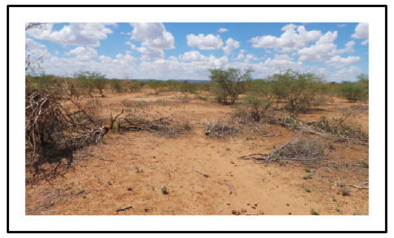
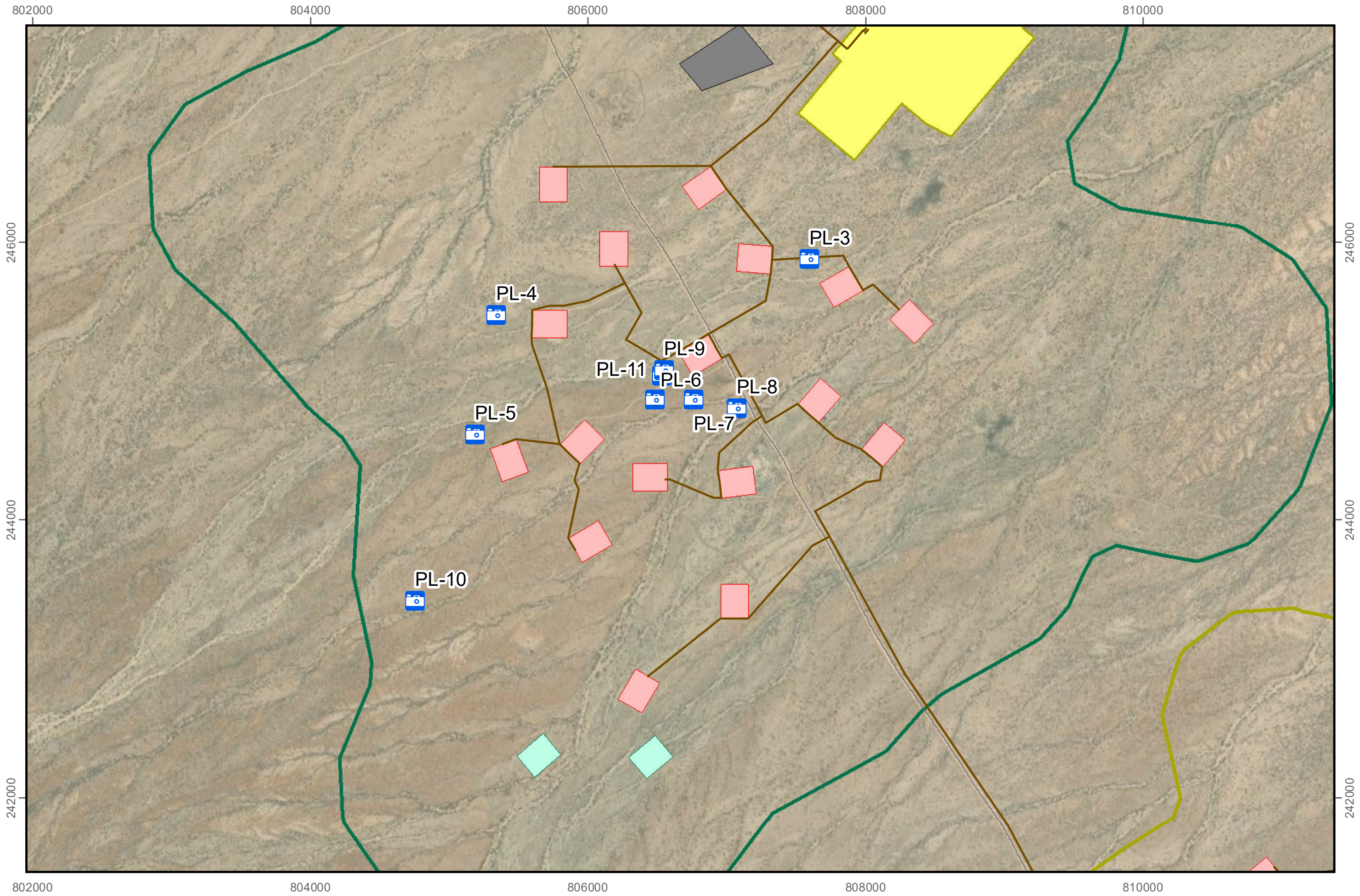


PL-11

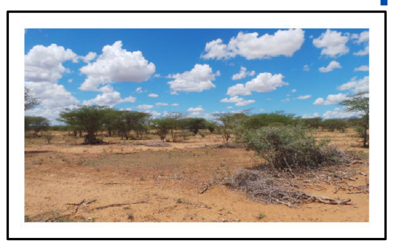
PL-10

PL-6





PL-5



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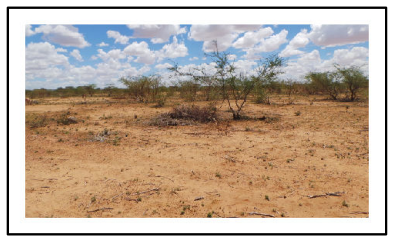


PL-4

Key

- Photo Location
- Interconnecting Network
- C46
- Wellpad (Contingent)
- Wellpad (Firm)
- Central Facilities Area (CFA) Boundary
- Ngamia (gazetted)
- Amosing (gazetted)
- Landfill Boundary

N

Scale (at A3): 1:50,000

0 1 2 Kilometres

Data sources:
Data source from Tullow and Worley Parsons

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1654017	KP 18-11-2019	HR 18-11-2019	AM 18-11-2019

PROJECT OIL KENYA

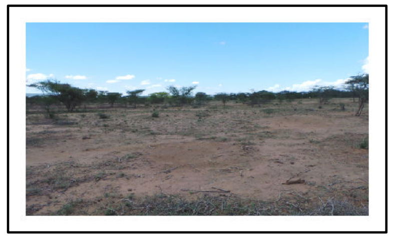
GOLDER MEMBER OF WSP

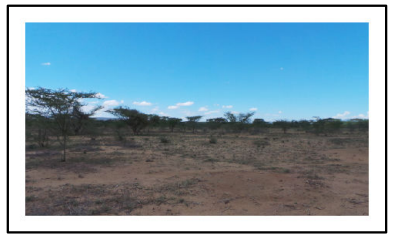
Cavendish House,Cores End Road,Bourne End,SL8 5AS,UK

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Map path:E:\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1433956\1433956_680_LVIA_BASELINE\02_PRODUCTION\MXD\1433956_680_LVIA_OG_2082_Ngamia_Photo_Locations.mxd

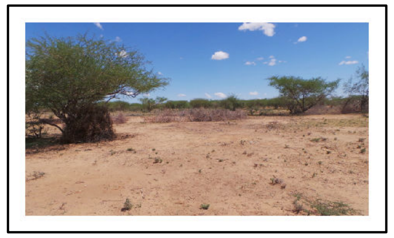
PL-17





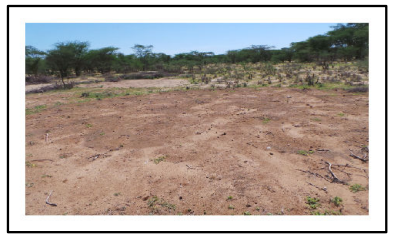
PL-18

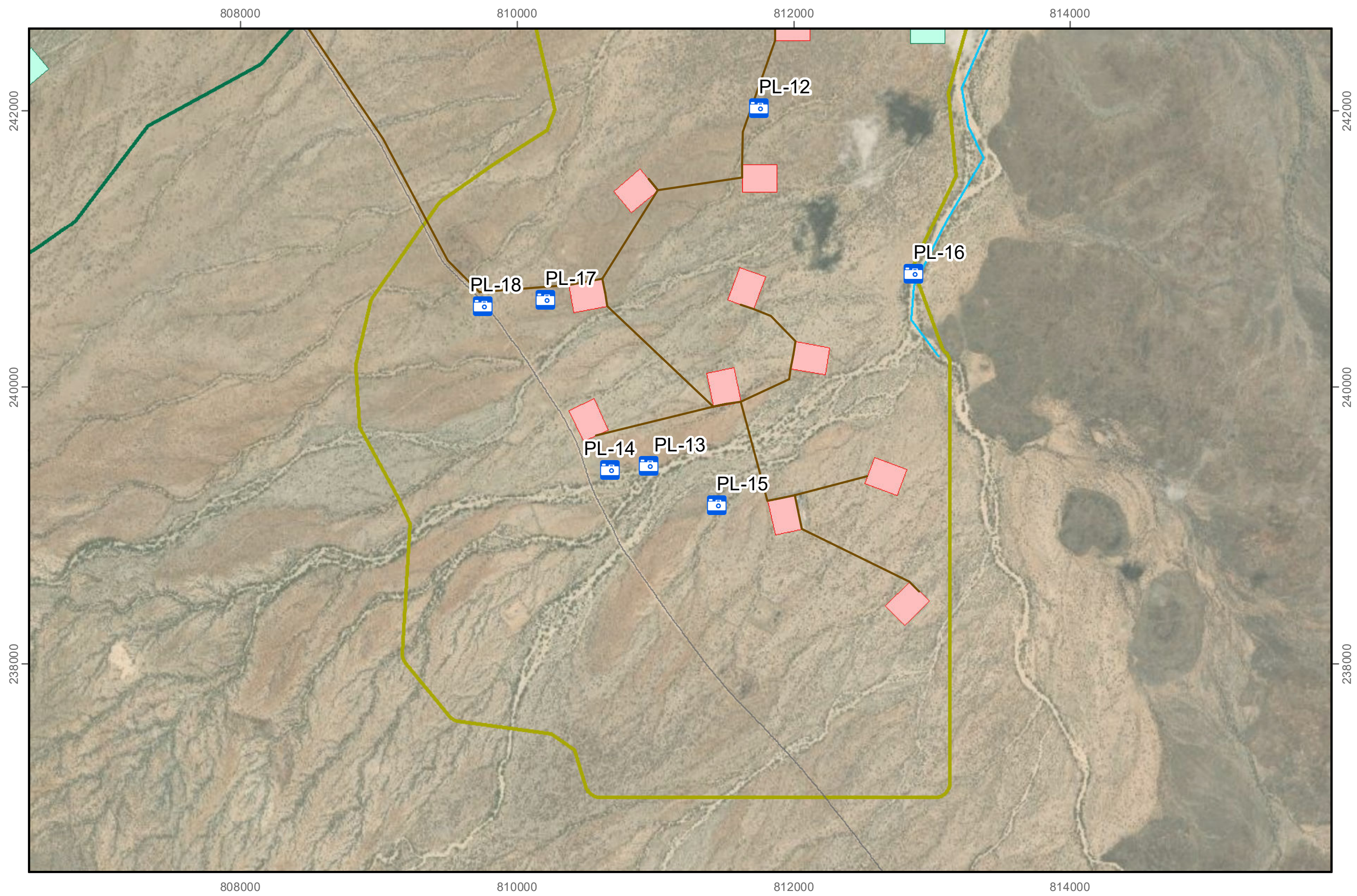
PL-12



PL-14

PL-15





PL-13

PL-16

Drawing 6.11-3: Photo Locations at Amosing

Key

- Interconnecting Network
- C46
- Watercourse
- Ngamia (gazetted)
- Amosing (gazetted)
- Wellpad (Contingent)
- Wellpad (Firm)

N

Scale (at A3): 1:50,000

0 1 2 Kilometres

Data sources:
Data source from Tullow and Worley Parsons

Coordinate System:

Project Ref: 1433956	Prepared By: KP 18-11-2019	Reviewed by: AM 18-11-2019	Approved by: AM 18-11-2019

PROJECT OIL KENYA

GOLDER MEMBER OF WSP

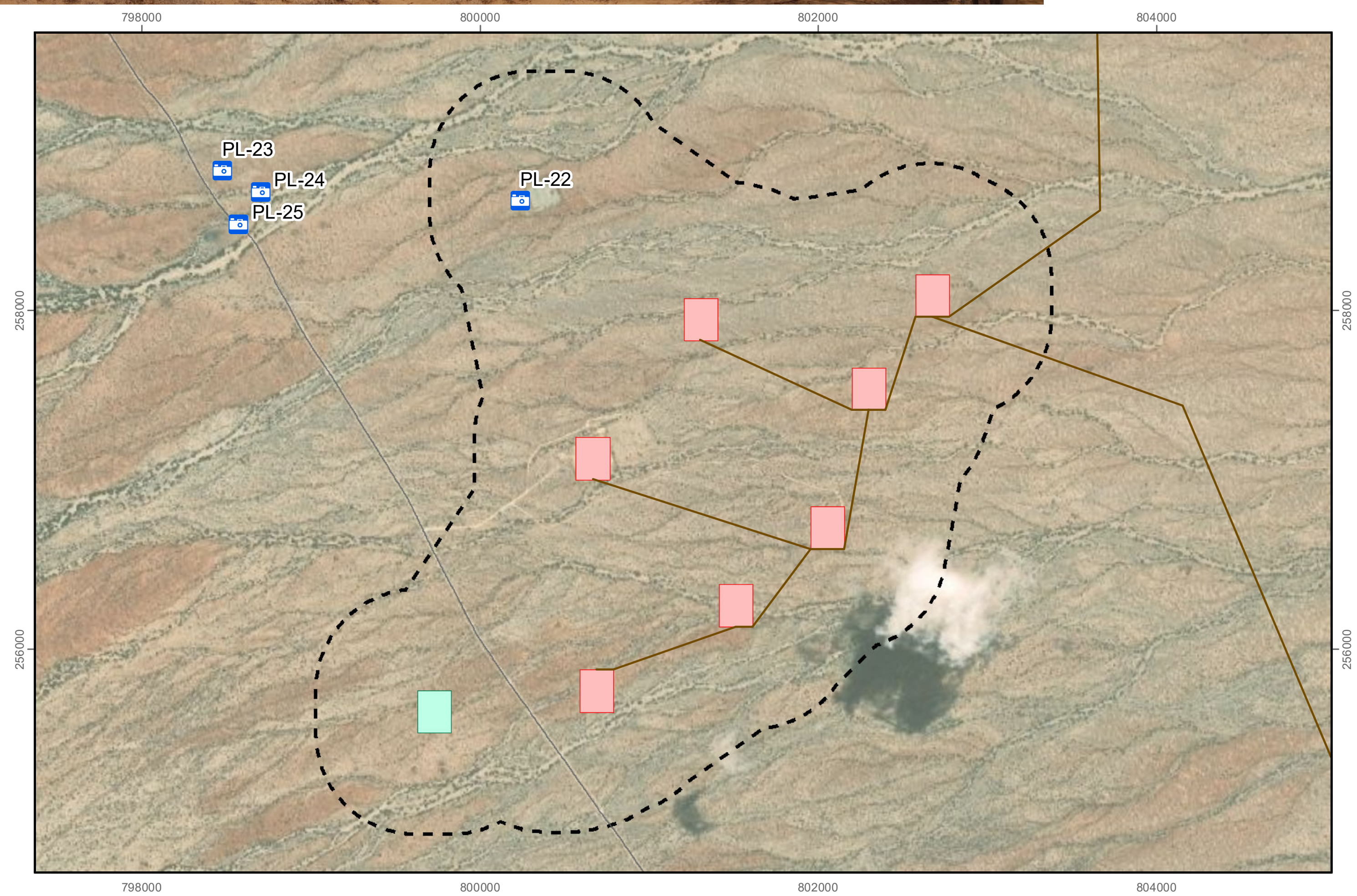
Cavendish House,Cores End Road,Bourne End,SL8 5AS,UK

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Map path:E:\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1433956\1433956_680_LVIA_BASELINE\02_PRODUCTION\MXD\1433956_680_LVIA_OG_2081_Amosing_Photo_Locations.mxd

PL-22

PL-23



PL-24

PL-25

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Drawing 6.11-4: Photo Locations at Ekales

Key

- Interconnecting Network
- C46
- Ekales (indicative)
- Wellpad (Contingent)
- Wellpad (Firm)
- Photolocation (PL)

N

Scale (at A3): 1:40,736

1 0.5 0 Kilometres

Data sources:
Data source from Tullow and Worley Parsons

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1433956	KP 18-11-2019	HR 18-11-2019	AM 18-11-2019

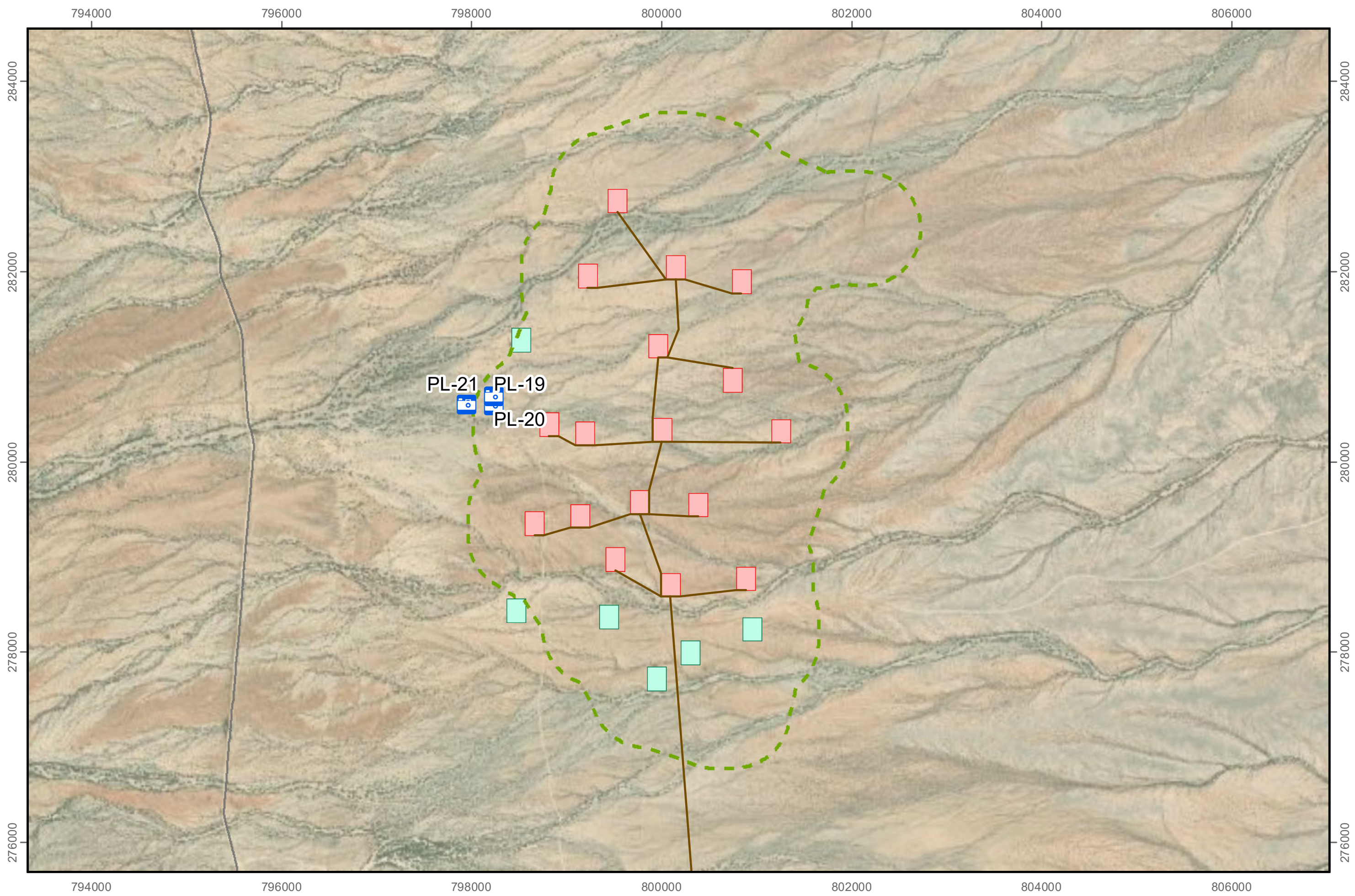
PROJECT OIL KENYA

GOLDER
MEMBER OF WSP

Cavendish House,Cores End Road,Bourne End,SL8 5AS,UK

PL-19

PL-20



PL-21

Drawing 6.11-5: Photo Locations at Etom

Key

- Interconnecting Network
- A1
- Etom (indicative)
- Wellpad (Contingent)
- Wellpad (Firm)
- Photolocation (PL)

N

Scale (at A3): 1:72,905

Kilometres

1 0.5 0

Data sources:
Data source from Tullow and Worley Parsons

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed by:	Approved by:
1433956	KP 18-11-2019	HR 18-11-2019	AM 18-11-2019

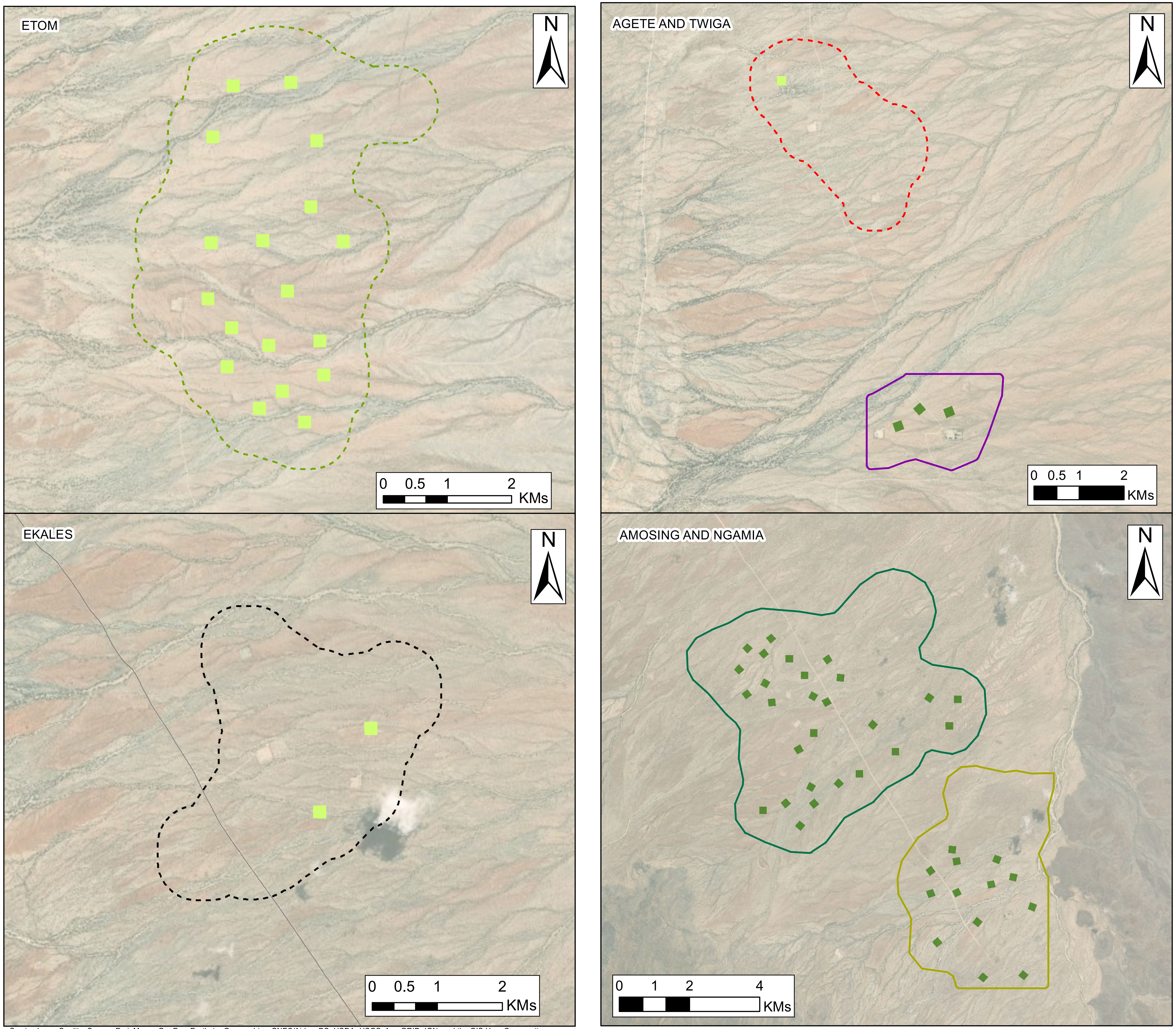
PROJECT OIL KENYA

GOLDER MEMBER OF WSP

Cavendish House,Cores End Road,Bourne End,SL8 5AS,UK

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Map path:E:\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1433956\1433956_680_LVIA_BASELINE\02_PRODUCTION\MXD\1433956_680_LVIA_OG_2086_Etom_Photo_Locations.mxd



Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Drawing 6.13-1 - Cultural Heritage - Primary Data Gathering Survey Locations

Project Oil Kenya

Key

- Town/Village
- Watercourse
- A1
- C46
- Surveyed Area - 2021
- Surveyed Area - 2019
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)

Note: Excludes survey coverage of Turkwel Survey.
Data Sources:
Proposed Infrastructure and base data available from Project Oil Kenya.
Surface water data licensed under the Open Data Commons Open Database License (ODbL) by the OpenStreetMap Foundation (OSMF).

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed By:	Approved by:
1433956	CB 02-07-2021	AM 02-07-2021	AM 02-07-2021

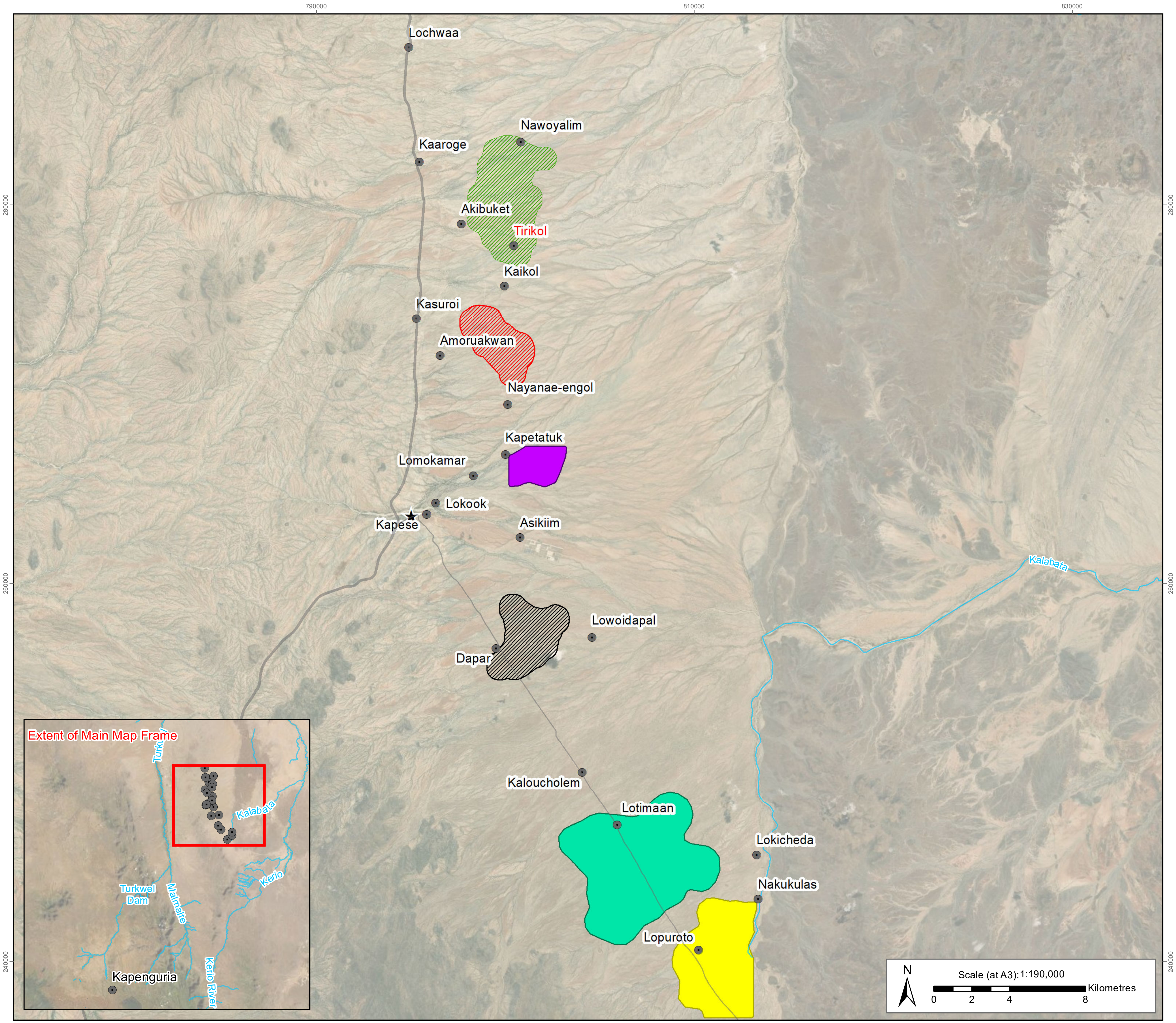
PROJECT OIL KENYA

GOLDER MEMBER OF WSP

Cavendish House,Cores End Road,Bourne End,SL8 5AS,UK

Drawing 6.13-2 - Cultural Heritage - Locations for KIIs

Project Oil Kenya



Key

- Settlement
- Watercourse
- A1
- C46
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)

*KII not completed at Tirikol as no elders present

Data sources:
Proposed Infrastructure and base data available from Project Oil Kenya.
Surface water data licensed under the Open Data Commons Open Database License (ODbL) by the OpenStreetMap Foundation (OSMF).

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed By:	Approved by:
1433956	CB 02-07-2021	AM 02-07-2021	AM 02-07-2021

PROJECT OIL KENYA

GOLDER MEMBER OF WSP

Cavendish House,Cores End Road,Bourne End,SL8 5AS,UK

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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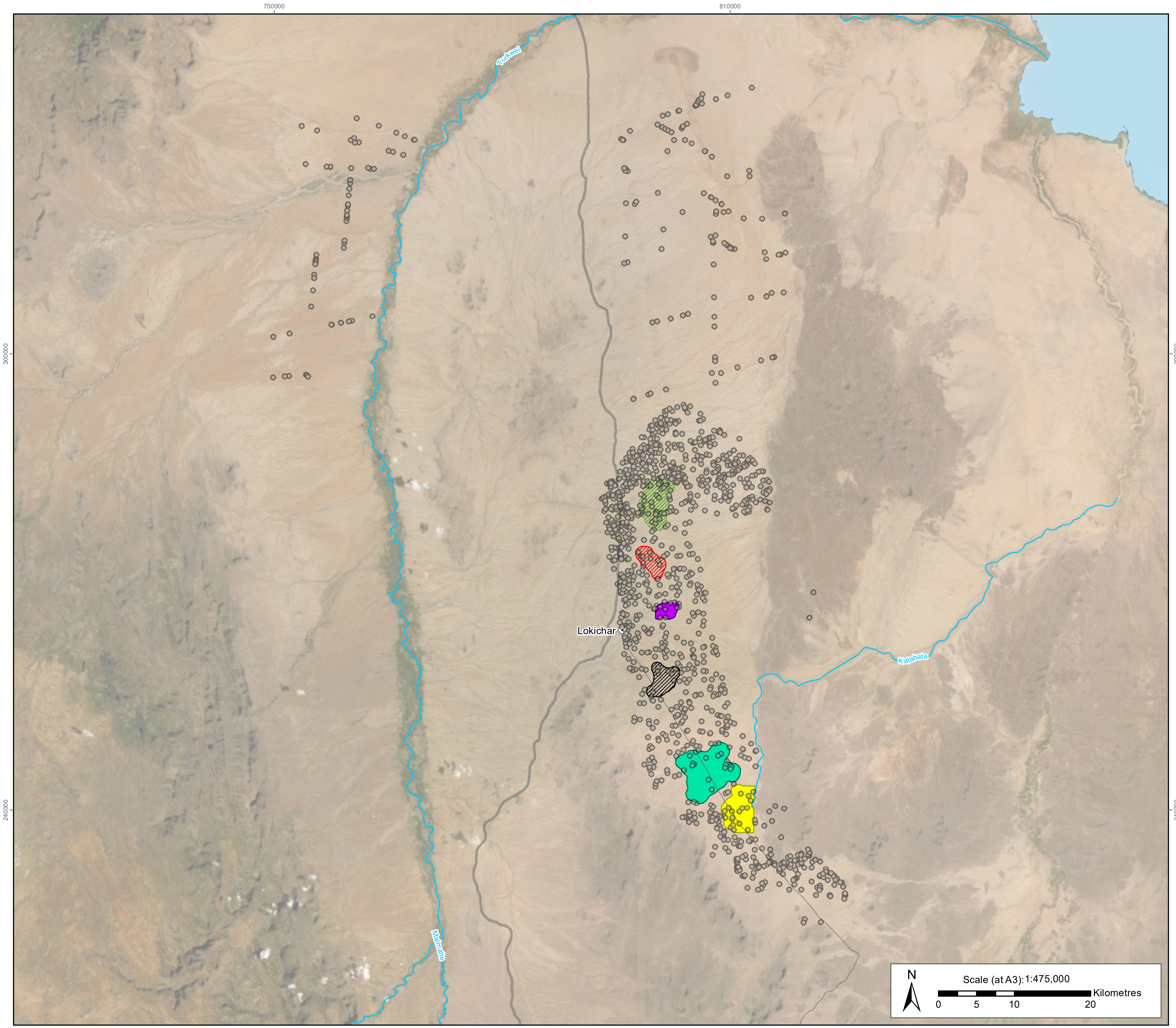


Drawing 6.13-3 - Cultural Heritage - All Known Assets from Secondary Data

Project Oil Kenya

Key

- Cultural Heritage Asset
- Town/Village
- A1
- C46
- Watercourse
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)
- Lake Turkana

Data sources:
Proposed Infrastructure and base data available from Project Oil Kenya.
Surface water data licensed under the Open Data Commons Open Database License (ODbL) by the OpenStreetMap Foundation (OSMF).

Coordinate System: WGS 1984 UTM Zone 36N

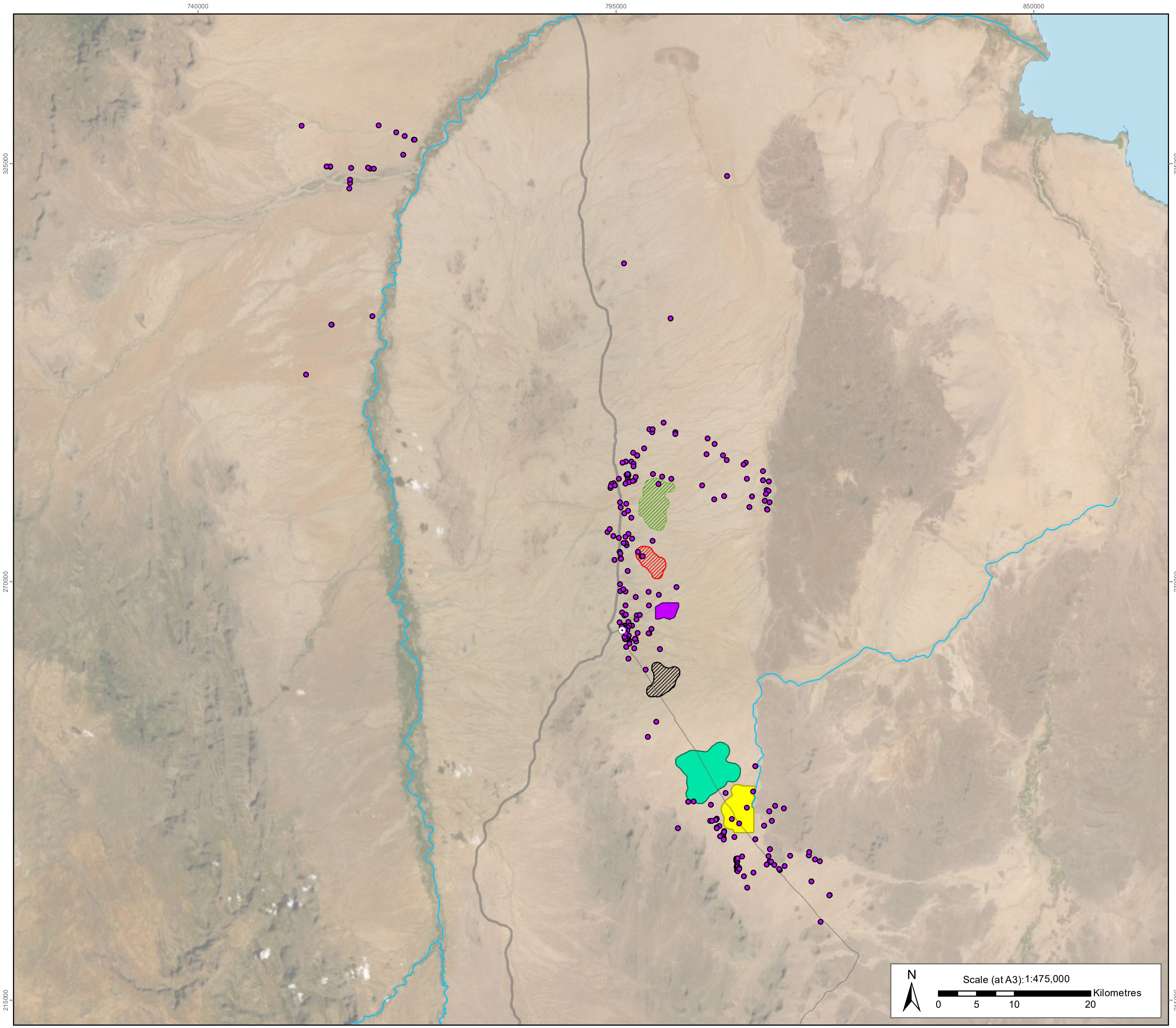
Project Ref:	Prepared By:	Reviewed By:	Approved by:
1433956	CB 02-07-2021	AM 02-07-2021	AM 02-07-2021

PROJECT OIL KENYA

GOLDER
MEMBER OF WSP

Cavendish House,Cores End Road,Bourne End,SL8 5AS,UK

Map path:E:\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1433956\1433956_682_CH_BASELINE\02_PRODUCTION\MXD\1433956_682_CH_OG_2018_Secondary_Data_All_Assets.mxd



Drawing 6.13-4 - Cultural Heritage - Secondary Data - Known Burials

Project Oil Kenya

Key

- Burial
- Town/Village
- Watercourse
- A1
- C46
- Lake Turkana
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)

Data sources:
Proposed Infrastructure and base data available from Project Oil Kenya.
Surface water data licensed under the Open Data Commons Open Database License (ODbL) by the OpenStreetMap Foundation (OSMF).

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed By:	Approved by:
1433956	CB 02-07-2021	AM 02-07-2021	AM 02-07-2021

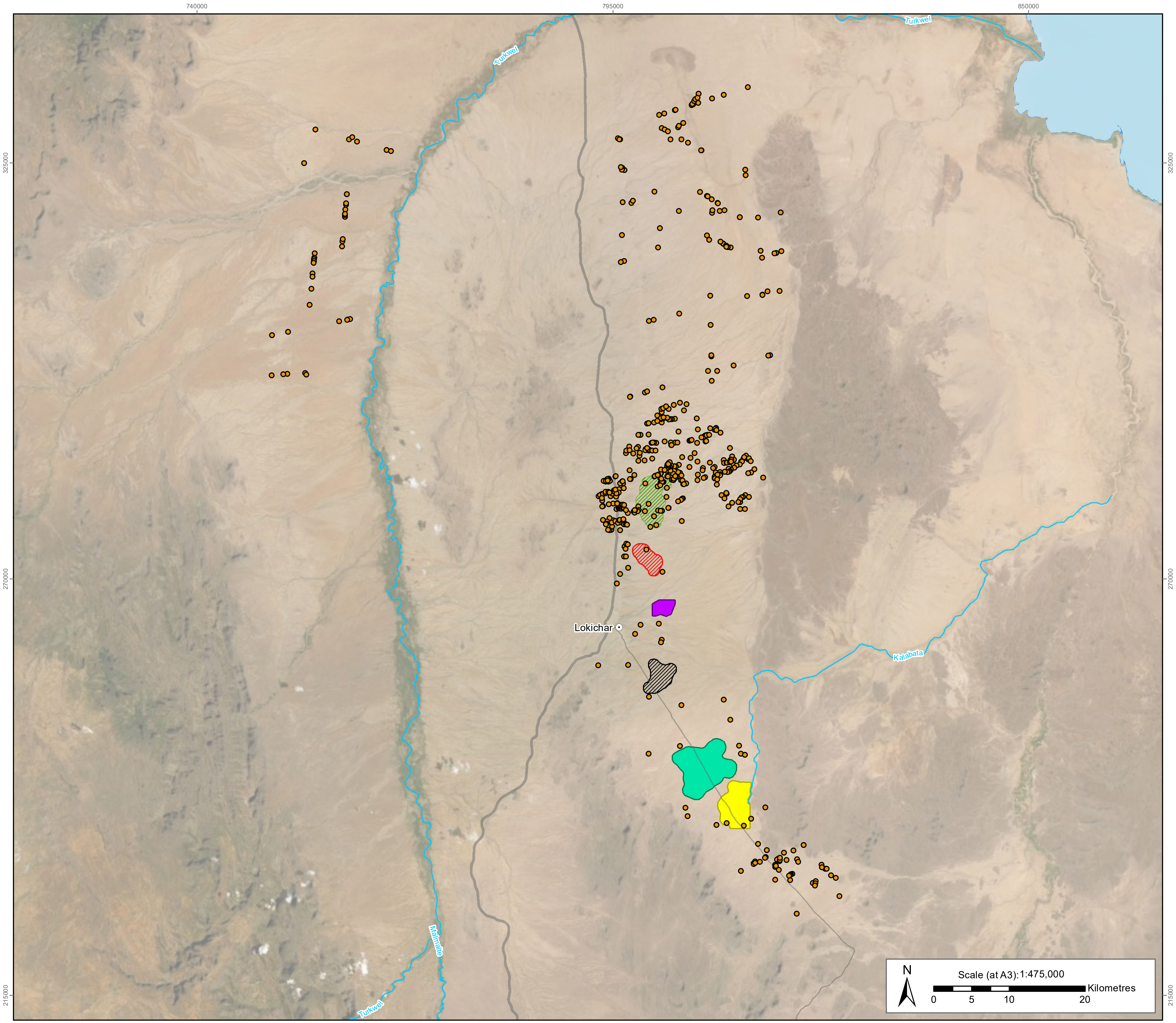
PROJECT OIL KENYA

GOLDER MEMBER OF WSP

Cavendish House,Cores End Road,Bourne End,SL8 5AS,UK

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Map path:E:\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1433956\1433956_682_CH_BASELINE\02_PRODUCTION\MXD\1433956_682_CH_OG_2019_Secondary_Data_Burials.mxd



Drawing 6.13-5 - Cultural Heritage - Secondary Data - Lithic Remains

Project Oil Kenya

Key

- Lithic Remains
- Town/Village
- A1
- C46
- Watercourse
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)
- Lake Turkana

Data sources:
Proposed Infrastructure and base data available from Project Oil Kenya.
Surface water data licensed under the Open Data Commons Open Database License (ODbL) by the OpenStreetMap Foundation (OSMF).

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed By:	Approved by:
1433956	CR 02-07-2021	AM 02-07-2021	AM 02-07-2021

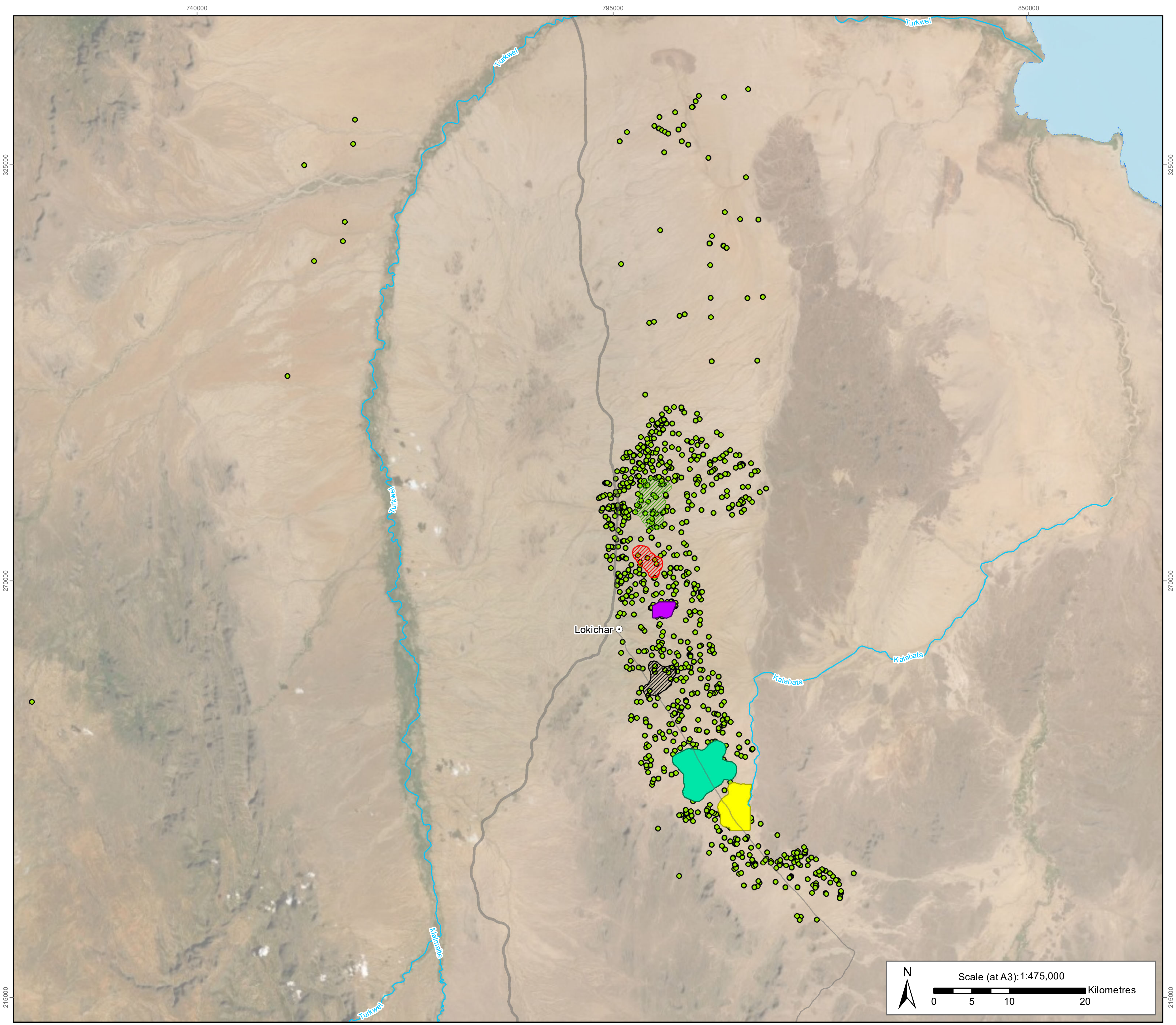
PROJECT OIL KENYA

GOLDER MEMBER OF WSP

Cavendish House,Cores End Road,Bourne End,SL8 5AS,UK

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Map path:E:\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1433956\1433956_682_CH_BASELINE\02_PRODUCTION\MXD\1433956_682_CH_OG_2020_Secondary_Data_Lithics.mxd



Drawing 6.13-6 - Cultural Heritage - Secondary Data - Pottery

Project Oil Kenya

Key

- Pottery
- Town/Village
- A1
- C46
- Watercourse
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)
- Lake Turkana
- Turkwel Gorge Reservoir / Project Water Source

Data sources:
Proposed Infrastructure and base data available from Project Oil Kenya.
Surface water data licensed under the Open Data Commons Open Database License (ODbL) by the OpenStreetMap Foundation (OSMF).

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed By:	Approved by:
1433956	CB 02-07-2021	AM 02-07-2021	AM 02-07-2021

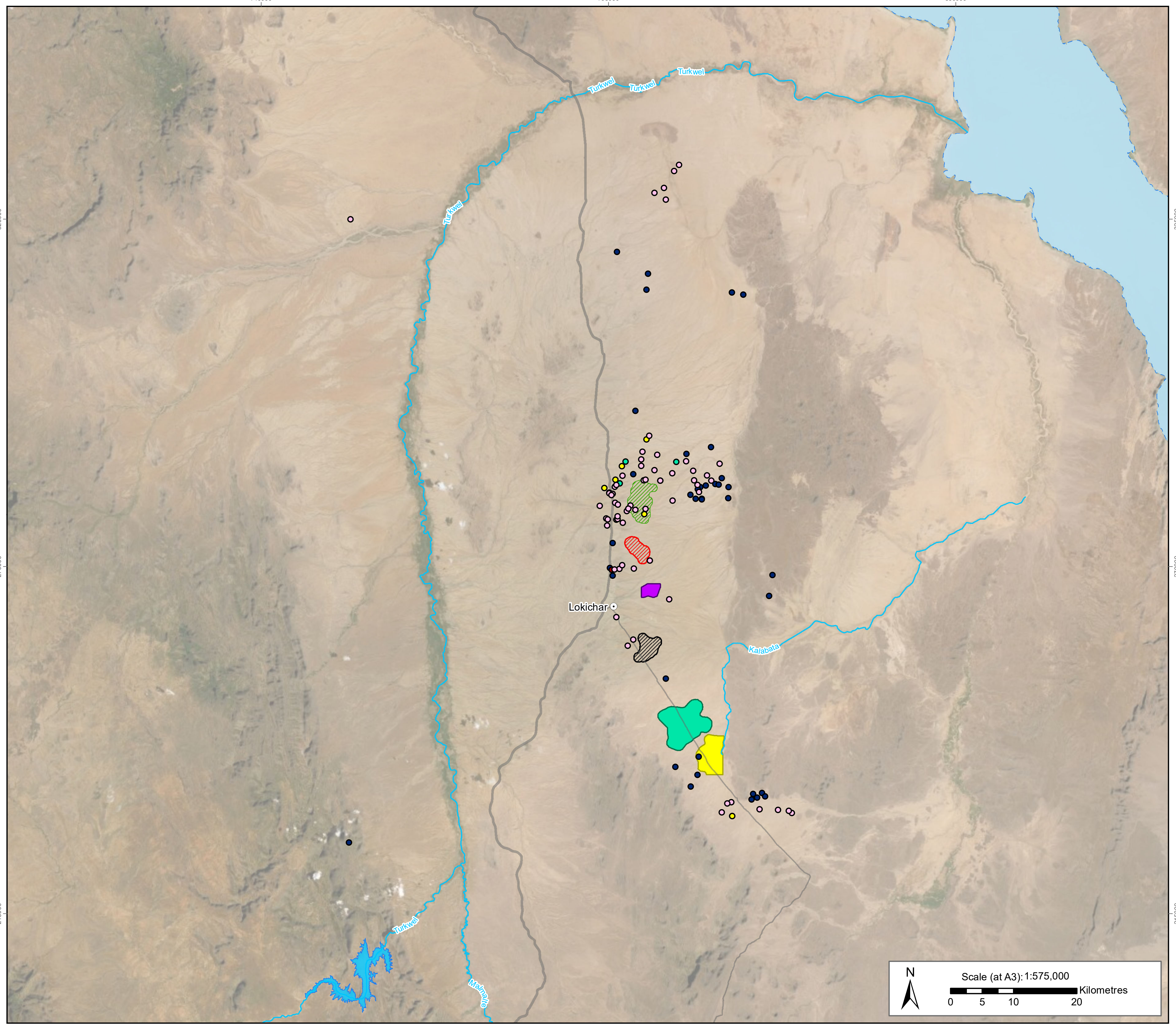
PROJECT OIL KENYA

GOLDER MEMBER OF WSP

Cavendish House,Cores End Road,Bourne End,SL8 5AS,UK

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Map path:E:\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1433956\1433956_682_CH_BASELINE\02_PRODUCTION\MXD\1433956_682_CH_OG_2021_Secondary_Data_Pottery.mxd



Drawing 6.13-7 - Cultural Heritage - Secondary Data - Other Assets

Project Oil Kenya

Key

- Faunal
- Grindstone
- Jewellery
- Monument
- Palaeontological
- Town/Village
- A1
- C46
- Watercourse
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)
- Lake Turkana
- Turkwel Gorge Reservoir / Project Water Source

Data sources:
Proposed Infrastructure and base data available from Project Oil Kenya.
Surface water data licensed under the Open Data Commons Open Database License (ODbL) by the OpenStreetMap Foundation (OSMF).

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed By:	Approved by:
1433956	CB 02-07-2021	AM 02-07-2021	AM 02-07-2021

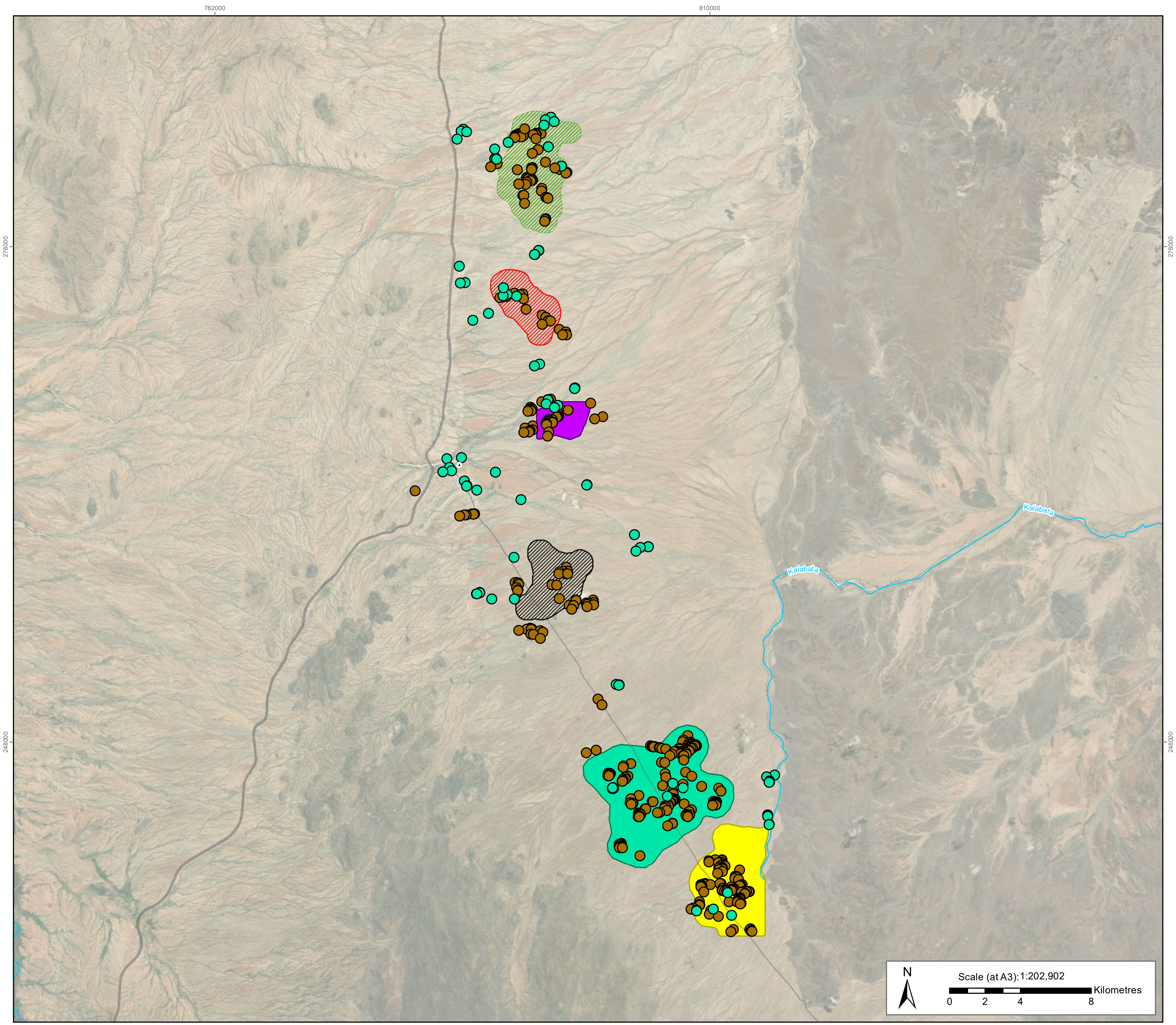
PROJECT OIL KENYA

GOLDER MEMBER OF WSP

Cavendish House,Cores End Road,Bourne End,SL8 5AS,UK

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Map path:E:\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\1433956\1433956_682_CH_BASELINE\02_PRODUCTION\MXD\1433956_682_CH_OG_2022_Secondary_Data_Other.mxd



Drawing 6.13-8 - Cultural Heritage - All Known Assets from Primary Data Gathering

Project Oil Kenya

Key

- Archaeology
- Living Cultural Heritage (CH)
- Town/Village
- A1
- C46
- Watercourse
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)

Data sources:
Proposed Infrastructure and base data available from Project Oil Kenya.
Surface water data licensed under the Open Data Commons Open Database License (ODbL) by the OpenStreetMap Foundation (OSMF).

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed By:	Approved by:
1433956	CB 02-07-2021	AM 02-07-2021	AM 02-07-2021

PROJECT OIL KENYA

GOLDER
MEMBER OF WSP

Cavendish House,Cores End Road,Bourne End,SL8 5AS,UK

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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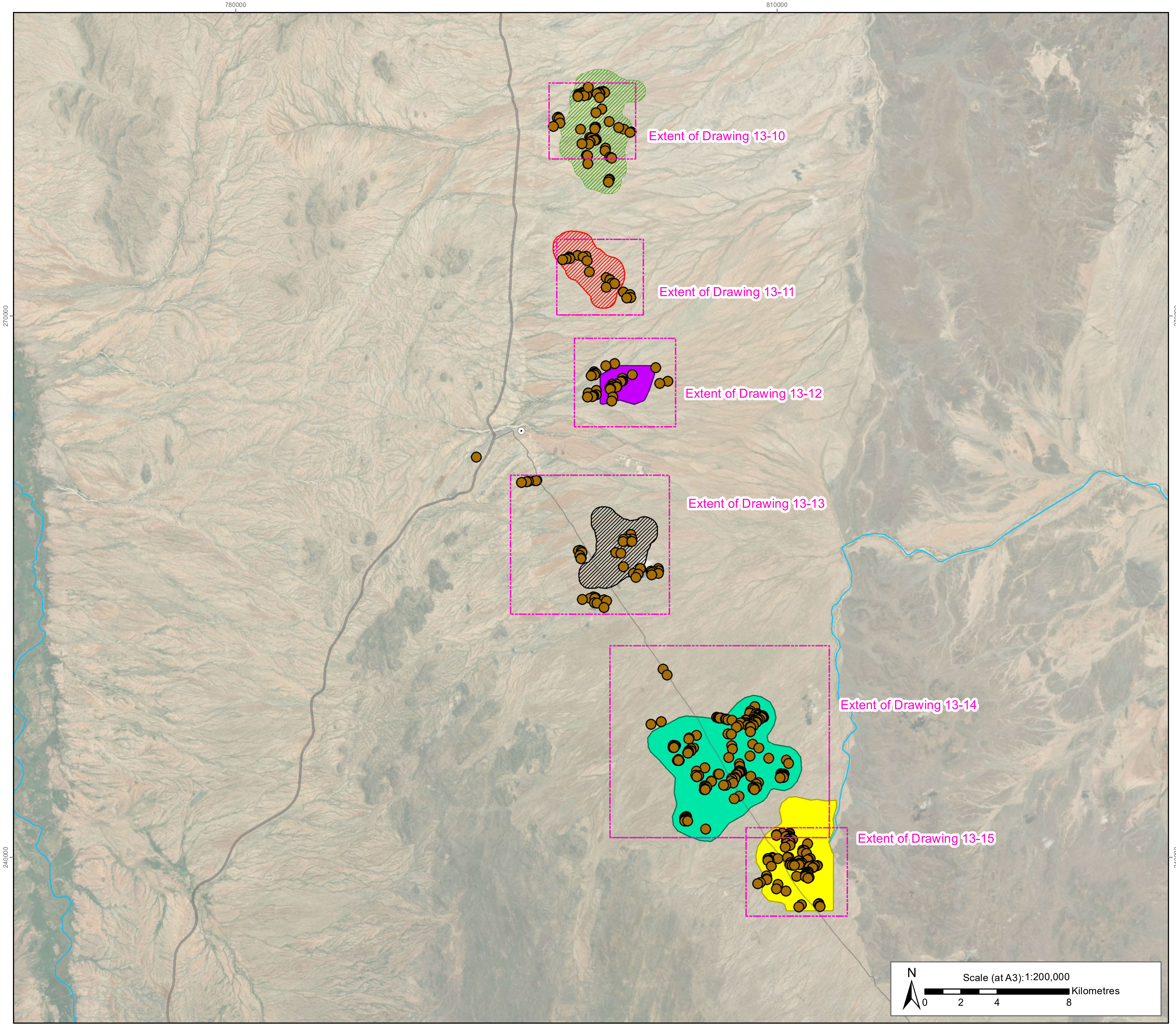

Drawing 6.13-9 - Cultural Heritage - Primary Data - Archaeology (Key Map)

Project Oil Kenya

Key

- Archaeology Asset
- Town/Village
- A1
- C46
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)
- Watercourse

Data sources:
Proposed Infrastructure and base data available from Project Oil Kenya.
Surface water data licensed under the Open Data Commons Open Database License (ODbL) by the OpenStreetMap Foundation (OSMF).

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref: 1433956	Prepared By: CB 02-07-2021	Reviewed By: PW 02-07-2021	Approved by: AM 02-07-2021

PROJECT OIL KENYA

GOLDER MEMBER OF WSP

Cavendish House,Cores End Road,Bourne End,SL8 5AS,UK

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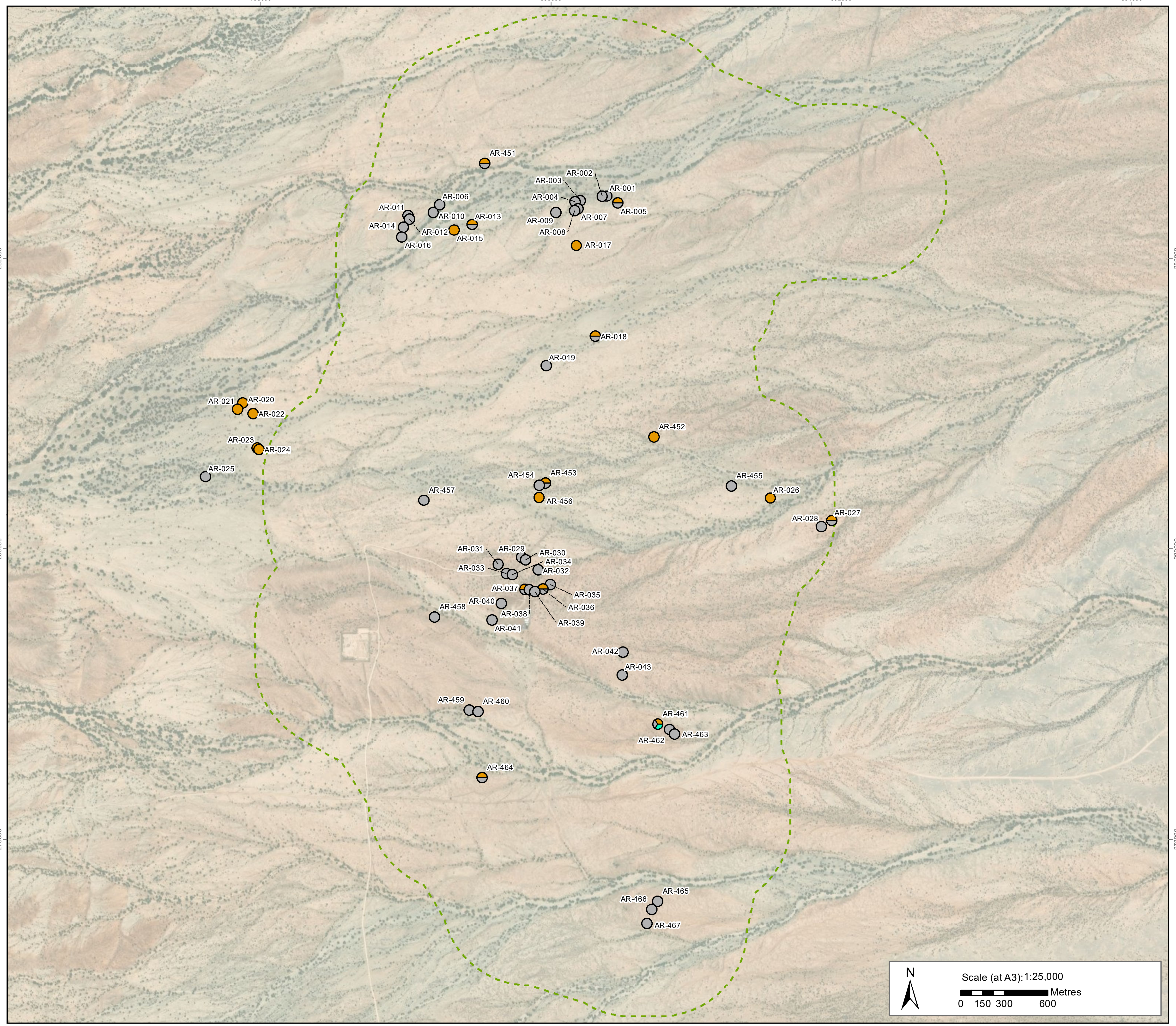

Drawing 6.13-10 - Cultural Heritage - Primary Data - Archaeology (Etom)

Poject Oil Kenya

Key

Archaeological Asset

- Pottery
- Lithic
- Palaeontological
- Jewellery
- Etom (indicative)

Data sources:
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Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed By:	Approved by:
1433956	CB 02-07-2021	AM 02-07-2021	AM 02-07-2021

PROJECT OIL KENYA

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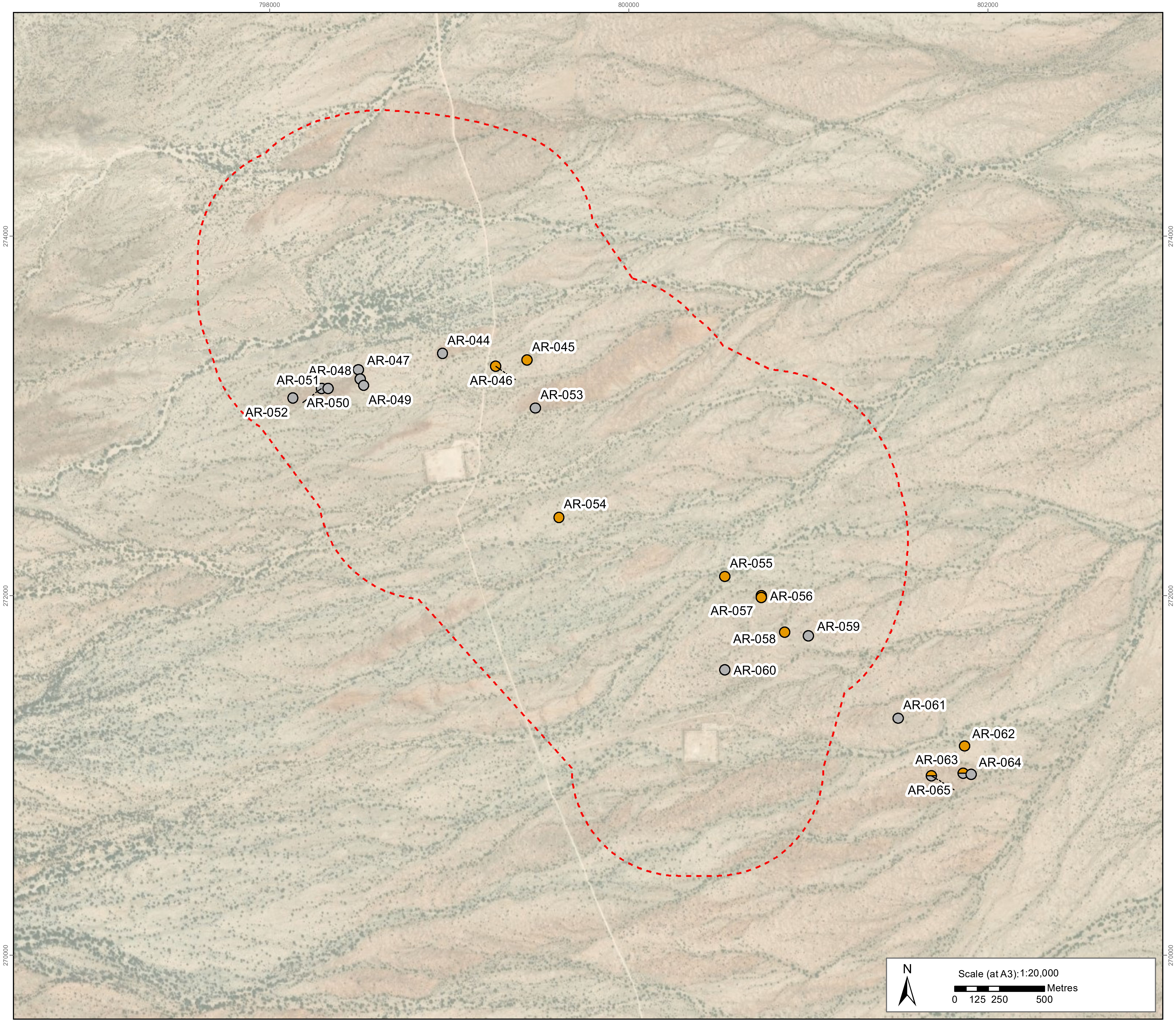

Drawing 6.13-11 - Cultural Heritage - Primary Data - Archaeology (Agete)

Project Oil Kenya

Key

Archaeological Asset

- Pottery
- Lithic
- Palaeontological
- Jewellery
- Agete (indicative)

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Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed By:	Approved by:
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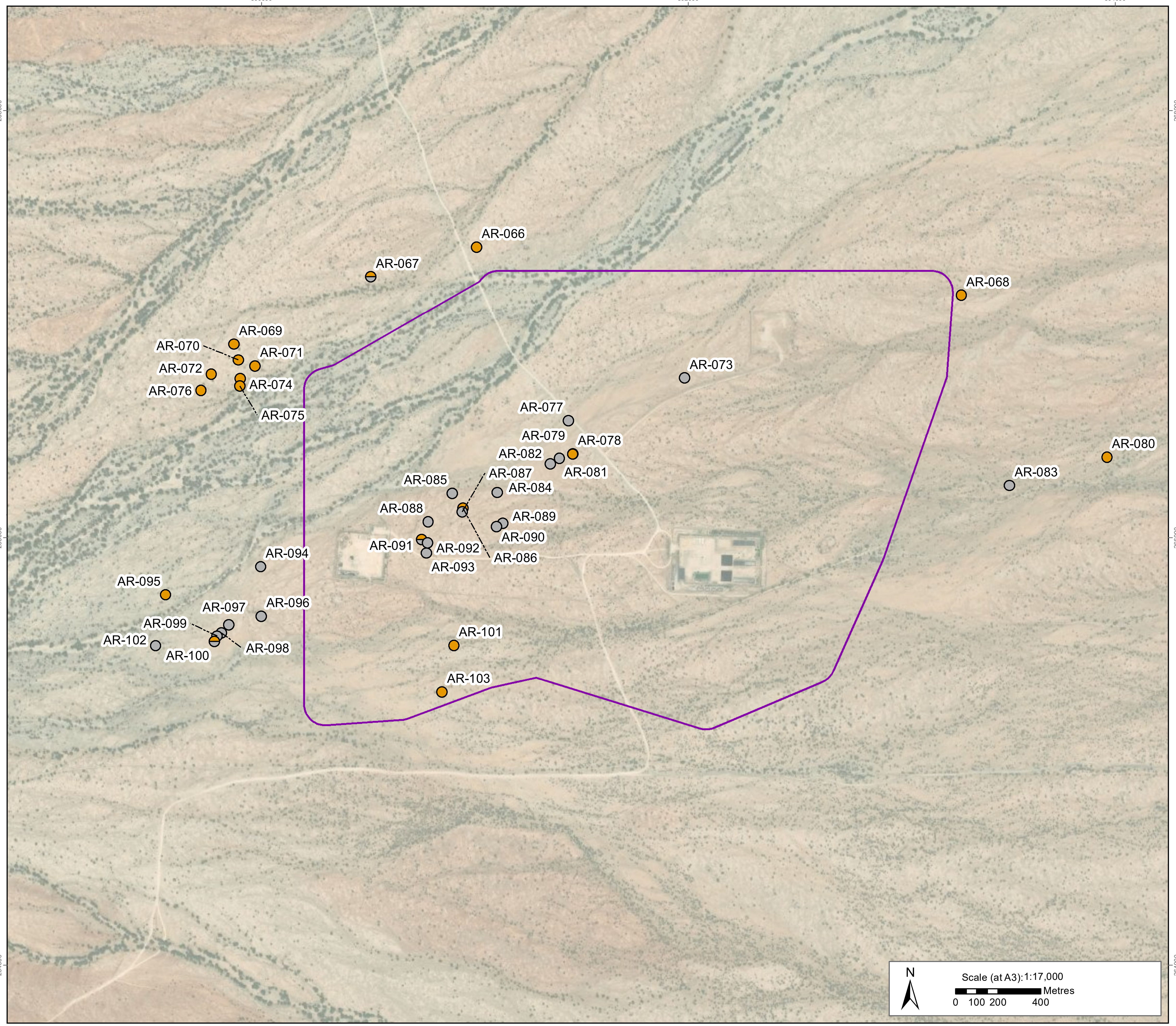
Drawing 6.13-12 - Cultural Heritage - Primary Data - Archaeology (Twiga)

Project Oil Kenya



Key

Archaeological Asset

- Pottery
- Lithic
- Palaeontological
- Jewellery
- Twiga (gazetted)

Data sources:
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Coordinate System: WGS 1984 UTM Zone 36N

Project Ref: 1433956	Prepared By: CB 02-07-2021	Reviewed By: AM 02-07-2021	Approved by: AM 02-07-2021

PROJECT OIL KENYA

GOLDER MEMBER OF WSP

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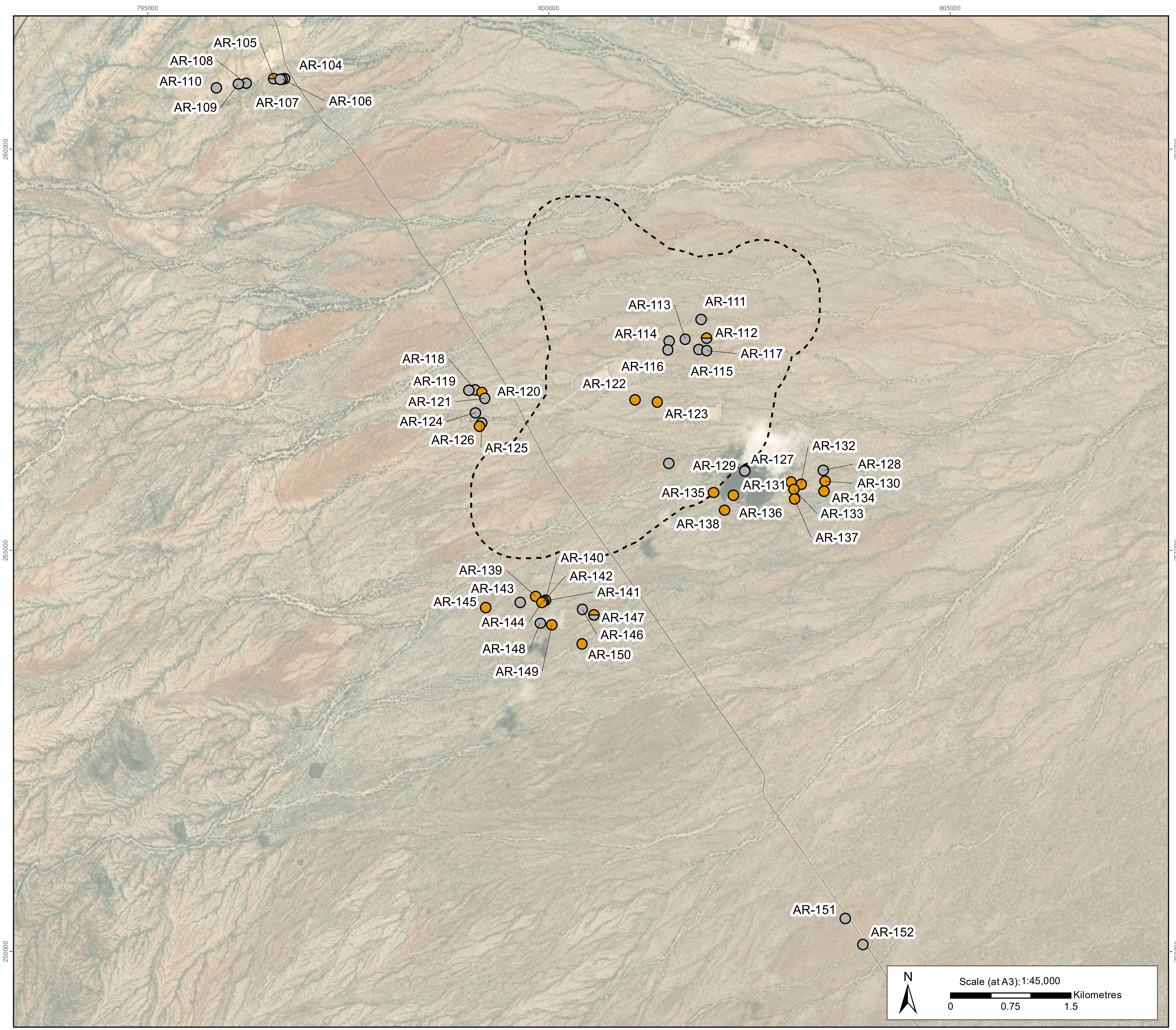

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Drawing 6.13-13 - Cultural Heritage - Primary Data - Archaeology (Ekales)

Project Oil Kenya

Key

Archaeological Asset

- Pottery
- Lithic
- Palaeontological
- Jewellery
- Town/Village
- A1
- C46
- Ekales (indicative)

Data sources:
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Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed By:	Approved by:
1433956	CB 02-07-2021	AM 02-07-2021	AM 02-07-2021

PROJECT OIL KENYA

GOLDER MEMBER OF WSP

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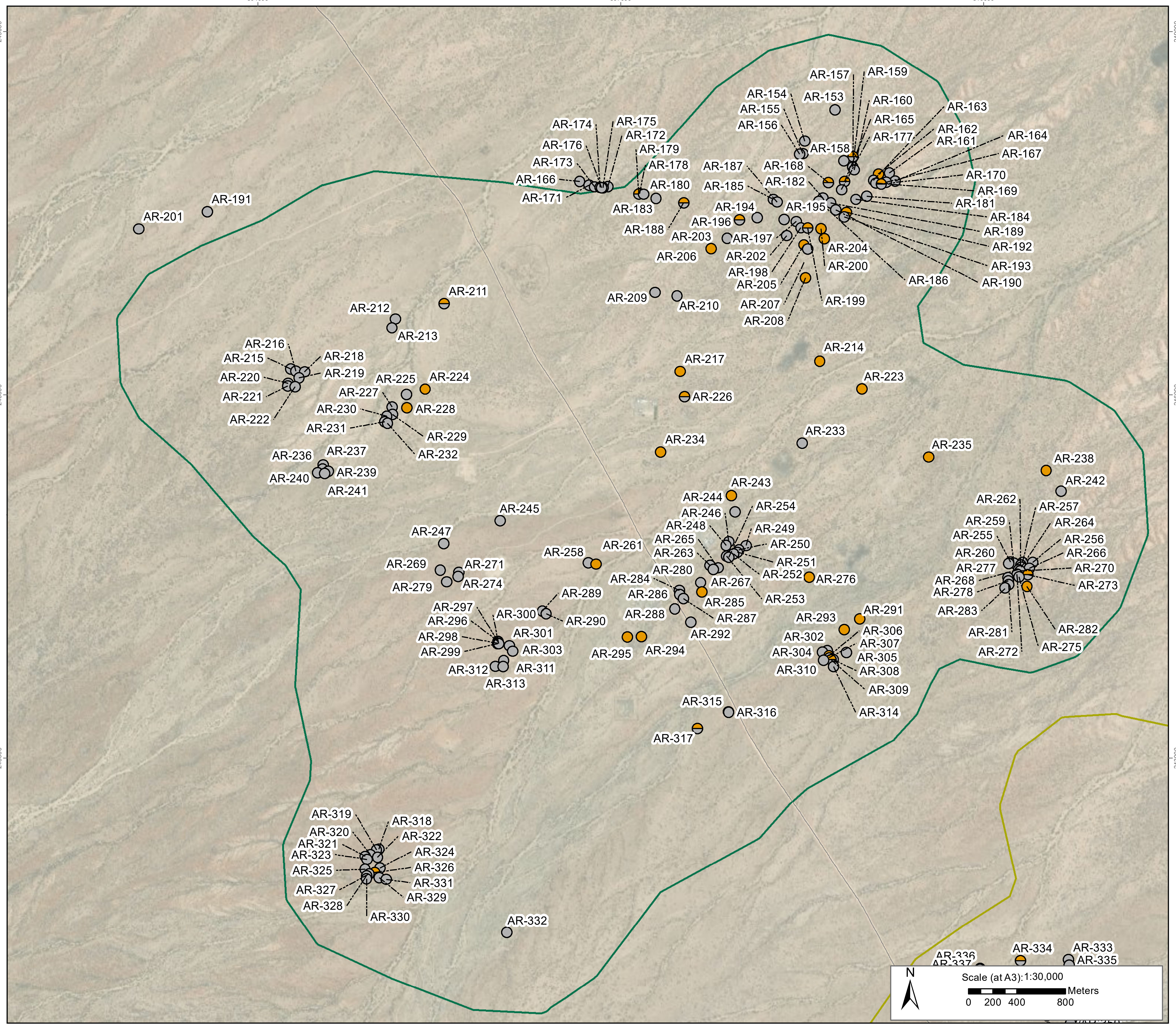

Drawing 6.13-14 - Cultural Heritage - Primary Data - Archaeology (Ngamia)

Project Oil Kenya

Key

Archaeological Asset

Pottery
Lithic
Palaeontological
Jewellery
C46
Ngamia (gazetted)
Amosing (gazetted)

Data sources:
Proposed Infrastructure and base data available from Project Oil Kenya.
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Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed By:	Approved by:
1433956	CB 02-07-2021	AM 02-07-2021	AM 02-07-2021

PROJECT OIL KENYA

GOLDER MEMBER OF WSP

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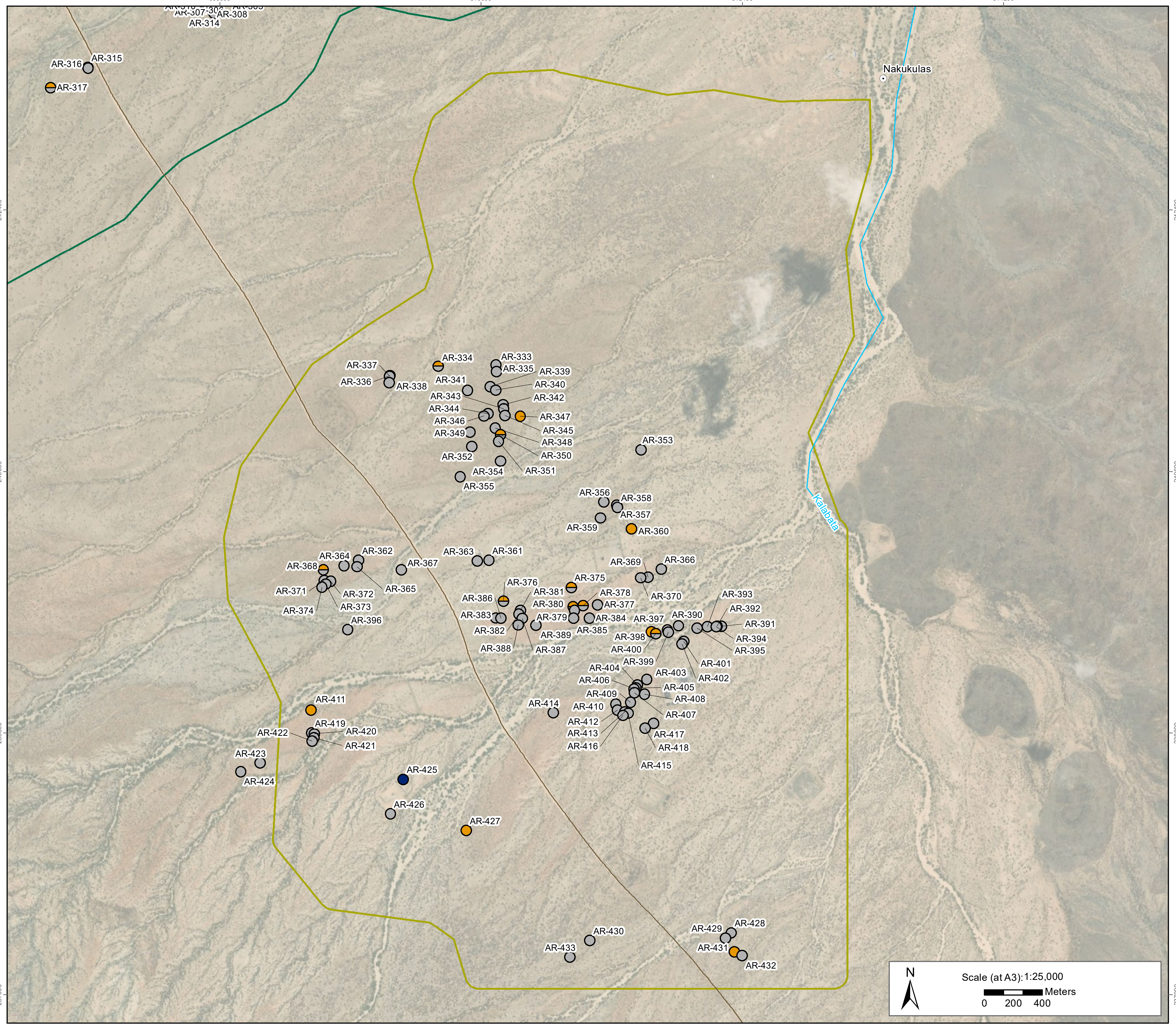

Drawing 6.13-15 - Cultural Heritage - Primary Data - Archaeology (Amosing)

Project Oil Kenya

Key

Archaeological Asset

- Pottery
- Lithic
- Palaeontological
- Jewellery
- Watercourse
- Town/Village
- C46
- Ngamia (gazetted)
- Amosing (gazetted)

Data sources:
Proposed Infrastructure and base data available from Project Oil Kenya.
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Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed By:	Approved by:
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PROJECT OIL KENYA

GOLDER MEMBER OF WSP

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Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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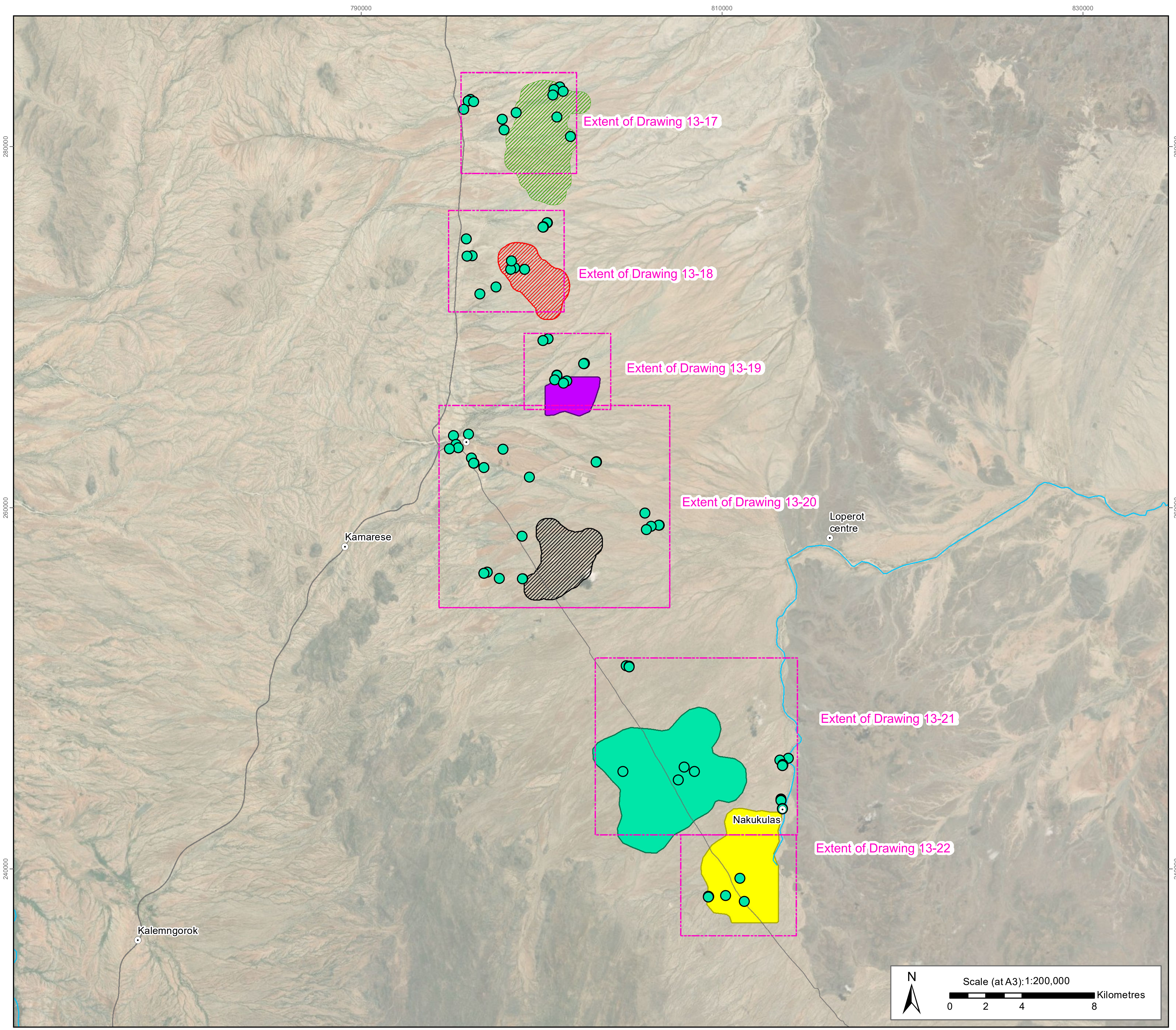

Drawing 6.13-16 - Cultural Heritage - Primary Data - Living Cultural Heritage (Key Map)

Project Oil Kenya

Key

- Living Cultural Heritage (CH)
- Town/Village
- Watercourse
- A1
- C46
- Etom (indicative)
- Agete (indicative)
- Twiga (gazetted)
- Ekales (indicative)
- Ngamia (gazetted)
- Amosing (gazetted)

Data sources:
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Coordinate System: WGS 1984 UTM Zone 36N

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PROJECT OIL KENYA

GOLDER MEMBER OF WSP

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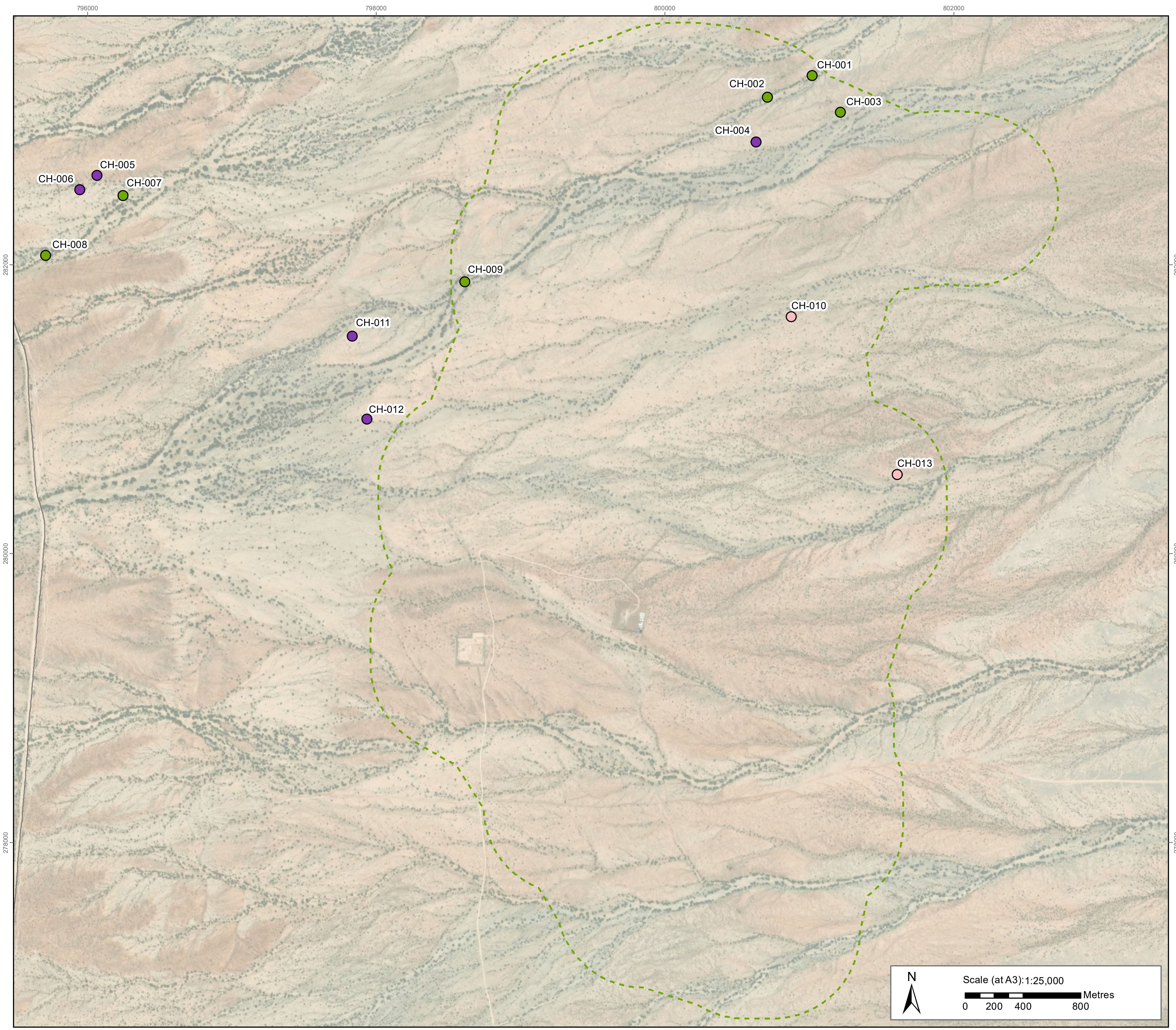

Drawing 6.13-17 - Cultural Heritage - Primary Data - Living Cultural Heritage (Etom)

Project Oil Kenya

Key

- Grave/Burial
- Meeting Tree
- Fire Pit
- Religious Building
- Living Cultural Heritage Other
- Lokichar
- A1
- Etom (indicative)

Data sources:
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Coordinate System: WGS 1984 UTM Zone 36N

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PROJECT OIL KENYA

GOLDER MEMBER OF WSP

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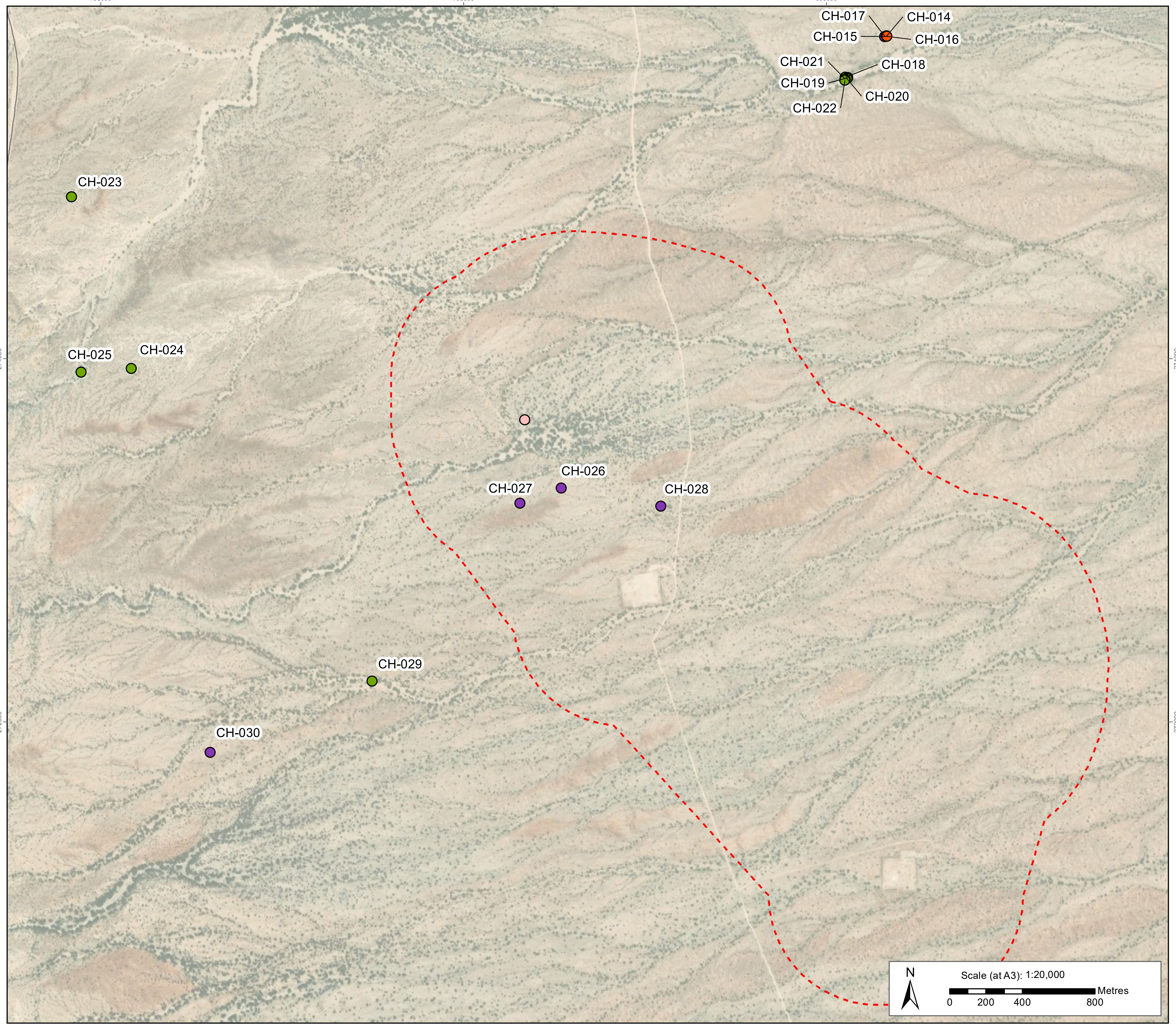

Drawing 6.13-18 - Cultural Heritage - Primary Data - Living Cultural Heritage (Agete)

Project Oil Kenya

Key

- Grave/Burial
- Meeting Tree
- Fire Pit
- Religious Building
- Living Cultural Heritage Other
- A1
- Agete (indicative)

Data sources:
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Coordinate System: WGS 1984 UTM Zone 36N

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PROJECT OIL KENYA

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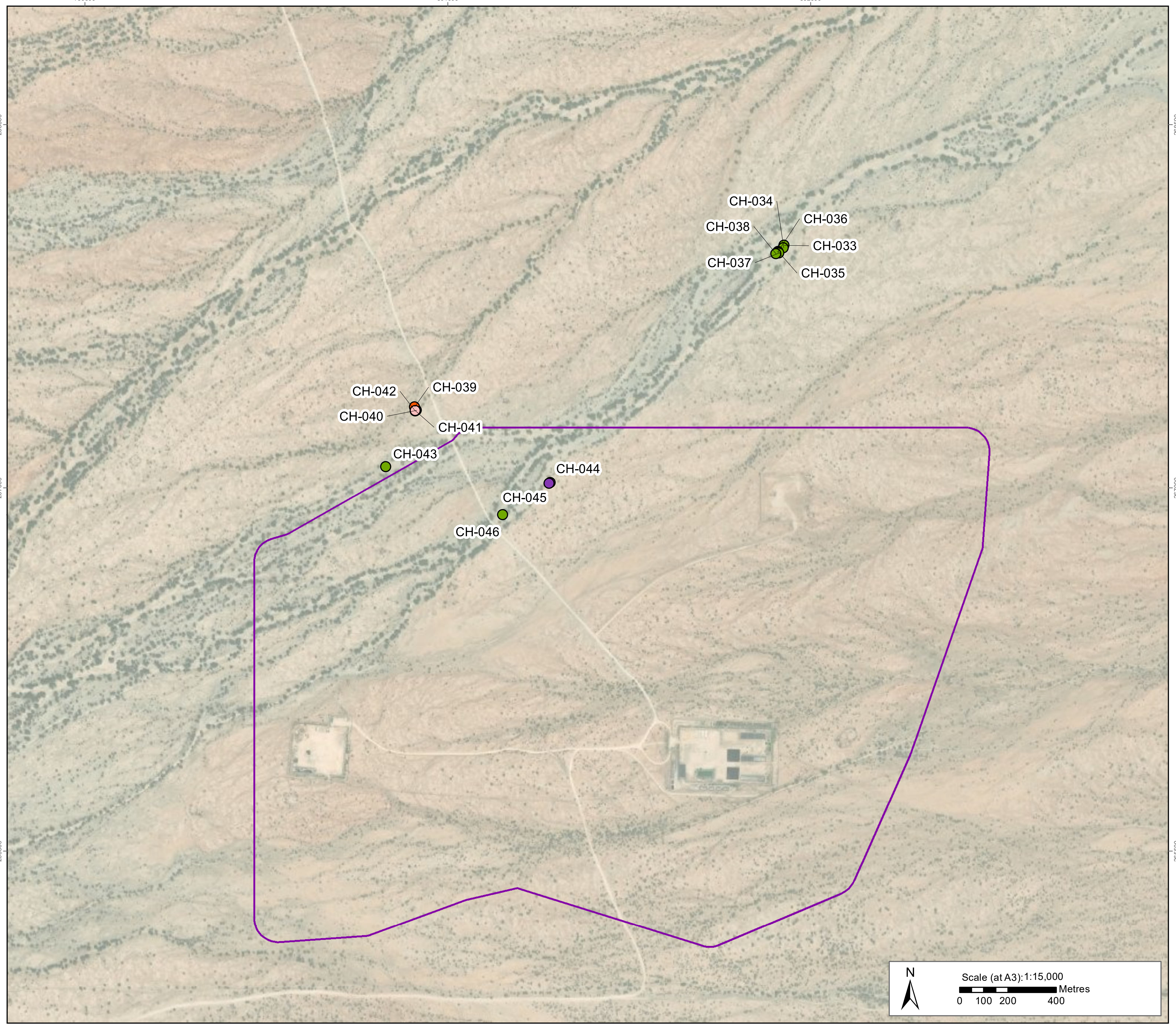

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Drawing 6.13-19 - Cultural Heritage - Primary Data - Living Cultural Heritage (Twiga)

Project Oil Kenya

Key

- Grave/Burial
- Meeting Tree
- Fire Pit
- Religious Building
- Living Cultural Heritage Other
- Twiga (gazetted)

Data sources:
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Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared By:	Reviewed By:	Approved by:
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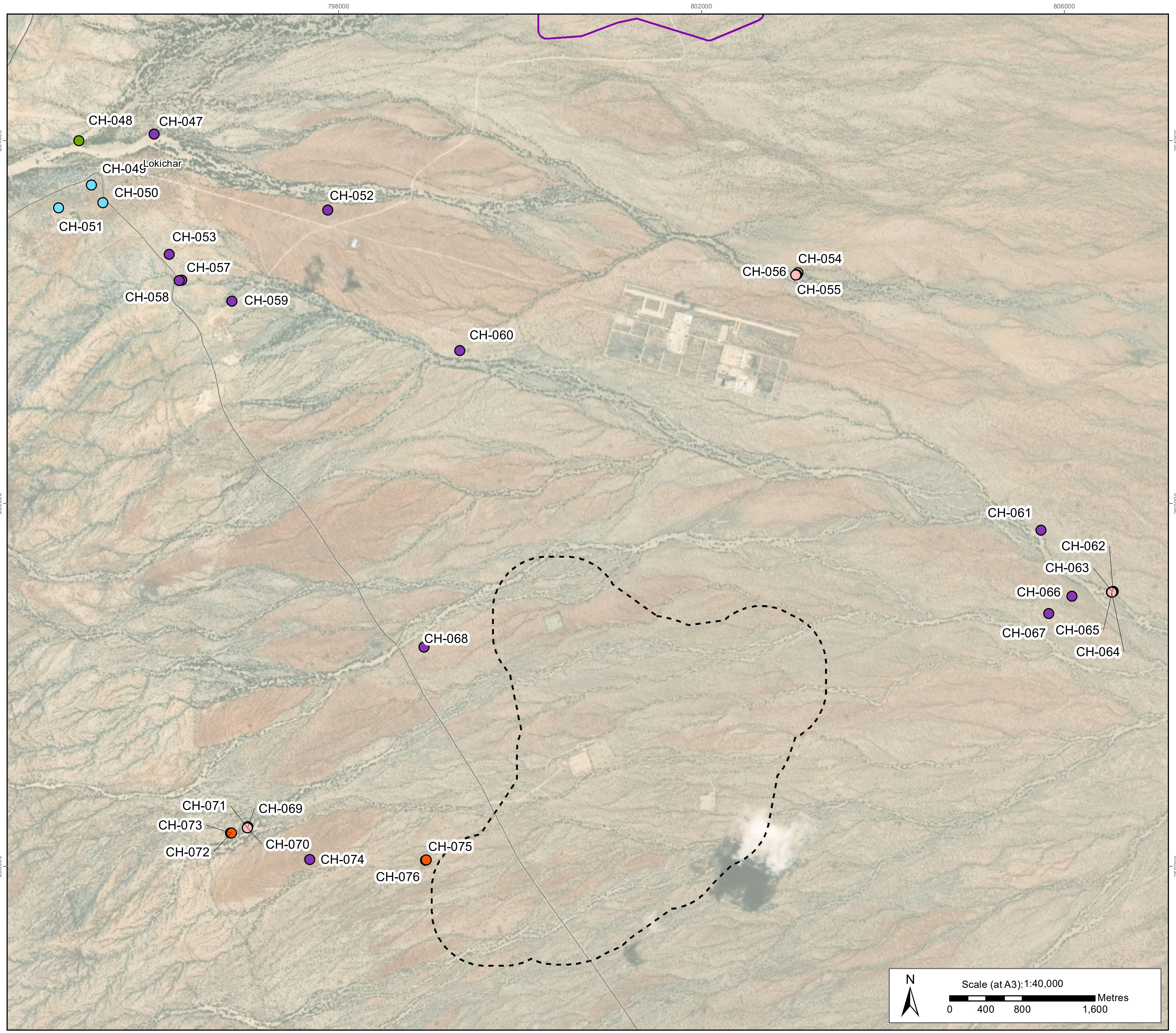

Drawing 6.13-20 - Cultural Heritage - Primary Data - Living Cultural Heritage (Ekales)

Project Oil Kenya

Key

- Grave/Burial
- Meeting Tree
- Fire Pit
- Religious Building
- Living Cultural Heritage Other
- Town/Village
- A1
- C46
- Twiga (gazetted)
- Ekales (indicative)

Data sources:
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Coordinate System: WGS 1984 UTM Zone 36N

Project Ref: 1433956	Prepared By: CB 02-07-2021	Reviewed By: AM 02-07-2021	Approved by: AM 02-07-2021

PROJECT OIL KENYA

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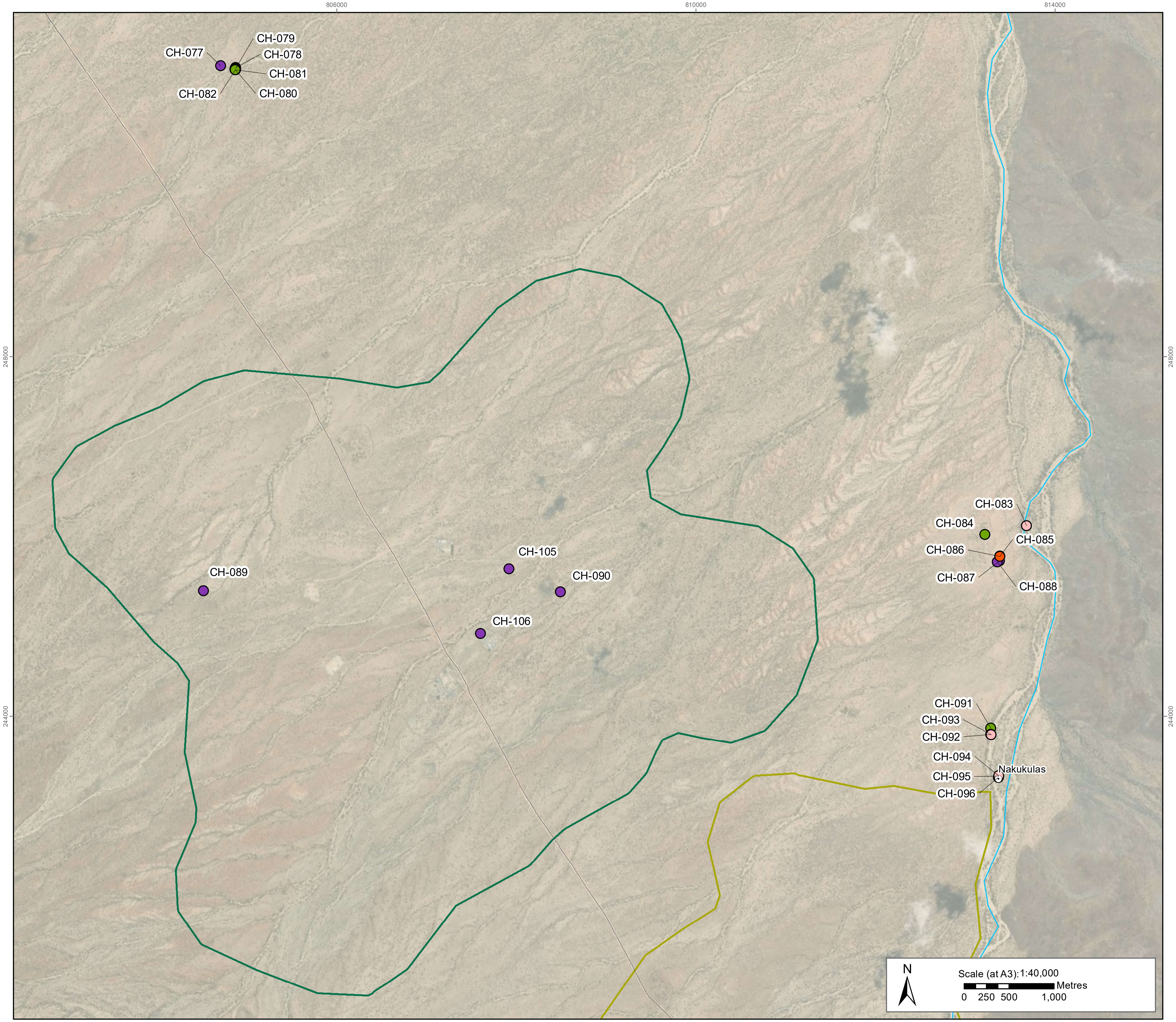

Drawing 6.13-21 - Cultural Heritage - Primary Data - Living Cultural Heritage (Ngamia)

Project Oil Kenya

Key

- Grave/Burial
- Meeting Tree
- Fire Pit
- Religious Building
- Living Cultural Heritage Other
- Town/Village
- A1
- C46
- Watercourse
- Ngamia (gazetted)
- Amosing (gazetted)

Data sources:
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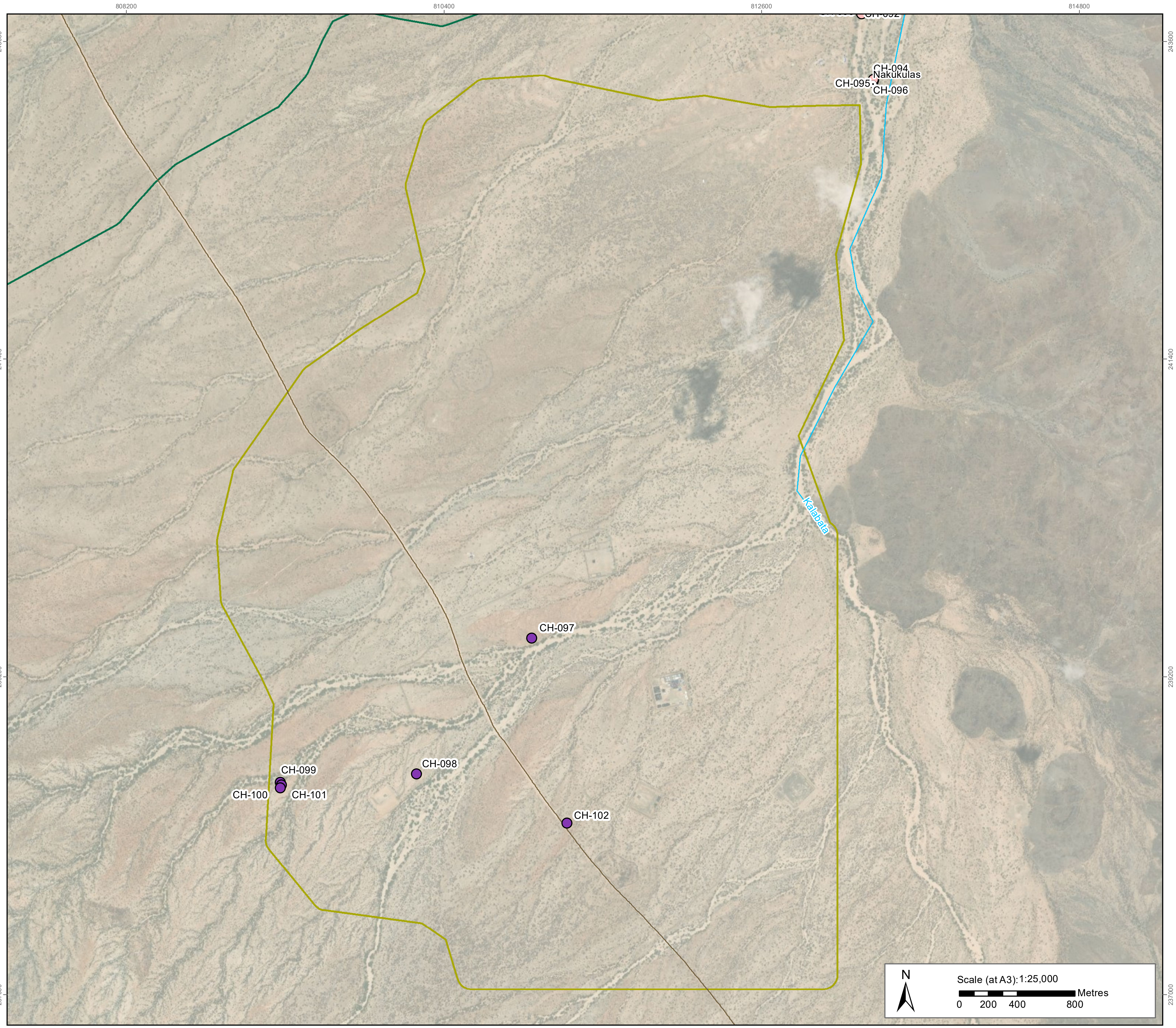

Drawing 6.13-22 - Cultural Heritage - Primary Data - Living Cultural Heritage (Amosing)

Project Oil Kenya

Key

- Grave/Burial
- Meeting Tree
- Fire Pit
- Living CH Other
- Town/Village
- C46
- Watercourse
- Ngamia (gazetted)
- Amosing (gazetted)

Data sources:
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Coordinate System: WGS 1984 UTM Zone 36N

Project Ref: 1433956	Prepared By: CB 02-07-2021	Reviewed By: AM 02-07-2021	Approved by: AM 02-07-2021

PROJECT OIL KENYA

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ESIA Report

Signature Page

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ESIA Director

Golder Associates (UK) Ltd

13 September 2021

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